40 UNDER 40: INNOVATORS WHO RULE THE WORLD

SEPT. 1, 2017

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AND

WHY EVERYONE FROM WALL STREET TO WALMART IS BETTING ON IT

READ!

HOW THIS REVOLUTIONARY TECHNOLOGY IS TRANSFORMING BUSINESS

BLOCK-CHAIN MANIA!

PLUS

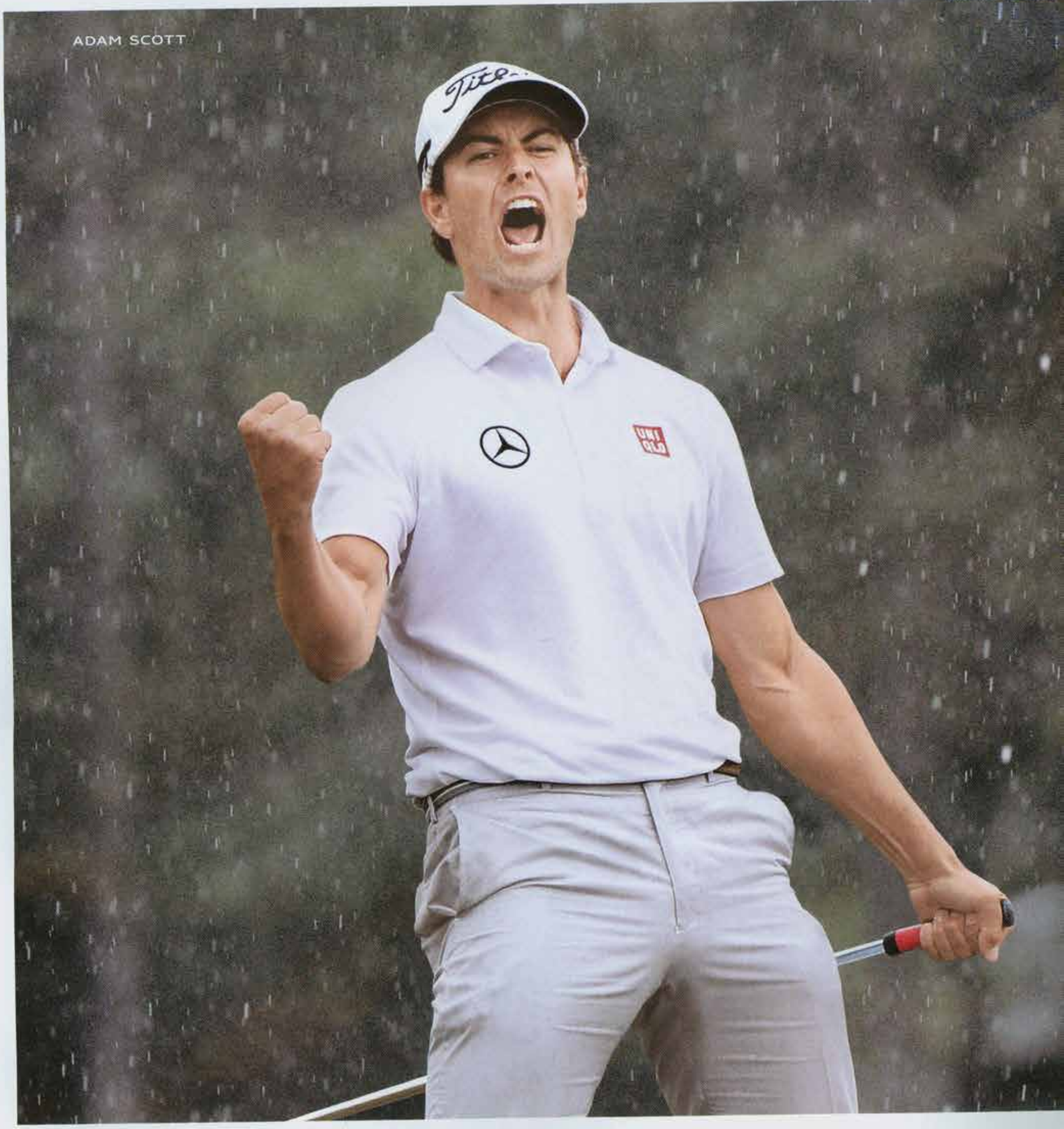
HOW THE BITCOIN BOOM TRIGGERED A CRIME SPREE

WARNING

STOCKS ARE WAY TOO EXPENSIVE

INSIDE KEVIN HART'S COMEDY EMPIRE

ASIA PACIFIC EDITION / NUMBER 11



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BROAD STROKES
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NEW KIDS ON THE BLOCKCHAIN

THERE OUGHT TO BE a restraining order preventing the word "revolutionary" from getting too close to the word "technology." The overwhelming number of apps, algorithms, and other inventions of code that emerge from week to week do not, in fact, transform society or even upend an industry, despite the marketing hype that often accompanies them. Nor do most wizardly machines, from Fitbits to VR helmets to Google Glass, truly alter everyday life or business practices—at least not right away. For all the heady talk of "disruption"—and we in the media are big on that—technological advancement tends to be accretive, even slow.

But in this issue, a formidable trio of *Fortune* writers—Robert Hackett, Jen Wieczner, and Jeff John Roberts—dive into a technology that may well change everyday business in scores of industries: It's called blockchain (please see our package of stories starting on page 26).

Blockchain is the sophisticated accounting architecture that underpins Bitcoin, the cryptocurrency at the center of an investing mania of late. (As this issue was going to press, the price of a single Bitcoin was around $4,200, up sevenfold from a year ago.) But as Chris Dixon, a general partner at venture capital firm Andreessen Horowitz, tells our own Mr. Hackett, the "money stuff... overshadows the more important technology story."

Indeed, the same distributed code-based ledger that drives Bitcoin has the potential to move any kind of data swiftly and securely—and, at the same time, make a record of that change, movement, or transaction available instantly and permanently to anyone. That's a critical (and maybe even business-saving) advantage for companies in a host of industries, from finance to shipping to health care, as our reporting team shows.

Danish shipping giant Maersk is testing a blockchain that enables its customers to keep tabs on their cargo as it moves from port to port, while simultaneously letting Dutch customs officials and the U.S. Department of Homeland Security do the same. Walmart is testing its own tracker—potentially allowing it to identify every stop a product makes on its journey to a store shelf, which could be a game-changer in the event of, say, an outbreak of foodborne illness. (It could take mere seconds to identify whether a given package of mangoes or lettuce was at risk.)

Financial companies are testing blockchains as platforms for stock trades and interbank money transfers; diamond dealers are investigating a version to verify the provenance of precious stones; aircraft makers are exploring how a blockchain might track disparate parts of their jets as they make their way from machinist shop to tarmac. Even the state of Delaware, where the majority of *Fortune* 500 companies are incorporated, is experimenting with a system that may soon allow companies to register shares, undertake proxy votes, and do virtually all of their public filings via a blockchain.

The tech is hardly glitch-free, as Wieczner relates in her gripping tale of high-tech cryptocurrency heists (see "The 21st-Century Bank Robbery," on page 34). But "having witnessed what the advent of digital, cloud, and mobile did to laggard companies," writes Hackett, "no one wants to be the sucker left behind." There isn't a sector of the economy today, after all, where customers aren't demanding faster transactions and lower costs.

Given the promise of this tech in so many industries today, it's no surprise that it's a magnet for brilliant young innovators. You'll find three on our 2017 40 Under 40 list, which highlights the most influential global leaders under that witching age (see our package of stories beginning on page 42). This year's roster includes everyone from statesmen to stand-ups to startup idols.

It's a generation filled with revolutionaries—some of them, even the technological kind.

CLIFTON LEAF
Editor-in-Chief, *Fortune*
@CliftonLeaf

Why new bipartisan efforts to patch up the existing health care system likely won't be enough to fix it.

Obamacare's Thousand Cuts

After the GOP's failed push for repeal, the ACA lives on. But the health exchanges—and the insurers that serve them—are still in big trouble.

By Sy Mukherjee

HEALTH CARE **PRESIDENT TRUMP'S** and the GOP's efforts to repeal and replace the Affordable Care Act fizzled out this summer in spectacular fashion. But while the sprawling U.S. health care industry was spared an 11th-hour overhaul, a thick cloud of doubt lingers over the $3 trillion sector. At the center of the storm: insurance companies—and the billions of dollars in subsidies they now receive to cover low-income patients via the ACA. Despite the implosion of the repeal bills, many insurers are nonetheless ▷▷

▲ PHOTOGRAPH BY SAM KAPLAN—TRUNK ARCHIVE

▷▷ asking for hefty premium hikes that could throw the system into even deeper disarray.

That would offer an ironic denouement to the Republicans' seven-year quest to vanquish the ACA—which, as the world knows, sputtered out after three failed Senate bills in about as many days and a dramatic late-night vote, the culmination of a battle that exposed enormous intraparty disagreement and highlighted the unexpected unpopularity of repeal.

There are, to be sure, some in Congress who are fending off this surprise ending—and using a rare weapon to achieve it: bipartisanship. The group's goal now is to do what the previous GOP-only efforts didn't attempt—to stabilize the shaky ACA markets rather than kill them.

A crucial Senate health committee has scheduled hearings for September to review a bipartisan framework that would guarantee insurers payments (called "cost-sharing subsidies") that help reduce low-income Americans' out-of-pocket medical expenditures, carry on the universal coverage mandate, and incorporate GOP proposals to make more bare-bones plans available as well as repeal certain ACA taxes.

The question now, though, is whether such bipartisan problem-solving may be too little too late. Multiple insurance companies say the uncertainty that continues to surround Obamacare has left them no choice

HEALTH INSURERS WERE ON A PATH TOWARD PROFITABILITY IN 2017, ACCORDING TO THE KAISER FOUNDATION—2018 IS AN OPEN QUESTION.

but to seek premium hikes, if they are to remain in the various ACA exchanges. These marketplaces—which enable individuals not covered through their employers or government programs to purchase individual plans—look increasingly unstable as insurers pull out of (or even threaten to leave) them.

This time last year, insurers on the individual markets were on "a path toward regaining profitability in 2017," according to the nonpartisan Kaiser Family Foundation. It's an open question whether that will still be the case in 2018.

Despite the recent show of bipartisanship, some Republicans in Congress have vowed to resist any attempt to rescue the law. President Trump has, likewise, repeatedly threatened to cut off the cost-sharing subsidies to insurance companies—which alone would send premiums up 20%, according to an August CBO report, and increase the deficit by $194 billion over 10 years.

Indeed, that's already happening in sporadic cases—and may accelerate soon. In early August, Anthem announced it was cutting back sharply on its participation in Obamacare exchanges in several states, lamenting that "planning and pricing for ACA-compliant health plans has become increasingly difficult due to a shrinking and deteriorating individual market."

Other major insurers have made similar statements to explain double-digit premium increases. The takeaway? What seems like costly uncertainty now could get a lot more chaotic before the year is out. ■

OBAMACARE, BY THE NUMBERS

10.3 MILLION

The number of Americans as of mid-March who were enrolled in and paying for an Obamacare exchange plan, instead of procuring insurance through an employer or separate federal program.

49%

The highest requested premium increase across 21 major cities for a benchmark ACA exchange "Silver" plan in 2018. Many others had double-digit hikes. At least one insurer, though, did lower its premium by 5%.

23%

The average additional level of premium increase requested by Idaho's PacificSource Health Plans (on top of a regularly planned 23% hike), due to threats to cut off insurer payments.

7 MILLION

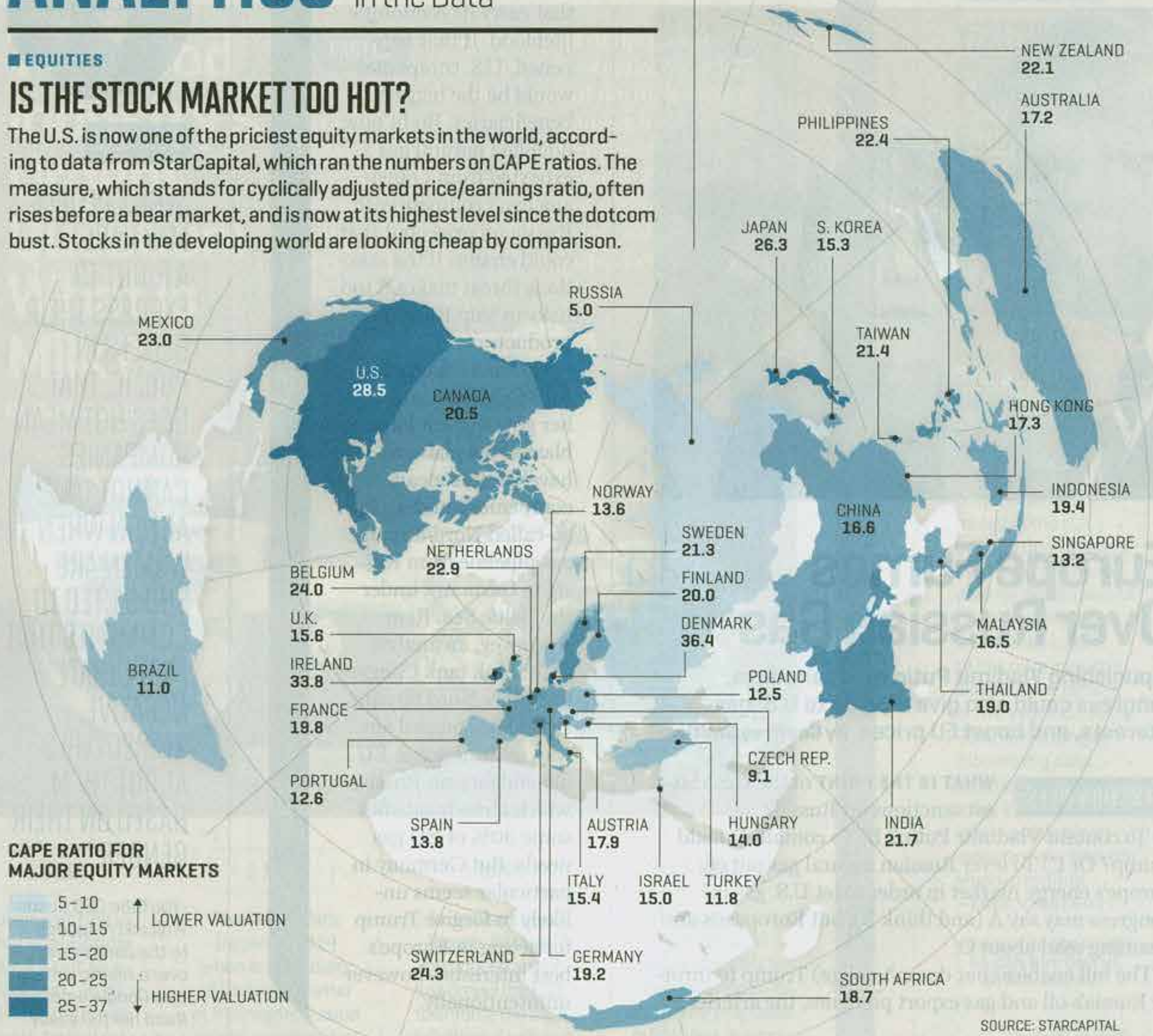
Americans who, in 2017, qualified for the cost-sharing subsidies currently under siege. The subsidies, paid to insurance companies, vastly lower patient deductibles and out-of-pocket costs.

ANALYTICS Seeing Trends in the Data

EQUITIES

IS THE STOCK MARKET TOO HOT?

The U.S. is now one of the priciest equity markets in the world, according to data from StarCapital, which ran the numbers on CAPE ratios. The measure, which stands for cyclically adjusted price/earnings ratio, often rises before a bear market, and is now at its highest level since the dotcom bust. Stocks in the developing world are looking cheap by comparison.



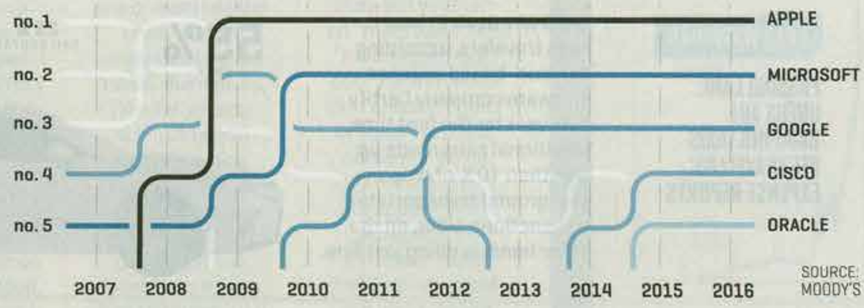
SOURCE: STARCAPITAL

HOARDERS

APPLE IS SITTING ON A HUGE PILE OF CASH

For the second year in a row, Apple was the corporate world's No. 1 cash holder, with about $250 billion. According to Moody's analysis, the top five companies (all in tech) together hold a colossal $594 billion.

THE TOP FIVE U.S. NONFINANCIAL CASH-RICH COMPANIES



SOURCE: MOODY'S

Europe Fumes Over Russian Gas

In punishing Vladimir Putin with sanctions, Congress could also give a leg up to U.S. gas interests, and boost EU prices. By Geoffrey Smith

SANCTION WOES

WHAT IS THE POINT of the U.S.'s latest sanctions on Russia? A) To contain Vladimir Putin? B) To contain Donald Trump? Or C) To lever Russian natural gas out of Europe's energy market in order to let U.S. gas in? Congress may say A (and think B), but Europeans are steaming mad about C.

The bill enables (but doesn't oblige) Trump to throttle Russia's oil and gas export pipelines, the arteries that carry its economy's lifeblood. If that happened, U.S. companies would be the biggest beneficiaries. Right now, liquefied natural gas exported from Louisiana can't compete with Russia on price, but that could change if the sanctions threat makes it too risky to ship Russian product.

German Chancellor Angela Merkel and her government have blasted the plans, as have the European companies building the so-called Nord Stream 2 gas pipeline from Russia to Germany, under the Baltic Sea. Rem Korteweg, an analyst with think tank Clingendael, says Nord Stream should be stopped anyway, as it increases EU dependency on Russia, which already satisfies some 30% of EU gas needs. But Germany in particular seems unlikely to forgive Trump for acting in Europe's best interests—however unintentionally.

QUOTABLE

"WHILE PEOPLE MAY HAVE A RIGHT TO EXPRESS THEIR BELIEFS IN PUBLIC, THAT DOES NOT MEAN COMPANIES CANNOT TAKE ACTION WHEN WOMEN ARE SUBJECTED TO COMMENTS THAT PERPETUATE NEGATIVE STEREOTYPES ABOUT THEM BASED ON THEIR GENDER."

—YouTube CEO Susan Wojcicki responds to the controversy over a memo written by a Google employee. Read her full essay on Fortune.com.

ROAD WARRIORS

PASSING LANE: UBERS ARE BUMPING TAXIS OFF TRAVELERS' EXPENSE REPORTS

TAXIS ARE DEAD to business travelers, according to cloud-based expense software company Certify. This year for the first time, traditional cabs made up less than 10% of employees' ground transportation transactions. Uber, on the other hand, is doing just fine.

TRUMP: SEAN GALLUP—GETTY IMAGES; MERKEL: FLORIAN GAERTNER—PHOTOTHEK VIA GETTY IMAGES; PUTIN: MIKHAIL SVETLOV—GETTY IMAGES; WOJCICKI: BENJAMIN RASMUSSEN; CAR: COURTESY OF TOYOTA

The Food Industry's Urgent Question: What Is Milk?

By Beth Kowitt

LABELS **A WAR IS BREWING** in the grocery aisle over an existential quandary: What is the real definition of the food we eat? A new class of startups is gaining market share with plant-based alternatives to refrigerator staples like milk and meat. But trade groups and others argue that without a cow, almond milk is just "nut water," and without eggs, vegan mayo is "pea paste." Let the food fights commence.

JUST MAYO: DANIEL ACKER—BLOOMBERG VIA GETTY IMAGES; GREEN GIANT, RIPPLE, AND BEYOND MEAT: COURTESY OF THE COMPANIES

1. RICE

Cauliflower rice is so hot that Google called it out as a "rising star" in its 2016 food-trends report, based on search queries. Now the rice industry is pushing back. "Vegetables that have gone through a ricer are still vegetables, just in a different form," USA Rice president and CEO Betsy Ward said in May. "Only rice is rice, and calling 'riced vegetables' 'rice,' is misleading and confusing to consumers."

2. MAYO

The Mayo Wars began in 2014 when a subsidiary of Unilever [owner of Hellmann's] sued vegan mayo maker Hampton Creek, alleging false advertising—arguing it's not legally "mayo" without eggs. Unilever dropped the suit, but in 2015 the FDA called the product "misbranded." In the end, Hampton Creek kept the name "Just Mayo" but made "egg-free" bigger on its label and added the words "spread and dressing."

3. DAIRY

In January, Sen. Tammy Baldwin introduced an act to compel the FDA to enforce the legal definition of milk and cream as "lacteal secretion" obtained by the "milking of one or more healthy cows." Her bill contends that plant-based alternatives [like the growing nut-milk genre] are "misleading to consumers." In response, startup Ripple, which makes pea-based milk, launched a cheeky "Not Milk" digital ad campaign.

4. MEAT

A European Union trade group is pushing for stricter meat-labeling rules. Under the proposed guidelines, names like "vegetarian balls" and "vegetarian burger" are okay, but vegetarian "*meat* balls" and "*hamburger*" are not. "Fancy names" like "chiken," "porc," or "beaf" are also off-limits. So far, U.S. meat producers appear more accepting of alt-meat. Tyson has even invested in a plant-based food startup.

LATIN AMERICA

VENEZUELA'S DEEPENING CRISIS HAS GLOBAL TENTACLES

AS THE SOUTH American country inches closer to full-on civil war, most businesses have cut bait. Delta suspended flights, GM shut operations [after its plant was seized], and Coca-Cola ceased production following a sugar shortage. Now bondholders [many based in the U.S.] are starting to worry. For years Venezuela paid its debts despite the mounting chaos. But thanks in part to low oil prices, the likelihood of default in five years exceeds 90%, according to Bloomberg data. Inflation is projected to hit 2,000% next year—putting ever more pressure on the Maduro regime.
—ANNE VANDERMEY

NUMBER OF BOLIVARES $1 CAN BUY ON THE BLACK MARKET

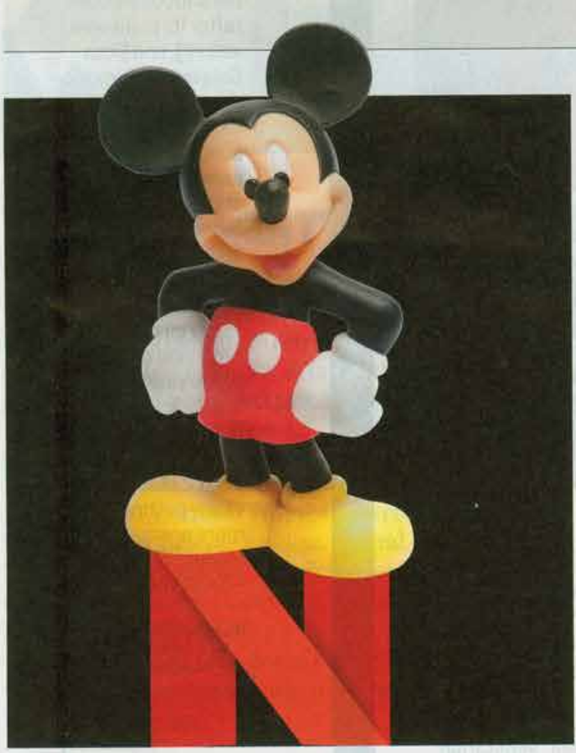
SOURCE: DOLARTODAY

RETAIL

E-COMMERCE: BETTER LATE THAN NEVER

WHEN REGIONAL retailer Hibbett Sports recently bragged that it was launching its first e-commerce site, investors saw it as too little, too late, and sent shares down 30%. But for some retailers, arriving fashionably late isn't all bad. Struggling J.C. Penney, for example, offered in-store pickup of online orders years after Macy's, but still got some traction from it. Despite the rise of Amazon, regular retail offers higher margins than online shopping, so emphasizing in-store sales can pay off. Plus, 90% of transactions still happen in brick-and-mortar establishments. The lesson? It's never too late to add e-commerce. But tweaking an app or adding a site is table stakes—it takes much more to win the game.
—PHIL WAHBA

SOURCE: EMARKETER



What Disney's Netflix Snub Means

Both investors and consumers have reason to worry about the media breakup. By Michal Lev-Ram

TELEVISION

IT'S A BREWING BATTLE fit for a Marvel series. On Aug. 7, Netflix announced its first-ever acquisition, snapping up Scottish comic book company Millarworld for an undisclosed amount. The next day, the corporate parent of Marvel offered its own Bam! Zap! Pow! Disney CEO Bob Iger told investors he will pull all of the Mouse House's content from the leading streaming platform by 2019. His master plan? To launch a Disney-branded streaming service, bypassing Netflix. The news sent shares of both companies down, as nonplussed investors feared that each would have a tougher time without the other. But the split fits with Netflix's strategy too—it wants to develop and own more of the content it distributes, which will inoculate it from future defections. Notably, it hired *Scandal*-creator Shonda Rhimes away from Disney the following week. The moves that could benefit Disney and Netflix, though, won't necessarily benefit consumers, who could end up paying more for different platforms. The good news? We'll soon have more streaming options. The bad news? We'll soon have more streaming options.

BOOK VALUE

HOW THE WU-TANG CLAN MET PHARMA BRO

MARTIN SHKRELI is a villain fit for literature. While most infamous for hiking the price of a lifesaving drug, the "pharma bro"—now facing up to 20 years in prison for securities fraud—also bought the lone copy of an unreleased Wu-Tang Clan album and refused to share the tracks with the group's diehard fans. In his debut book, *Once Upon a Time in Shaolin*, Cyrus Bozorgmehr chronicles how the album fell into the wrong hands. It's a bizarre tale of the fragile modern music industry. No surprise, the villain is the most interesting part.
—LAURA ENTIS

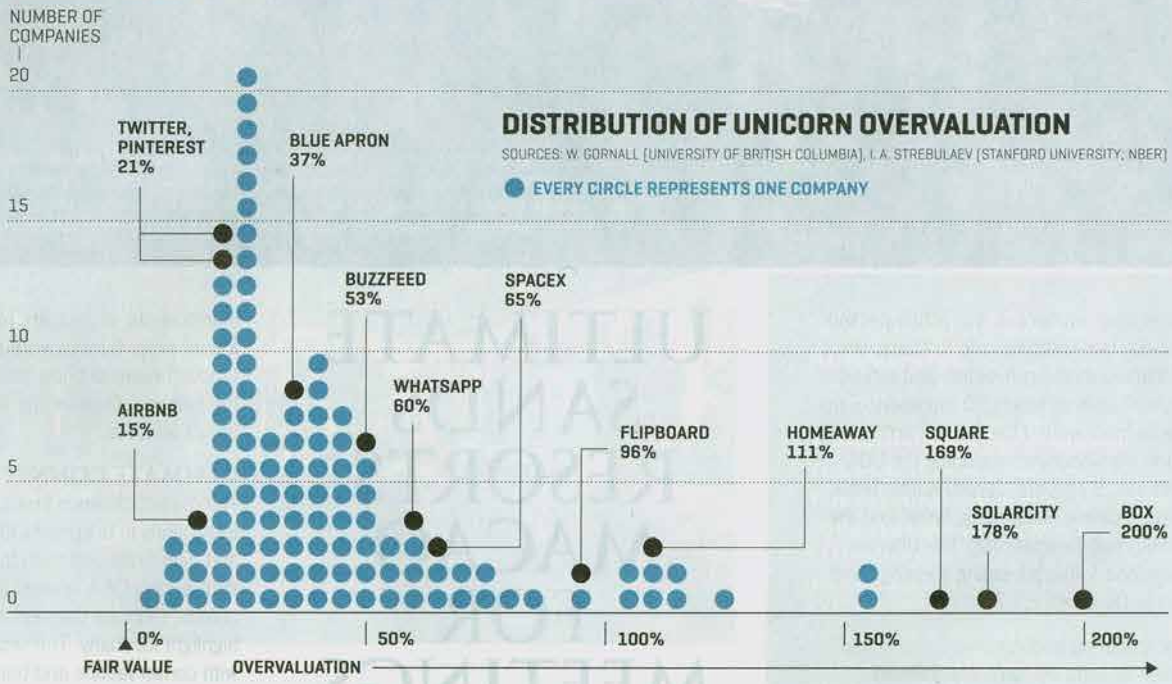
BAG: STUDIO CASPER—GETTY IMAGES; MICKEY MOUSE: MARIA17—GETTY IMAGES

What's in a Valley Valuation?

New research posits that without fancy accounting, half of unicorn startups would lose their horns. **By Anne VanderMey**

BUBBLE WATCH

WHAT ARE SILICON VALLEY'S darlings really worth? Two business school professors took a sample of 116 "unicorns," companies with valuations of $1 billion or more, and calculated their fair value—using the price of preferred shares to value shares that don't have those rights. Their conclusion: Half the "unicorns" were worth less than $1 billion, and more than a dozen were overvalued by 100%.



MASAYOSHI SON: ALESSANDRO DI CIOMMO—NURPHOTO VIA GETTY IMAGES

BUYING SPREES

SOFTBANK IS HANDING OUT FUNDING. TECH GIANTS DON'T MIND IF THEY DO.

THE PIONEERING Silicon Valley venture capitalist Eugene Kleiner had a quaint adage about fundraising: The time to take the tarts, he liked to say, is when they're being passed.

Global tech players seem to be heeding his advice all at once due to the largesse of one particular investor, Masayoshi Son's SoftBank. Through its planned $100-billion Vision Fund and its own balance sheet, SoftBank has written billion-dollar-plus checks for India's Flipkart, China's Didi, and a diverse group of U.S. tech and pharmaceutical players, including Fanatics, Roivant Sciences, WeWork, and Nvidia. SoftBank is even said to be eyeing a stake in troubled mega-startup Uber.

Son has said he wants to create a community of technology companies.

His definition of community clearly is expansive.

—ADAM LASHINSKY

Dubbed Ultimate Show Time, the extravaganza at The Venetian Macao featured fine dining and fun entertainment. A six-person Chinese drum group opened the gala, the grand finale of The Ultimate Download, starting the evening with a bang. Also wowing the crowd were Australia's Soul Mystique quick-change acts and homegrown Sands Resorts talents like the Singing Chefs & Waiters and Moulin Rouge-style dancers.

ULTIMATE SANDS RESORTS MACAO FOR MEETINGS AND EVENTS

Fun and dynamic events make 'The Ultimate Download – Asia's Leading Meetings and Events Destination' a sizzling success

An exciting, immersive and action-packed four-day familiarization trip to Macau drew 150 international convention and exhibition professionals including 20 members of the media from around the world. Participants came from countries including the USA, Australia, Singapore, Japan, Korea, India, Taiwan, China, Hong Kong, Israel and the United Arab Emirates for "The Ultimate Download – Asia's Leading Meetings and Events Destination."

The gathering underscored Sands Resorts Macao's unparalleled conventions and exhibitions offerings, combining an opportunity to get to know the hospitality group better alongside thought-provoking panel discussions, fabulous meals and top-calibre entertainment. Attendees were feted over lunches and dinners at Sands Resorts' seven hotels. With such energy, no wonder that Macau has emerged as one of the world's most exciting places for conventions, events and incentive travels—a place that lives up to its deep history of bringing cultures and people together in wonderful ways.

BON VIVANT

For attendees, The Ultimate Download began with French flair amid the splendour of The Parisian Macao. With a half-scale Eiffel Tower in the background, delegates networked while drinks and nibbles at the property's magnificent poolside. The party provided a preview of the intense four days ahead and started the event on a high note.

ULTI-MART

To give a glimpse of what Macau has to offer and showcase what the Sands Resorts team can do, organizers mounted Ulti-Mart, a mini-expo. Booths were set up in a function room to allow attendees to browse the hall and discover the many offerings at Sands Resorts.

Ulti-mart showcased the best of Macau as a destination and the wide variety of offerings from Sands Resorts. Attendees went from booth to booth to experience for themselves the tantalizing array of services and facilities available.

ULTIMATE CONNECT

The mini-conference brought together the best minds in hospitality to discuss trends and hear first-hand from thought leaders. With a lively Q&A session and engaging debate, Ultimate Connect was the highlight for many. The session was filled with conversations and briefings about sustainable tourism, travel trends, product updates and discoveries.

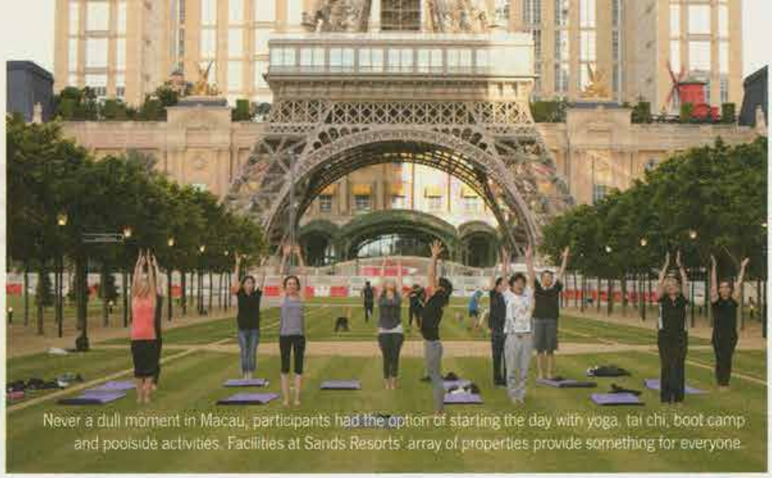
ULTIMATE CHEF

Beyond all the wining and dining, there was also serious cooking. Twenty participants from 10 countries signed up for an entertaining and mouth-watering competition which put the spotlight on culinary talents. Contestants created amazing dishes out of secret ingredients revealed on the spot. The unique event can also be customized for clients' team building programs. At Ultimate Chef, a team of delegates from Japan and Korea triumphed with a creation that the jury deemed "restaurant worthy"—high praise in a city well-loved by gourmets. A Singaporean-Israeli team made second place, and an Indian team took third.

ULTIMATE SHOW TIME

A glamorous dinner at The Venetian Macao served as the grand finale for four intense and thoroughly enjoyable days with the Sands Resorts team. Entertainment was on the menu for the evening, aside from the elegant cuisine and the free-flowing wine.

Thrill-seekers scaled the heights of the iconic 1109-foot Macau Tower for skywalking, one of many possible customized options available for visitors in the territory. The menu of possibilities available will be sure to entice event organizers and engage meetings and events travelers to Macau, Asia's most exciting destination.



Never a dull moment in Macau, participants had the option of starting the day with yoga, tai chi, boot camp and poolside activities. Facilities at Sands Resorts' array of properties provide something for everyone.

The Parisian Macao set the mood to launch the four-day presentation by welcoming participants with a poolside drinks and canapes party. Guests mingled and marvelled at the effusive hospitality and glamour of the venue.

From Chinese drumming to an Australian quick-change act to Sands Resorts' own Moulin Rouge-style dancing and Singing Chefs & Waiters belting out opera, the gala was a night to remember and a fitting celebration of Macau.

BESPOKE EXPERIENCES

Guests could sign up for activities based on their personal interests. In the mornings, they had a choice of tai chi, yoga, swimming pool fun, boot camp, among other things. Outside of the gathering, there were city trips for food tasting, nature hiking and cultural tours. These gave attendees a sampling of some of the great things to do in Macau.

Speaking about the event, Ruth Boston, Senior Vice President, Marketing and Brand Management, Sands China Ltd. says, "The Ultimate Download – Asia's Leading Meetings & Events Destination has offered a great opportunity to showcase not only our world-class hotels, but also everything we can deliver in the meetings, conference and incentives arena. Stay at Sands Resorts and you have the perfect combination of the magnificent old and the sparkling new, literally side by side."

"One of the other key messages we wanted to get across to the participants was the wonderful culture."

Kelli Vettoretto, Australia-based Regional Vice President of global events organizer HelmsBriscoe, declared The Ultimate Download to be "the best-planned and executed educational I have ever participated in." She noted: "I am confident that this destination will grow in popularity for conferences and incentives from Australia and New Zealand."

Her colleague Linda Broderick, HelmsBriscoe Global Accounts Senior Director in the United States, says: "Macau is a terrific MICE Conventions and Exhibitions destination. After experiencing first-hand many of the excellent meeting venues, I can confidently recommend it to my clients considering an Asian location. The quality of the delivered was exceptional. In addition to the spectacular excitement offered by quality hotels, there is a wonderful cultural heritage attendees will enjoy. I look forward to the prospect of bringing groups to Macau in the near future."

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RESORTS MACAO

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AT-A-GLANCE

~~~~~

7 international hotel brands

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THE PARISIAN MACAO
FOUR SEASONS HOTEL MACAO, COTAI STRIP
THE ST. REGIS MACAO, COTAI CENTRAL
CONRAD MACAO, COTAI CENTRAL
SHERATON GRAND MACAO HOTEL, COTAI CENTRAL
HOLIDAY INN MACAO COTAI CENTRAL

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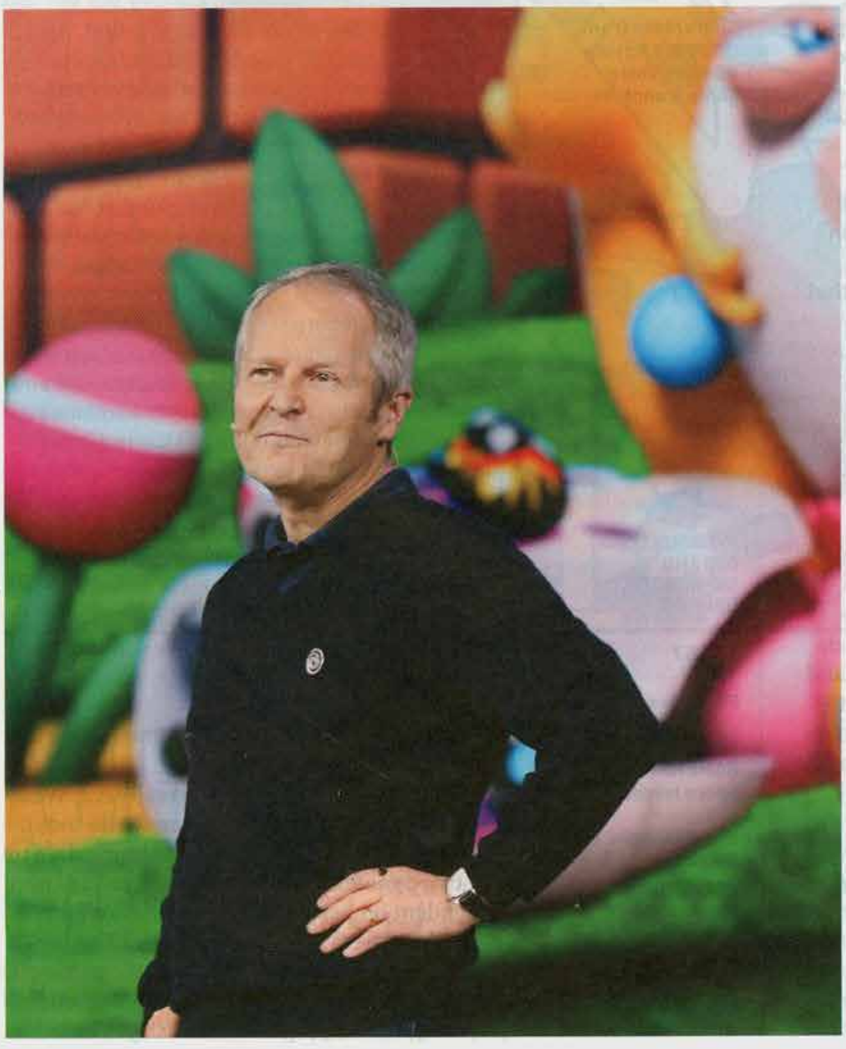
UBISOFT'S CEO ISN'T PLAYING GAMES

Yves Guillemot is pushing the video game publisher to keep innovating in a fast-changing industry.

By Chris Morris



© CHRISTIAN PETERSEN—GETTY IMAGES

WITH HITS LIKE *Assassin's Creed, Raving Rabbids,* and *Tom Clancy's Rainbow Six,* Ubisoft has become one of the world's biggest video game makers with nearly $1.7 billion in annual revenue. But sometimes, success comes with a price.

For the better part of the past two years, the company has had to deal with a looming takeover threat from French media conglomerate Vivendi, which has slowly been buying shares of the game publisher. As of mid-August, it held a 27% stake.

CEO Yves Guillemot has made it clear that Ubisoft has no interest in Vivendi's involvement, and he is working to shore up shareholder support against a takeover. At the same time, he has shepherded the release of a remarkable string of hit titles, helping the company's stock hit all-time highs.

We sat down with Guillemot to see where things stand in the face-off with Vivendi, how Ubisoft is dealing with the fast-paced changes in the gaming industry, and why including players in the game-making process is more important than ever.

***FORTUNE:* Do you expect this year to be the final showdown with Vivendi? That company has indicated it's planning to accelerate acquisitions in the video game industry, which may put you in the crosshairs.**

GUILLEMOT: What we feel is that they are financial guys. Our best defense has been to perform. When you perform, you can show your shareholders that it's better for them to stick with the team that's managing the company instead of going to another. What we've seen is that our shareholders are very happy with the direction we're taking, so it gives Vivendi less space to do a creeping control [a takeover accomplished by gradually acquiring the target company's ▷▷

Characters from Ubisoft's *Raving Rabbids* video game franchise.

▷▷ shares]. It's still a risk, but doing a creeping control in a company that is growing and is appreciated by the people who invest in it is more difficult than doing it to a company that is not performing well.

You're involved with e-sports, a.k.a. televised competitive video game tournaments, but I don't hear Ubisoft talk about it as much as some other game publishers. How big a priority is that for you?
It is a huge priority, but we need to make sure our games are ready for it. So, for example, with *Rainbow Six: Siege*, we waited a little bit at the beginning so it was more stable [unlikely to crash]. Recently, we said, "Okay, we can go full speed."

What's the benefit for you? What do you get out of being in the e-sports community?
The advantage is that those competitions are watched a lot. The more people who are watching your game, the more people will understand how to play it well. It's marketing. It's a way to teach people how to play. Also, many people want to play games that can give them a chance to shine. E-sports is a good way to shine.

Every publisher is looking for ways to adapt to a changing landscape, where it's increasingly important to keep people playing for longer stretches of time. How do you boost player engagement in Ubisoft titles?
Players are really looking at how they can play more of what they love at a reasonable price. So publishers are adapting to that. An open-world game [titles like *Watch Dogs* or the upcoming *Far Cry 5* that let players move freely through a virtual world and either follow the story line or explore side stories] is a way to say, "Okay, I get in and can do things the way I want. So it won't be a 20-hour game, it can be a 40-hour game." That's a good way for the players to express themselves and play longer.

You're asking game players to contribute their thoughts much earlier in the design process with upcoming games like *Beyond Good and Evil 2* and *Skull & Bones*. Do you expect that to continue?
You will see more and more of that in Ubisoft games. But we choose the game development team first—and that team's vision. Then we make sure they get information from the community. It's important that they're influenced by the community, but really stay true to their vision, because the more you follow influences from everybody, the less you have something that's different.

How critical do you think artificial intelligence is to the future of game design?
The big deal for the industry is really A.I. We have to master it a lot better than we do today. I'm convinced that being better at using data to influence games and make them alive and more dependent on people's playing behavior [for example, players who tend to be more aggressive in shooter games would face off against more enemies] is something that will be one of the things that changes the industry. ■

YVES GUILLEMOT
CEO AND COFOUNDER, UBISOFT

AGE: 57

FROM: France

FIRST VIDEO GAME HE PLAYED: *Space Invaders*

NONGAMING HOBBY: Motorcycles; takes road trips in Europe and the U.S. to clear his head

VICE: Swiss dark chocolate

COURTESY OF UBISOFT

INVEST

A BIG PAYOFF FOR CYBERCOP STOCKS

High-profile hacks have global companies scrambling to boost their cyberdefense budgets. Which security providers will make the most of the opportunity? **By Ryan Derousseau**

A HACKTIVIST GROUP that opposes the Dakota Access Pipeline has commandeered the computer network of a major U.S. airline. The group has given executives just two hours to pay it $1 million; in the meantime, a slideshow that vividly depicts the impact of an oil spill on surrounding wildlife is playing on the airline's televisions throughout its three airport hubs. The media jumps on the story, live-streaming the debacle to millions of viewers.

It's a chaotic circus. Fortunately, it's fake. ▷▷

▷▷ The airline-hack scenario is an example of the scripts that Emily Mossburg, principal in secure services at consultancy Deloitte, uses to war-game clients' responses to a cyberattack. During the six-hour exercise, a client's cybersecurity team, up to and including members of the C-suite, respond as if the hack were real, tweaking their strategies for dealing with a breach. Mossburg studies how much information the hacked company shares with customers, how quickly it reaches out to authorities, and how proactively it musters its defenses.

The whole exercise is, above all, an effort to stem the financial fallout. Cyberattacks have become a sad fact of real life, and they can make an enduring dollars-and-cents impact, not least to a company's stock price. Cybercrime costs the global economy between $450 billion and $600 billion a year. And recent events fit a familiar pattern: Hackers strike, and the victimized company's stock falls. In May and June, WannaCry and a similar ransomware program attacked corporate servers worldwide and infected hundreds of thousands of computers. The biggest victims included food company Mondelez International and pharmaceutical giant Merck, and as of mid-August neither corporation had seen its stock price recover.

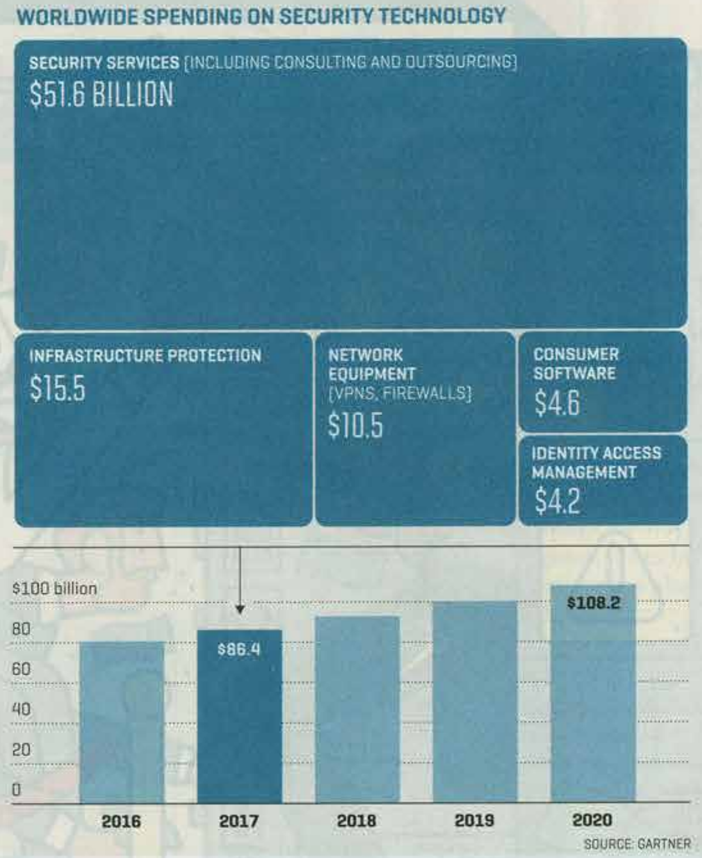
Even more unsettling to investors: Research suggests that the long-term impact of a breach on share values can be far greater than its immediate damage. According to a study of 24 hacked companies by consumer-review site Comparitech, a company's stock fell, on average, 0.43% on the day an attack was publicly disclosed. But three years after an attack, the share price for companies in the study lagged the Nasdaq by an average of 40 percentage points.

Other factors besides the hacks undoubtedly contribute to the underperformance, and some companies shrug off hacking incidents with little damage. Still, the costs of addressing a breach can weigh down a company's financial results for years. Consulting firm KPMG analyzed the impact of a 2013 theft of data from some 40 million credit card accounts from retailer Target. It estimated that the response by Target's cybersecurity team, funding of credit monitoring for customers, and staffing for call centers cost $60 million. The "slow-burn" costs proved far larger, with nearly $200 million spent on systems upgrades and court settlements, plus serious but less tangible costs like the hit to the company's reputation. Target had other challenges too, but the hack's costs certainly didn't help; and in the three years after the breach, Target's stock returned 24%, trailing the Nasdaq and the S&P 500 alike.

The publicity that comes with "increased visibility of breaches" heightens the long-term costs, says KPMG director Matthew Martindale. For companies that operate in Europe, new rules due to take effect in May 2018 could make the problem even worse. The European

WHERE THE SECURITY MONEY GOES

Hardware and software are crucial in cybersecurity, but most of the spending goes toward services like consulting and outsourcing.



Union's General Data Protection Regulation (GDPR), which the U.K. also plans to adopt, will require companies to make a good faith effort to notify authorities of breaches within 72 hours. This could do more damage to stocks of companies that suffer a hack, explains Laila Khudairi, head of enterprise risk at insurance firm Tokio Marine Kiln, since many will have to go public with news of an attack before they've defeated it. (The penalty for not speaking up: up to 2% of a company's global revenue.) U.S. companies doing business in Europe are rushing to adjust, with 68% planning to spend between $1 million and $10 million on upgrades and 9% spending more than $10 million, according to consulting firm PwC.

IT'S CYBERSECURITY FIRMS, of course, that benefit most from such upheaval. Spending in the space is expected to jump from an estimated $86 billion this year to $108 billion in 2020, according to research firm Gartner. As cyberdefense has grown in importance, scores of companies have joined the competition, from narrowly focused startups to tech giants to diversified consultancies like Deloitte. In that crowded field, we found these prominent names most intriguing.

A fairly new player among the cybersecurity elite, **Palo Alto Networks (PANW, $128 as of Aug. 10)** made a name for itself with a firewall that controls how data flows within and around a company's corporate infrastructure, allowing a customer's security team to control which applications connect and regulate traffic from other devices. "They've been the disrupter in the network security space," says Saket Kalia, a Barclays analyst, and its sales have shown it: Palo Alto's revenues jumped 248% between 2013 and 2016, to $1.4 billion.

The stock has been volatile, however, and it currently trades at 34% below its highs from the summer of 2015. A recent slump accelerated in February when Palo Alto missed analysts' revenue-growth expectations for the second quarter. One of the reasons for the stumble: The company is transitioning to a subscription model for its products. Previously, Palo Alto primarily licensed out software, so any given sale was a one-time affair. But under the subscription model, customers pay to remain on the platform and choose which Palo Alto products they need, a process the company hopes will create stickier customer relationships and enable it to become consistently profitable. Palo Alto's subscription and service revenues have risen to 62% of sales, from 44% in 2014. And the stock's recent slide gives investors the chance to buy at cheaper levels, notes Oppenheimer analyst Shaul Eyal.

ONE SOURCE OF INVESTOR ANXIETY: NEW RULES COULD REQUIRE COMPANIES TO GO PUBLIC WITH NEWS OF AN ATTACK BEFORE THEY'VE DEFEATED IT.

Check Point Software Technologies (CHKP, $105), an Israeli company that trades on the Nasdaq, was Palo Alto's predecessor as the industry's standard-bearer and also built its success on firewall technology. The company faces "the classic innovator's dilemma," says Morgan Stanley analyst Keith Weiss: With growth slowing, it needs to introduce next-generation technology, but it doesn't want to do so too fast, lest it lose existing clients. That said, Check Point has a "large base of customers that are not going anywhere," says William Blair analyst Jonathan Ho. In April, it launched Infinity, a security platform for enterprises that are moving more storage to the cloud. The stock is priced in line with the broader market, with a forward price-to-earnings ratio of 20.4; Ho believes it will merit a higher valuation as Infinity gains momentum.

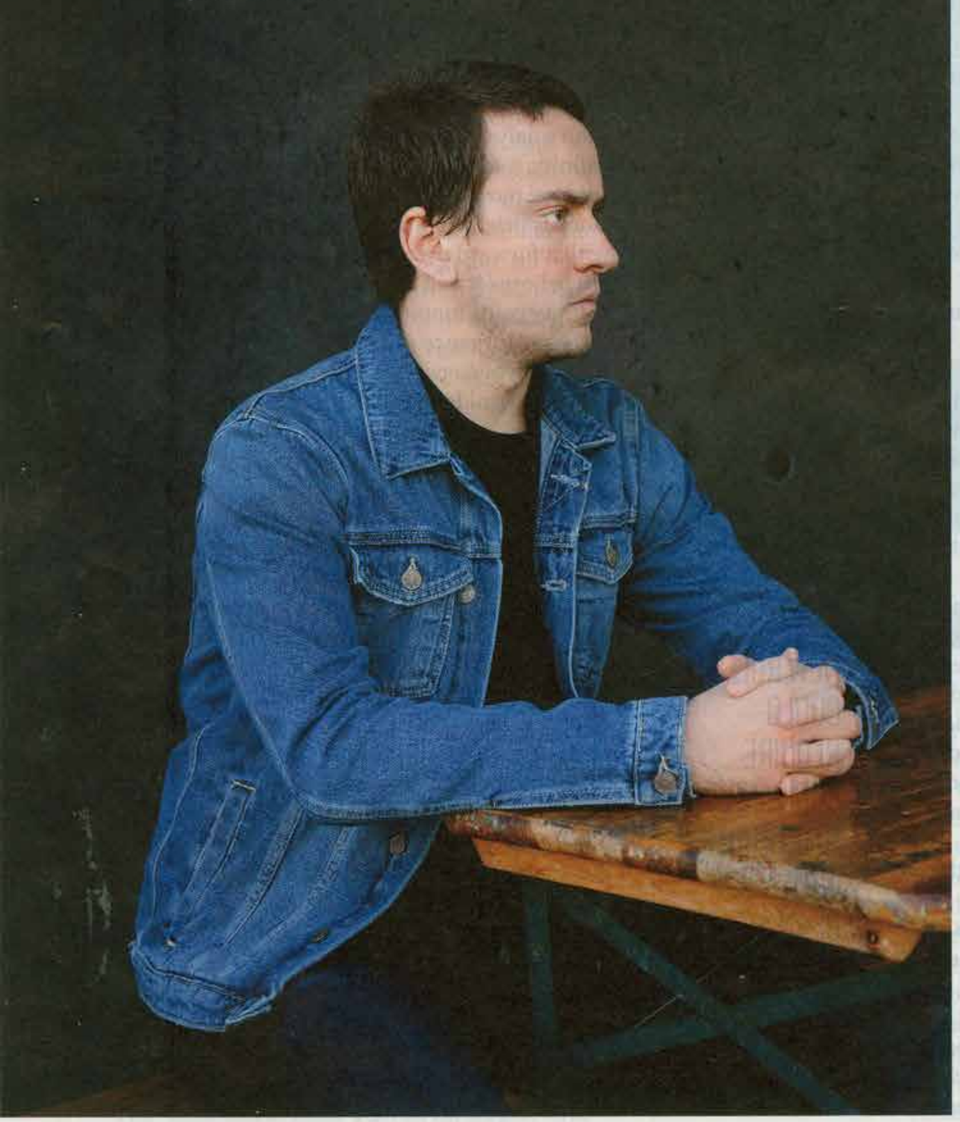
The resurgence of **Cisco Systems (CSCO, $31)** in cybersecurity has brought a new competitive wrinkle to the field. Cisco long viewed security as an afterthought, focusing primarily on hardware and leaving cyberdefense analysts "unimpressed with the company over the past decade," says Needham & Co.'s Alex Henderson. But Cisco is now marketing products that take advantage of its scale and deep troves of data: Its latest security software claims to be more predictive in preventing threats—for example, by recognizing traffic patterns that could signal an attempted breach.

The company laid off 6,600 people over the past year in a reorganization designed in part to put more focus on security, and in June it announced a partnership with Apple to develop a tool that offers enterprise cybersecurity teams greater control over iOS devices. Cisco's global supplier and customer base, meanwhile, could help it reap big benefits from the increased spending driven by Europe's GDPR upgrades. Cybersecurity still accounts for only a sliver—4%—of Cisco's $49 billion in revenue, but it's among its fastest-growing segments. And at a price of just 16 times earnings, Cisco is one of the field's more enticingly affordable stocks. ■

GET OUT OF HIS LANE

George Hotz, at age 17, was the first person to unlock the iPhone. Now, he's unlocking the self-driving potential of everyday cars.

By Andrew Zaleski



VENTURE

ON A STRETCH OF highway outside San Francisco, an Acura ILX sedan cruises along at 55 miles an hour. Jazz from the 1940s softly plays through the car's stereo. Just underneath the rearview mirror is a rectangular box fitted with a smartphone, projecting lines of neon green onto the image of the nighttime expressway being taken in via its built-in camera. The driver's hands aren't on the wheel, because this car is driving itself, but not thanks to technology from the myriad companies all racing to develop self-driving cars. Instead this car owes its autonomous driving ability to George Hotz, a 27-year-old Carnegie Mellon dropout who is turning America's public roads into his own personal laboratory.

As founder of Comma.ai, Hotz helms a Bay Area startup circumventing companies developing self-driving cars like Tesla and Waymo by giving people the technology to do it themselves.

One year ago, Hotz was about to sell the Comma One—a $999 product for that very purpose—when a letter came from the National Highway Traffic Safety Administration threatening daily fines if his startup put untested self-driving tech on the road.

So Hotz scrapped it and, last November, gave his technology away for free, releasing an open-source, self-driving platform called Openpilot. He also released open-source plans for Neo, a smartphone-powered device which plugs into certain compatible Honda and Acura models, and can control the car's gas, brakes, and steering, and navigate using Openpilot.

"Self-driving cars need nothing but engineers in order to solve it. It does not need manufacturers, regulators, any of these people," says Hotz. "The best thing they can do is stay out of the

Hotz, vacationing in Germany: "At the end of the day, I care about winning."

▲ PHOTOGRAPH BY AUBREY WADE

THE BIG PLAYERS

WAYMO: The autonomous-vehicle company spun out of Google currently has logged 3 million self-driving miles on public roads. In April, the company started offering rides in its autonomous minivans to people in Phoenix.

TESLA: Every Model S and Model X vehicle sold today comes equipped with Tesla's Hardware 2 package of sensors, cameras, and radar. Through future software upgrades, CEO Elon Musk claims Hardware 2 will be capable of full Level 5 autonomy, which would enable drivers to completely disengage from driving and observing the road.

CRUISE AUTOMATION: Acquired by General Motors in 2016 for more than $1 billion, Cruise Automation is currently testing 30 Chevrolet Bolt cars equipped with self-driving technology in Detroit, Scottsdale, and Hotz's backyard of San Francisco.

way of the engineers."

Audacious claims are a Hotz trademark, surpassed only by his escapades. He first gained notoriety at age 17, then known by his hacker alias "geohot," as the first person to unlock the iPhone so it could be used on any wireless carrier. He's a person whose bold thoughts are simultaneously clear in their aim but are cascading so swiftly they can sound disorganized.

Hotz says 73 drivers are using Openpilot. More than 1,000 people, he says, use Chffr, a dash-cam smartphone app that records drives and uploads them to the data center in the basement of a three-story house in San Francisco that Hotz's 12-person startup works out of.

Combined, those two tools have collected more than 1 million miles of driving data, and that's the heart of Comma.ai's self-driving coup.

His engineers use this data to train behavioral models of driving. Whereas other companies tinkering with self-driving cars are teaching their cars by defining different road conditions and manually labeling driving data—this is a passing lane; this is a stop sign—Comma.ai relies on the patterns and behaviors of everyday drivers to train the models used by Openpilot.

"Most people are trying to take data and label it. He's not doing that. He's letting everything go into the computer, and if it stands still, it's a tree; if it moves it's a pedestrian. He's counting on his computer to know that on its own," says Jim McPherson, a lawyer and consultant on self-driving technology.

Hotz says this is the only way to properly define driving: observe how drivers drive, catalog that data, and use it to teach other cars. (He likens driving to a dance, albeit a mechanized one on asphalt with a two-ton object involved in nearly 40,000 deaths in the U.S. in 2016 alone.)

This is where Comma.ai's approach makes observers of self-driving technology worried. If average drivers are teaching Openpilot how to drive, won't Openpilot then have a skewed, even unsafe, picture of driving?

"If somebody decides to put one of these on their car and something goes wrong in public, that's where I start to get scared," says Venkat Krovi, a professor in Clemson University's Department of Automotive Engineering. "If a car hasn't come across a certain case before, it's hard to know how it'll respond to that case."

But Hotz strongly rebuts this, claiming as Comma.ai gathers more data, the system will grow smarter. He's currently hacking a Toyota Prius to make it Openpilot-compatible, and Comma.ai recently began selling the Panda, an $88 device that plugs into a car's onboard diagnostic port to collect vehicle metrics on braking force, steering, speed, and more, which he'll then use to reverse-engineer cars that don't yet support Openpilot.

The grand plan for Comma.ai, which is still running on $3.1 million of seed money raised from venture capital firm Andreessen Horowitz, is to sell an aftermarket hardware-software package, and then sell subscriptions for its network of driving data. "We're planning to make this even more open-source than it was, because at the end of the day, I care about winning," Hotz says. "A lot of people who are trying to compete with us are quickly going to find out that we're going to open-source their whole business." ■

Comma.ai's Panda (above) is like a Fitbit, but for your car. It collects driving data, which is analyzed by the company's Chffr app (below).

© IMAGES COURTESY OF COMMA.AI

IN THE BELLY OF THE BRAZEN BULL

The Lamborghini Aventador S boasts a "masterpiece" suite of technical innovations. So how will it perform in the hands of a supercar novice? By Daniel Bentley

"HAVE YOU EVER driven on a track before?" my capable professional instructor asks. In truth, I have, but the hesitation in my voice tells him I've never driven anything like this. And I haven't. I'm in the cockpit of a 740 horsepower, half-million-dollar supercar. I'm about to drive a Lamborghini.

Seconds later as I slalom tightly spaced cones at speeds that don't seem possible for such a large vehicle, all thoughts of price and prestige are out of mind. I feel the rumble of the V-12 engine travel through the seat into my fingers. Pirelli tires can be heard screeching as I steer and countersteer. In that moment I'm no longer behind the wheel of the flagship Aventador S—I'm in the world's most exciting go-kart.

Four-wheel steering on the Aventador S makes for a car perfectly tuned for carving a winding mountain pass.

I approached the track day for the North American launch of the Aventador S, at Pocono Raceway in Pennsylvania, with some trepidation. Lamborghinis have a reputation for many things: power, unmistakable design, and being a bit crazy—setting it apart from the more refined Ferrari as the bad boy of Italian sports cars.

In a pre-drive press briefing, Alessandro Farmeschi, Lamborghini America's chief operating officer, touts all the technical marvels hiding under the Aventador's carbon fiber: four-wheel drive, four-wheel steering, "adaptive magnetorheological suspension." But the question on my mind is, Does all this tech get in the way of the snarling, uncompromised supercar promised by the charging bull on the hood?

That question is answered 20 seconds into my first hot lap. Distracted by the roars, pops, and crackles of the titanium exhaust, I inadvertently take a tricky corner far too fast. I make a rookie mistake and let off the gas, which causes the car to oversteer and lose grip at the rear end. The car's brain, a system called LDVA (Lamborghini Dinamica Veicolo Attiva), steps in after detecting that traction has been lost and sends more power to the front wheels, saving my behind. I'm dragged around the corner with my heart in my mouth, sweat on my palms, and four wheels still firmly planted on the tarmac.

THE AVENTADOR LINE has been around since 2011, and the S model represents a comprehensive visual and technical upgrade. The front splitter now sports two distinct "fangs," which the company says were inspired by both cobras and sharks. The triple rear exhaust tips have been reconfigured to resemble a rocket, because of course.

The Aventador S retains the Lamborghini DNA with its naturally aspirated V-12 engine, which has been featured in every flagship Lambo since its first production sports car, the 350 GT, in 1964. While the industry shifts toward using smaller engine blocks with turbochargers to increase power and torque, Lamborghini is standing firm with a whopping 6.5-liter engine to deliver all of its 740 horsepower and 508 lb.-ft. of tire-shredding torque. The result? Zero to 62 mph in 2.9 seconds and a top speed of 217 mph. (After flooring the Aventador on the back straight of the track, I have no reason to dispute these figures.)

LDVA, the brain unit that bailed me out, controls the car's lateral dynamics (steering), vertical dynamics (suspension), and longitudinal dynamics (drive) to optimize the performance for the conditions it senses. It can be partly user-controlled through the Aventador's four driving modes: Strada, Sport, Corsa, and the exquisitely titled Ego—which enables drivers to adjust the car's steering, suspension, drive, and other parameters to their individual liking.

More technical wizardry is employed when turning the car. Four-wheel steering, which is becoming increasingly popular in high-performance supercars, offers two primary benefits: At slower speeds, the front and rear wheels turn in opposite directions, virtually shortening the wheelbase of the car and making it far more nimble in corners. At high speed, the wheels turn in the same direction, which virtually lengthens the wheelbase of the car, making it far more stable. It's extremely noticeable, especially in tight turns, without feeling like a shopping cart with a loose wheel, and is the car's most delightful feature.

All this combines for a package that is winning over a new breed of customers. Volkswagen AG–owned Automobili Lamborghini has sold 1,500 more Aventadors in five years than its predecessor the Murciélago in a decade. Along with the V-10-powered Huracán, the company sold 3,457 cars in 2016—a record year.

Part of that success comes from Lamborghini's deliberate positioning of itself as a lifestyle brand for the young and rich—Kanye West, Justin Bieber, and soccer star Cristiano Ronaldo are owners—and its commitment to providing thrills by the bucket load.

While *other* Italian sports-car makers are notoriously selective about whom they will sell a car to, Club Lambo is open to everyone. All you need is means to purchase, the desire to see and be seen, and a stomach for unrelenting speed. ■

Luxury inside and out: The geometric design language of the Aventador S translates to the cockpit.

BLOCK
MANIA

EVEN IF THE CRAZE FOR BITCOIN AND ETHEREUM ABATES, THE POWER OF THE "BLOCKCHAIN" TECH BEHIND THOSE CURRENCIES IS VERY REAL. HERE'S HOW BUSINESSES ARE TRYING TO HARNESS IT—AND WHY THEY CAN'T AFFORD TO IGNORE IT.

BY ROBERT HACKETT

CHAIN

ONE SUMMER MORNING in a coffee shop on Atlantic Avenue in Brooklyn, I sit behind my MacBook Pro as tens of thousands of machines around the globe prepare to indelibly inscribe a record of my tinkering into their collective consciousness. I am in the midst of creating my own digital tokens—essentially online currency—on a sprawling, decentralized network known as Ethereum.

Mike Goldin, a software developer at ConsenSys, an Ethereum development studio based in Bushwick, walks me through the coding process. Goldin is my Sherpa today, graciously attending, with utmost patience, to my every query. (The 10-plus hours I spent downloading software the day prior was unnecessary, he tells me; we're going to employ some work-arounds that will achieve my goal in a matter of minutes.)

After considering a variety of names for my token—"fortunecoin," "hackettoken," "neither"—I settle on a cheeky one that evokes a spectacular flameout of the great '90s Internet bubble: "Petsdotcoin." I click "create."

Transaction hash
0xc14d13893bd0f0ff997a8a701c-0c8844661a6ddb921a42f2f61c-8c7adb0d158c

(Pending)...(Pending)...(Pending)...

Twenty-seven seconds and one block confirmation later, I am the proud owner of 500 newly minted "petsdotcoin" tokens. Their creation cost me $1.57 in Ether, the cryptocurrency that fuels the Ethereum network. Despite that expense, my tokens are valued at 0 Ether, or $0.00, as the program reminds me. They are worthless. But if I had tied those bits to some worthwhile business idea, petsdotcoin might have offered investors a radical new way to fund me, track their stake, and participate in a miniature, virtualized, in-app economy. In that respect, my funny-money vanity project is a tiny part of a movement of profound economic significance.

In case you haven't been keeping track, digital tokens are a new asset class, powered by cryptocurrency networks like Bitcoin and Ethereum. The sector has attracted maniacal investor interest this year, giving these e-coins absurdly inflated valuations that have inspired endless comparisons to the "dotcom" era. (Hence, petsdotcoin.) At press time, the total market value of all virtual currencies had rocketed past $135 billion, up from just under $20 billion at the beginning of the year.

Hundreds of projects have collectively raised more than a billion dollars through "initial coin offerings" (ICOs). There are now tokens funding every conceivable endeavor: Decentralized cloud storage (FileCoin, Storj). Digital advertising (Basic Attention Token, adToken). A gentlemen's club in Las Vegas (Legends Room). Marijuana (Potcoin). Satire (PonzICO). There's even one for dentists (DentaCoin). In a photo recently posted to Instagram, Floyd Mayweather, the boxer, sits on a private jet surrounded by stacks of dollar bills, touting the sale of tokens for a prediction market called Stox—a moment some saw as proof that ICO hype had reached peak zaniness.

The smart money is also playing in this pool. Established venture capital firms like Sequoia, Andreessen Horowitz, and Union Square Ventures are pouring millions of dollars into cryptocurrency hedge funds. The topic is all the rage on Wall Street. But notably, the long-betting investors in this space see today's numismatic delirium as a distraction. "Right now it's much easier to get more focused on the short-term ICO money stuff," says Chris Dixon, a general partner at Andreessen Horowitz. "I think this unfortunately overshadows the more important technology story."

That story goes like this: Underneath the crypto-hysteria is a grand innovation in the humble realm of accounting. The most bullish acolytes of this electronic book-balancing breakthrough, Dixon included, hold that token-based projects will anchor the web's next revolution, spawning crowdfunded businesses and services that deliver more value to their users while being less dependent on advertisers or rent-seeking middlemen.

Facebook, meet Tokenbook.

Look beyond the ICO frenzy, and you can glimpse another paradigmatic shift inspired by that same accounting innovation. Incumbent businesses in countless industries, from finance to energy to health care to food, are peeling back the layers on this budding technology, seeing the potential to trim costs, share and secure information more efficiently, and unleash new products at unprecedented speed. And they're doing so knowing that one day their survival may be at stake: Having witnessed what the advent of digital, cloud, and mobile did to laggard companies, no one wants to be the sucker left behind.

The technology in question: that choreographic marvel called a blockchain.

NO TERM AT PRESENT is more hyped, and more poorly understood. During a discussion at *Fortune*'s Brainstorm Tech conference this summer, Peter Smith, CEO of Blockchain, a London-based cryptocurrency wallet provider, half-jokingly defined "blockchain" as a marketing term exploited by salespeople to ink deals.

A less cynical definition might go as follows: A blockchain is a kind of ledger, a table that businesses use to track credits and debits. But it's not just any run-of-the-mill financial database. One of a blockchain's distinguishing features is that it concatenates (or "chains") cryptographically verified transactions into sequences of lists (or "blocks"). The system uses complex mathematical functions to arrive at a definitive record of who owns what, when. Properly applied, a blockchain can help assure data integrity, maintain auditable records, and even, in its latest iterations, render financial contracts into programmable software. It's a ledger, but on the bleeding edge.

Blockchain boosters say its development is one that rivals, in significance, the invention of double-entry bookkeeping. That's the revolutionary method of tabulating assets and liabilities that emerged in Renaissance Italy and that, according to some historians, put wind in the sails of capitalism, allowing investors and

entrepreneurs to team up in corporations and launch merchant ships beyond the horizon in search of commercial success. Blockchains, in this analogy, are triple-entry bookkeeping, where the third entry is a verifiable cryptographic receipt of any transaction.

Perhaps most spectacularly, a blockchain can get rivals to cooperate in creating a common record that is accessible to everyone and controlled by no one. This was the genius of Satoshi Nakamoto, the alias for the as-yet-unidentified creator (or creators) of the first blockchain, Bitcoin, which debuted in 2009. (Since then, the value of a single Bitcoin has reach a high of more than $4,300.) Part of Bitcoin's secret sauce is its consensus mechanism, which allows people to agree on a canonical order of transactions, thereby preventing double-spending and fraud, through a combination of cryptography and economic incentives based on game theory—all without needing a third party or middleman, like a bank. Even if participants don't trust one another, they can rely on the shared ledger they create through the transactional dance of their software. You don't need honor among thieves—you just need a blockchain.

If Bitcoin proved what was possible, Ethereum, a rival system, took its ingenuity to a logical extreme. Vitalik Buterin, a twentysomething Russia-born programmer (No. 10 on *Fortune*'s 40 Under 40 list this year; see page 42), created a blockchain that aims to be anything to anyone: His Ethereum can create representations of any asset, which has made it the primary fuel of the digital-token boom.

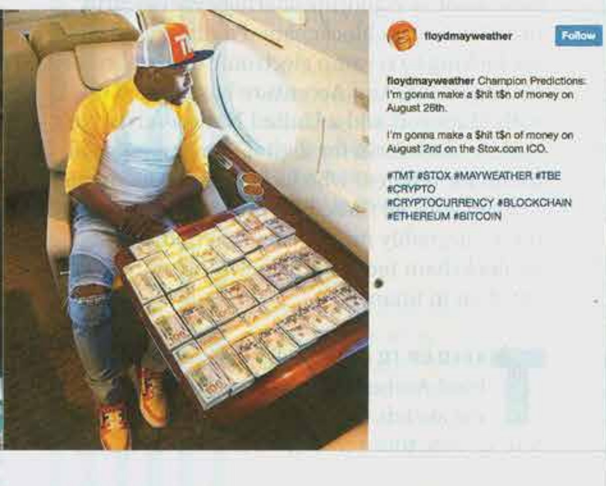
But by showcasing blockchain's fundamental flexibility, Ethereum's rise has also accelerated a deluge of research and development in corporate America. Scores of companies are adapting and advancing the core technology to suit their needs. While some are exploring digital currency and the open-source, free-for-all ecosystem of public blockchains (of which Bitcoin and Ethereum are prime examples), far more are concentrating on how the technology underpinning those systems can add value to their businesses—by helping them with everything from corralling medical records to tracking the provenance of a pork loin. Many are concocting "permissioned" or "private" blockchains, designed for a more centralized architecture where only authorized operators can join.

To some stalwarts, this corporate appropriation runs counter to the original, idealized blockchain as introduced by Nakamoto. "The word was hijacked to sell enterprise software, basically," says Olaf Carlson-Wee, founder of Polychain Capital, perhaps the most high-profile of the cryptocurrency hedge funds. Some entrepreneurs, like Chain CEO Adam Ludwin, argue that new ledger technology isn't really a blockchain if the items it tracks aren't financial. R3 CEV, a New York–based consortium of financial firms that began as a blockchain startup, now avoids the word, calling itself a "distributed ledger technology" company.

But this schism over terminology isn't hampering the science. Ultimately, anyone working on next-generation data structures with cryptographic signatures and joint-stakeholder elements might now be said to fall under the "blockchain" umbrella. "It's entered the vernacular like Kleenex," says Matt Higginson, partner in McKinsey's global banking practice. And whatever you want to call it, more and more businesses are gathering there.

ONE DAY LAST DECEMBER, Frank Yiannas went to a Walmart store near company headquarters in Fayetteville, Ark., and picked up a package of sliced mangoes. Yiannas is Walmart's vice president of food safety, and the fruit was part of a crucial experiment. He brought the mangoes back to his office, placed the container on a conference table, and gave his team a mission. "Find out where those mangoes came from," he ordered, setting a timer.

It took six days, 18 hours, and 26 minutes to get an answer. That's better than the weeks it can sometimes take companies, Yiannas says.



BELIEVE THE HYPE A Bitcoin fan photobombs Federal Reserve Chair Janet Yellen at a congressional hearing; boxer Floyd Mayweather shows his enthusiasm for the Stox cryptocurrency.

YELLEN: C-SPAN; MAYWEATHER: @FLOYDMAYWEATHER

Still, a near-week is a long time. In the event of an outbreak of foodborne illness—one in which a suspected pathogen is tied to mangoes somewhere—a lag that long could be painfully costly. By that point, Walmart might have had to pull every package of every mango product off its shelves, as a precaution; farmers, distributors, and Walmart itself would take the hit.

Yiannas has for years searched without success for what he calls the "Holy Grail of food traceability," a technology that could track and catalog a product's status across his supply chain. He admits he was "very skeptical" that a blockchain could fill the gap, but he gave it a try. Walmart partnered with IBM for a trial run on Hyperledger Fabric, a blockchain built under the purview of the Linux Foundation's Hyperledger group, where companies collaborate on blockchain R&D.

In the Walmart test, food shipments were tracked and digitally recorded via a blockchain. (Yiannas's team's manual search was the "control.") From the start of their journey at the farm, pallets of mangoes were tagged with numeric identifiers. Every time they crossed another checkpoint—from farm to broker to distributor to store—their status was signed and logged.

A few months after the fact, Yiannas repeats a version of the IBM demo for me. He enters a six-digit "lot" number on a web portal. In an instant, the mangoes' identifying details appear on-screen: Mango spears, 10 ounces, "Tommy" variety (a cultivar optimized for transport). The fruit was harvested April 24 from orchards in Oaxaca, in southern Mexico. A day later, the fruit underwent hot-water treatment to exterminate the eggs of potentially invasive insects. On April 27, an importer received the shipment; after a few more days, it passed through Customs and Border Protection, entering a U.S. processing plant where they were sliced on May 1. From there, the mangoes moved to a cold storage facility in Los Angeles (you can pull up a safety inspection certificate with a click of a mouse). Finally, the lot arrived at a Walmart store.

The time it took to compile and present all this information: about two seconds. (It clocked a similar time when Yiannas demonstrated it at Walmart's annual shareholder meeting this summer.) In the event of an *E. coli* or salmonella outbreak, the difference between two seconds and six-plus days can be decisive, even lifesaving. But in the context of a supply chain, a blockchain is far more than an emergency measure: The granular, secure records in the system could help prevent fraud, and provide an easy-to-use interface for executives to keep tabs on the flow of goods, as well as for regulators to peek under the hood when necessary.

"This was not about chasing the shiny coin," Yiannas says. "There were business challenges we were trying to solve."

Other companies are now exploring blockchains' potential for their logistics. Maersk, the Danish shipping giant, has started testing a blockchain to track its shipments and coordinate with customs officials. Airbus, the French aircraft maker, is looking to use blockchains to monitor the many complex parts that come together to make a jet plane. Daimler, the German automaker, is investigating similar possibilities for its vehicles.

The potential doesn't stop with tangible goods like windshield wipers or watermelons: Many companies and governments think blockchains could help them assemble tamper-resistant systems for storing virtually any kind of data. BAE Systems, the British defense contractor, is exploring sharing cybersecurity threat data on a blockchain. Pokitdok and Gem are looking to revamp electronic medical record management. And Accenture has teamed up with Microsoft and a United Nations group to build a blockchain for digital identity, especially useful for refugees who lack official documents.

Even with all these potential applications, there's arguably no industry where the promise of blockchain tech—or its peril—is more apparent than in finance.

FRUITFUL RESEARCH Frank Yiannas, vice president of food safety at Walmart, worked with IBM on a pilot project to track mangoes through the company's supply chain using a blockchain.

COURTESY OF WALMART

TAPED UP TO A GLASS dry-erase board behind Amber Baldet's desk is an unassuming sketch. It displays the black outline of four circles, four rectangles, a few conjoining lines, and a few acronyms of academic institutions such as SRI, UTAH, and UCLA.

The image is an early depiction of Arpanet, the forerunner of today's Internet. Baldet, who heads up the blockchain group at JPMorgan (and is No. 31 on our 40 Under 40 list), views her work as very much in a similar phase of development. For enterprises, she says, it's 1969, and they're tinkering with a technology that could, in time, be as important as the Internet.

Finance is the most obvious extension of blockchain tech, given the monetary roots of Bitcoin. Trade finance, security clearance and settlements, cross-border payments, and insurance are all areas that could be overhauled and made more seamless. Microsoft is collaborating with Bank of America on a blockchain to digitize and automate the money flow around

BLOCKCHAIN IN REAL LIFE

Amid the hype surrounding Bitcoin and Ethereum, it's easy to overlook how blockchains—the technology *behind* those currencies—are already transforming major industries. For businesses, the opportunities to secure supply chains, eliminate middlemen, and cut costs are increasingly compelling. Here are five examples of blockchains in action.—*Jeff John Roberts*

SHIPPING
Maersk, the world's largest shipping company, completed an inaugural test this spring of using a blockchain to track its cargo. The test involved not just Maersk but a series of third parties—the shipper, Dutch customs, and the U.S. Department of Homeland Security—with all of them tracking containers remotely. The tech's reliance on cryptographic signatures makes it harder for anyone to mislay goods or tamper with labels while cargo is on the move, and can reduce the time goods spend in transit.

BANKING
Despite its sophistication, the banking industry is still bedeviled by sluggish systems that can take hours or days to confirm basic transactions such as stock sales or money transfers. But the ongoing adoption of blockchains by the likes of Barclays, which conducted a groundbreaking transaction (it involved butter exports) using the technology in 2016, means this is changing. In the near future, look for rapid increases in the speed of banking services as well as the disruption of intermediaries like brokers and clearinghouses. Big banks are even planning to use blockchains to remake the SWIFT system, which is used for global interbank transfers.

LIVESTOCK
You might not peg Walmart as a blockchain pioneer. But the retail giant began using the technology in 2016 to track how pigs from China moved through the supply chain to the American table. Smaller outfits are following suit. In August, an Arkansas farmers' collective used QR codes on chicken crates to trace transactions involving their poultry. All of this promises to help companies reduce food spoilage and prevent disease outbreaks.

LAW
All sorts of agreements—from home sales to business purchases to employee contracts—require lawyers and courts to enforce. Now, more firms are experimenting with "smart contracts" that execute themselves: A blockchain system can, for instance, release money from escrow once one party to a contract transfers a deed. Lawyers nervous about their jobs can rest easy for now, as smart contracts are still a novelty. But this could change soon, especially as states like Arizona pass laws that confirm smart contracts are valid.

DIAMONDS
The diamond business is a tight-knit industry whose members and customers share common concerns over stones' origins and authenticity. This helps explain the success of Everledger, a company that can record over 40 identifying features of a diamond, including color and clarity, and register them to a blockchain. Everledger has digitized more than a million diamonds and has plans to branch out to other industries—specifically fine wine—in need of better anticounterfeiting records.

trades. HSBC, ING, U.S. Bank, and eight other banks recently completed a prototype application for the same purpose on R3's Corda ledger. Northern Trust, the asset management firm, is using Hyperledger Fabric for private-equity deal record keeping. And Ripple built a system to rival the SWIFT interbank money-transferring service. In a hotly competitive sector where customers demand faster transactions and lower costs, the rewards of building the best blockchain mousetrap could be vast—the penalties for missing out, proportionately painful.

To help stake JPMorgan's claim, Baldet's team has created a so-called permissioned variant of the Ethereum blockchain. The bank open-sourced the code late last year, under a "general public license" that allows anyone to draw from or contribute to the design. This retooled blockchain, dubbed Quorum, is the first software ever released by JPMorgan this way. It's an unusual move by the bank, which certainly had the resources to work in-house and in secret. But JPMorgan sees a benefit to rallying all parties to work on a common platform that could reduce costs. "We spend a whole lot of money trying to transact with our counterparties and our clients," Baldet explained at a recent *MIT Technology Review* event in Cambridge, Mass. "The more free that sort of thing is, the better for us."

The JPMorgan team is already breaking ground—and, in the process, underscoring key differences between private and public blockchains. In March, Quorum began adding support for "zero knowledge proofs," advanced cryptography commercialized by the Zerocoin Electric Coin Co., makers of the Zcash cryptocurrency. That cryptography enables state-of-the-art privacy features—something the Ethereum Foundation, the Swiss nonprofit that maintains the public Ethereum blockchain, has yet to do, though it plans to. JPMorgan, after all, is designing Quorum to prioritize the needs of corporations, especially in data confidentiality

DIGITAL DOINGS IN DELAWARE

The state that's the de facto capital of U.S. business law has caught the blockchain bug.

As of Aug. 1, a new law permits companies in Delaware—where more than two-thirds of *Fortune* 500 companies are incorporated—to keep their list of shareholders on a blockchain.

The boosters of the blockchain law hope it will encourage companies to replace Excel spreadsheets and SQL databases as a way to keep track of shareholders. But the law is also just the start of what could be a revolution in corporate record keeping. That's because Delaware is also in the process of creating a system intended to let companies do everything from file incorporation documents to register shares via a blockchain.

According to CEO Mark Smith of Symbiont, a New York–based company supplying blockchain technology to the state, a network of law firms and registered agents is already building tools to help companies store their records on Delaware's blockchain. If successful, the tools will provide an efficient new way for companies to undertake anything from proxy votes to share splits. Firms will also be able to use the cryptographic features built into the blockchain to provide regulators or investors with secure temporary access to confidential documents on a case-by-case basis.

The venture capital arm of retailer Overstock.com has already pledged to move records to Delaware's blockchain service, and other firms are expected to follow suit before long. For these companies, the advantages could be huge: These could include saving millions of dollars a year in record keeping and transaction costs, as well as much quicker auditing and due diligence procedures.

More broadly, the Delaware project aspires to create a one-stop shop for corporate records that is tamperproof—one of the hallmarks of blockchain technology—and always accessible. Meanwhile, access to the records will be available via a website (all the new blockchain stuff will be tucked into the back end) so there will be little in the way of a learning curve for ordinary people.

While Delaware's ambitions are grand, the experience of other states offers a cautionary note. Vermont, for instance, announced to much fanfare in 2015 that it would put its property records on a blockchain—but bailed on the plan after a year upon finding it to be too costly.

Smith claims Delaware will be different since it is using his company, rather than its own bureaucracy, to create and implement its blockchain bet. Meanwhile, Andrea Tinianow, a state official whom some call "the blockchain czarina," says the sweeping changes to Delaware records are not years away, but will be in place by 2018. —*J.J.R.*

and scalability—areas where private blockchains excel and, for now, public blockchains struggle.

Still, many industry insiders believe that public and private will eventually intersect—just as internal networks came to coexist with and feed the public Internet decades ago. "I think we're going to see the distinction between public chain and private chain eradicated in the next two to three years," says Jeremy Millar, chief of staff at ConsenSys, and a founding board member of the Enterprise Ethereum Alliance, a group of financial and tech firms that includes JPMorgan and is pushing Ethereum-based blockchains for business. "We'll be talking about global chains vs. industry and company chains."

At a recent blockchain event hosted by Microsoft in Manhattan, I ask a group of executives whether they're similarly bullish. The responses span the gamut from "absolutely" to "I have no idea." Patrick Nielsen, lead engineer of Quorum, overhears my line of questioning. He can barely conceal his amusement beneath an impressively leonine beard. We've got some academic institutions and military research agencies, he says with a wry smile, referencing the topology of the Internet in its early days. "Just have to add a few more nodes to the network."

OPEN SECRETS Amber Baldet's team at JPMorgan built an open-source blockchain platform: "The more free that sort of thing is, the better for us," she says.

© BENJAMIN SPRADLEY

IF AND WHEN ALL those nodes are in place, it could presage a major shift in the way humans, companies, and their data organize. Of all the analogies that come up in discussing blockchains, perhaps the most frequently cited is the design, in the 1970s, of TCP/IP—the watershed networking protocol that enabled computers to talk to one another and swap data and info. This technology helped upend the point-to-point telephone lines that predominated during the Bell era, paving the way for a network of networks—the Internet.

If the Internet is a supranetwork, then a blockchain, in its purest form, is a way to turn these networks into decentralized marketplaces. Ronald Coase, a 20th-century economist, won a Nobel Prize for formulating an explanation for why corporations existed. Their raison d'être, he said, was to maximize efficiencies in business and market negotiations: Dealmaking is more productive when done collectively. Blockchains could take that principle and multiply it exponentially.

Granted, there are many technical and cultural challenges standing between that vision and reality. The cryptocurrency boom has drawn attention to some of the drawbacks and limitations of blockchains—including the paucity of present demand for cryptocurrency in actual business dealings and transactions outside of pure speculation (lots of people invest in it, few use it) and the potential for security lapses. (For more on the latter, see "The 21st-Century Bank Robbery" in this issue.)

Vint Cerf, one of the coauthors of TCP/IP and now vice president and "chief Internet evangelist" at Google, has reservations. "I think that the claims that blockchains will change the world are hyperbolic for the most part," he zapped in an email to *Fortune*. "It has become a kind of magic pixie dust for some proponents." Still, even Cerf sees potential in blockchains, where "the parties involved in the system are known and can be evaluated for reliability and trustworthiness."

If Cerf's cautious hunches pan out, businesses could be innovating and growing with the help of blockchains, even if the digital token craze proves to be a fad. Maybe petsdotcoin won't be the next big hit. But it's no exaggeration to believe that blockchains could, in the long term, revamp business, government, and even society itself, just as surely as the Internet did last century, and double-entry bookkeeping did centuries earlier. Someday, you may literally be able to count on it. ■

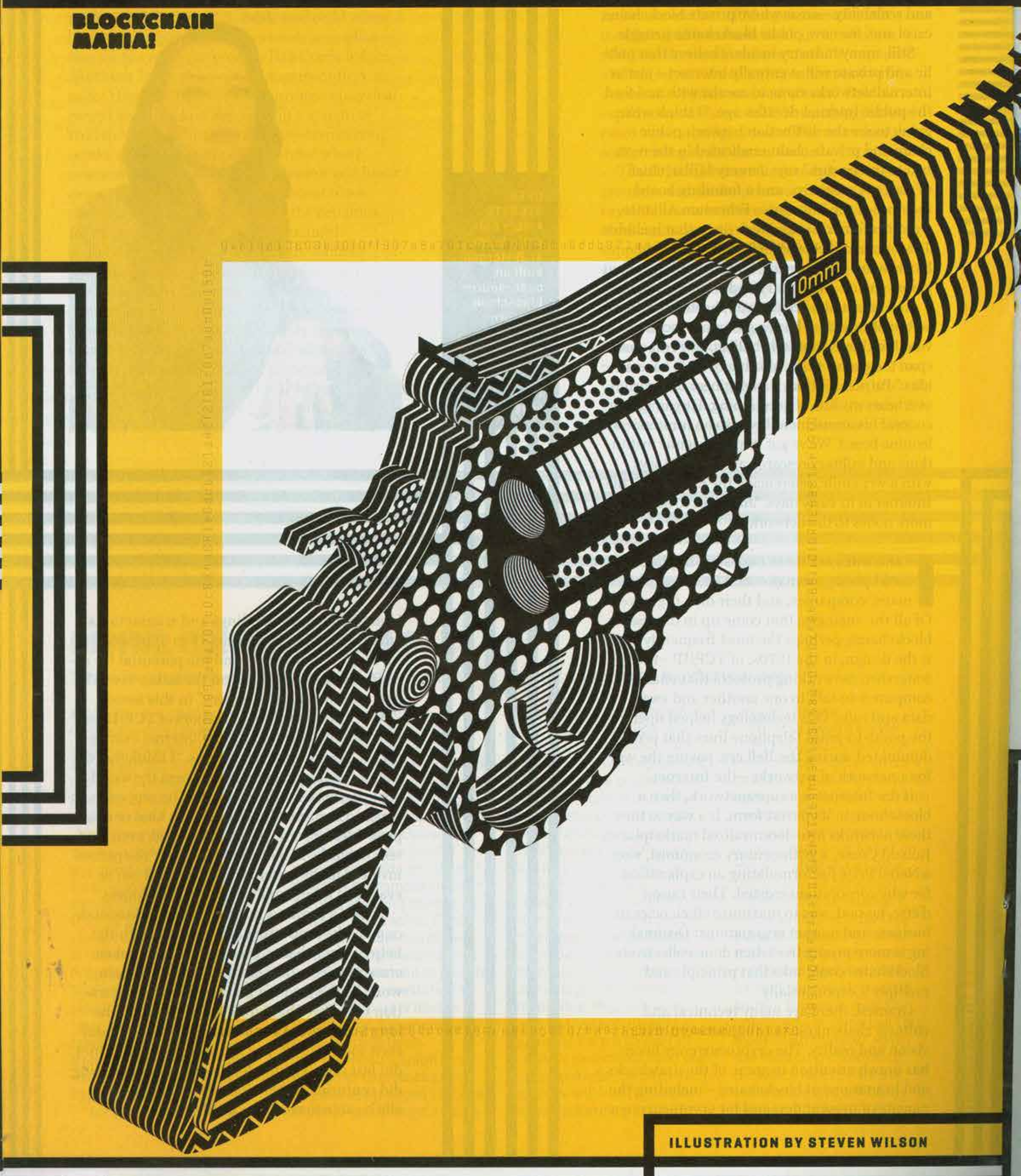


ILLUSTRATION BY STEVEN WILSON

THE 21ST-CENTURY BANK ROBBERY

CRYPTOCURRENCY IS REVOLUTIONIZING THE WORLD OF FINANCE. IT'S ALSO SHOCKINGLY EASY TO STEAL. HERE'S HOW COINBASE, THE WORLD'S BIGGEST CRYPTOEXCHANGE, IS FIGHTING TO REPAIR BLOCKCHAIN'S MOST DANGEROUS FLAW.

BY JEN WIECZNER

SEAN EVERETT wasn't sure how his bullish bet on cryptocurrency would turn out. But he definitely didn't expect it to be over so soon.

In March, he sold all his stocks, including Apple and Amazon, and used a chunk of the proceeds to buy Bitcoin and Ethereum on a site called Coinbase. The decision made Everett, the CEO of artificial intelligence startup Prome, almost instantly richer, as the blockchain-based currencies' value rocketed up exponentially over the next several weeks. But then, while he was out walking the dog after 10 p.m. on Wednesday, May 17, Everett got the call. It was T-Mobile, ringing him to confirm that it was switching his phone number to a different device.

It was a suspicious move that Everett had most certainly not requested. But even as he pleaded with the agent to block the switch, it was too late. Less than five minutes later, Everett's cell service abruptly shut off, and as he rushed to his computer, he saw himself being robbed in real time. A raft of email notifications confirmed that someone had taken control of his main Gmail account, then broken into his Coinbase "wallet." They'd gotten in with the help of his switched-over phone number: Everett's account required him to log in with a two-factor authentication code sent by text message, as a second safeguard—and now the text had gone straight to the thief.

It took only two minutes for the attacker to clean Everett out of what was then a few thousand dollars' worth of digital coins. From Everett's perspective, the even more painful heist was what came next: Ethereum's price quadrupled over the next three weeks. It had reached its all-time high of $400 just hours before I met Everett in a New York coffee shop on a humid June afternoon. Bitcoin, meanwhile, had broken $3,000 for the first time a day earlier, and Everett was pining for his missing digital coins. "I'm not only still out my money, I also didn't get the rise in price," he lamented.

Then again, the biggest surprise for Everett—and, it would turn out, for many other Bitcoin enthusiasts—was that the theft happened on Coinbase at all. San Francisco's Coinbase, the world's largest exchange for trading cryptocurrency, is one of very few such companies whose own coffers have never been hacked, a distinction that carries extra weight in the realm of blockchain, where several costly breaches have made global headlines. Almost any early investor you talk to lost money in Mt. Gox, an exchange that collapsed in 2014 after hackers pillaged nearly $500 million in Bitcoin. Last summer, thieves grabbed $72 million from Hong Kong cryptoexchange Bitfinex in one fell swoop.

But hackers have never breached Coinbase's own virtual fortress, and that impenetrability has earned it a reputation as the safest place to buy Bitcoin, helping it attract more than 9 million customers who store at least $3 billion in cryptocurrency there, and who have traded $25 billion to date on its retail brokerage as well as its institutional exchange, GDAX. The five-year-old Coinbase just raised $100 million in new funding, valuing the company at $1.6 billion—making it the blockchain industry's first "unicorn." "If you look at what they are world-class at, it's security, trust, safety... all these things that, frankly, banks are good at," Fred Wilson, the venture capitalist and one of Coinbase's earliest and largest backers, said at a conference in March. "They're like JPMorgan or Goldman Sachs for blockchain."

But Coinbase's individual customers do get burglarized—with surprising and unsettling frequency. Even Wilson himself was in for a rude awakening: While vacationing in Europe in early June, the VC woke up to the same telltale emails that Everett saw, signaling that an intruder was trying to get inside his Coinbase account. Wilson managed to lock it down before anything was stolen, but in a rare public chastising of a company in his own portfolio, he wrote in a blog post: "I am still a bit shaken up from the experience and a fair bit more paranoid from it."

Since then, *Fortune* has spoken with more than a dozen victims, including tech CEOs

PHOTOGRAPH BY **WINNI WINTERMEYER**

and well-known blockchain proponents, whose Coinbase accounts have been targeted and hacked in almost exactly the same fashion; still more have been attacked on other exchanges. The day after Everett's robbery, Los Angeles entrepreneur Adam Dachis's account was wiped out of what was then $10,000. On July 7, thieves emptied $18,000 from the Coinbase wallet of blockchain adviser Mike Costache, during the four hours he slept one night while traveling overseas. Since Christmas, there have been months when Coinbase users have been robbed as often as 30 times—a rate of one robbery every single day.

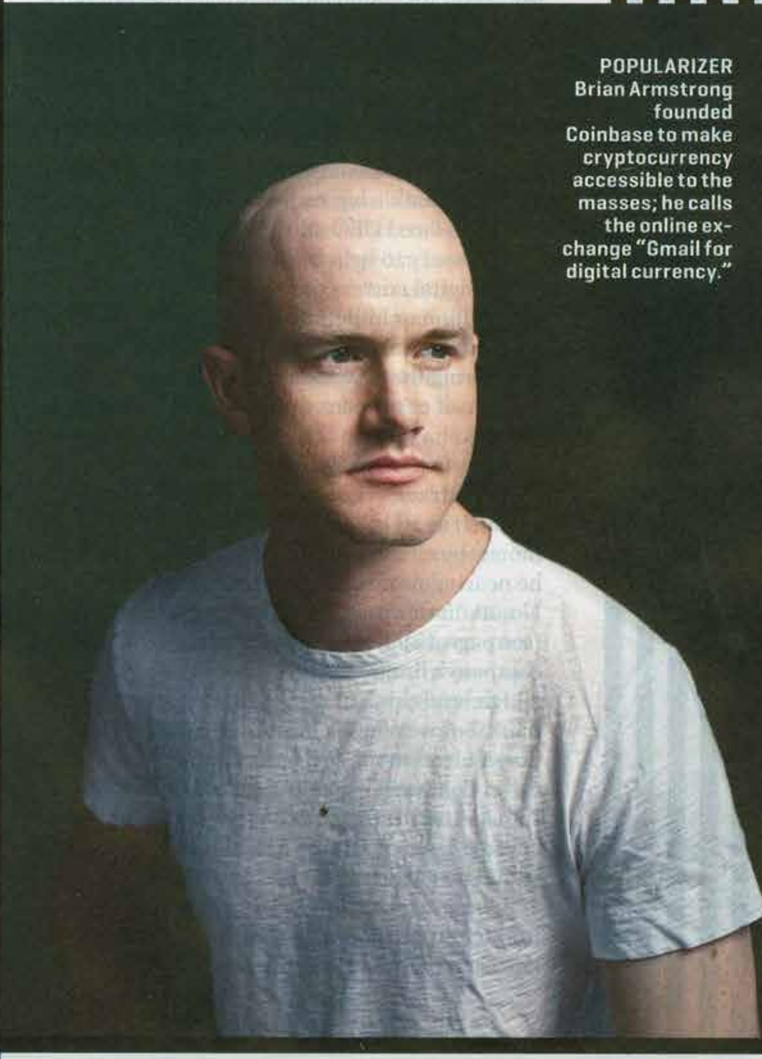
In each case, the same blindsiding realization arrives, bringing the inherent paradox of blockchain into focus. The quintessential strength that sets cryptocurrency apart from traditional money—that transactions are instant and irreversible—is also its fatal flaw. "One of [Bitcoin's] reasons for existence is that it's censorship-resistant," says Tom Robinson, cofounder and chief data officer of Elliptic, a London-based blockchain intelligence firm. That means no one, not even a government or central bank, can stop a digital currency transaction from happening. And therefore the fraud protections traditional bank depositors rely on are mostly unavailable. "Any kind of charge-back and reversibility would be the antithesis of what Bitcoin was created to achieve," says Robinson.

That's one reason that, when criminals want to pull a heist, they're increasingly choosing cryptocurrency over real dollars. In 2016, $28 million in losses from crimes involving virtual currency were reported to the FBI's Internet Crime Complaint Center, more than triple the 2015 total. And that figure is based heavily on voluntary reports by individual victims. It doesn't include large-scale thefts from exchanges like the Bitfinex hack, so it likely underestimates the true damages by many orders of magnitude.

Cybercrime is rising at traditional financial institutions too: For example, thefts through so-called account takeovers, a crime analogous to the Coinbase hacks, rose 61% last year to $2.3 billion, according to Javelin Strategy & Research. But hacking losses are a blip relative to the trillions of dollars kept in banks. Hackers are stealing a much larger proportion of the cryptocurrency pie, whose total market value is only about $135 billion. In the past 12 months, for example, criminals have absconded with 1% of Ethereum's total market value, or $225 million, according to cybersecurity firm Chainalysis; the Bitcoin toll is estimated to be even higher.

Brick and mortar bank robbers have "two problems: stealing the money and hiding the evidence," explains Moran Cerf, a professor of business and neuroscience at Northwestern's Kellogg School of Management and a former corporate hacker. "Bitcoin solves the second one for you because everyone there is anonymous." Bitcoin diehards seem resigned to the reality of irreversible transactions—and its drawbacks. "I think of that as a feature and not a bug," says Chris Burniske, a blockchain investor and author of forthcoming book *Cryptoassets*—even though his own accounts were looted in December for digital coins that would now be worth over $100,000.

But when victims watch their money up and leave into the digital wallet of a nameless stranger, it becomes more than just a problem for Coinbase: It's a threat to the promise of Bitcoin itself. As the value of cryptocurrency soars, more investors are grappling not just with how to profit from it, but how to hold on



POPULARIZER Brian Armstrong founded Coinbase to make cryptocurrency accessible to the masses; he calls the online exchange "Gmail for digital currency."

UNTOUCHABLE
A digital-coin vault maintained by the firm Xapo, 200 meters inside a mountain in Switzerland. Cryptocurrency keys are kept there on servers that have never touched the Internet.

to it at all. "Coinbase looks like a bank, talks like a bank, and takes millions of dollars in cash like a bank, but, in practice, it functions like a dimly lit underground casino," says Cody Brown, whose account was hacked for $8,000 in the span of just 15 minutes in May. "You don't realize that the balanced fonts, smooth blue gradients, and endless copy about trust mean absolutely nothing—until you are robbed blind."

Coinbase, for its part, won't discuss specific cases except to say that it investigates all account takeovers. But Brian Armstrong, Coinbase's 34-year-old CEO and founder, says Brown's and Wilson's experiences were "helpful" in teaching the company how to improve. Its security measures already match or exceed those at banks—from using machine learning to detect dubious activity, to mandating dual-factor authentication. Yet Armstrong recognizes that Coinbase is also a juicier target: "We need to be held to a higher standard," he tells *Fortune*, "because digital currency is so new and interesting and powerful that it is attractive to a lot of people out there to try to steal it."

IF BITCOIN WERE A RELIGION, its equivalent of "What would Jesus do?" would be "BYOB: Be your own bank," an unofficial slogan widely embraced in the industry. The original blockchain was launched in 2009, by the mysterious founder (or founders) going by the name Satoshi Nakamoto, as a utopian form of electronic cash that could change hands, as Nakamoto wrote in a legendary white paper, "without going through a financial institution."

But that ideal also attracted a subversive element, repelling many potential adopters. That's where Armstrong saw an opportunity to bring polish to an industry run by "hackers and cryptoanarchists" at the time, he says: "If this was going to go mainstream, it needed something that had a more trusted brand around it."

An early engineer at Airbnb, Armstrong quit in 2012 to create the "Gmail for digital currency." His strategy: making it easier and safer to store, and then buy and sell, cryptocurrency. While early Bitcoin wallet companies made people keep track of their own private keys—the secret 64-character passwords that alone provide access to one's cryptocurrency—Coinbase's pioneering innovation was its offer to store keys on customers' behalf. That also came with risk, as customers wouldn't need to know their actual key, but rather just a password, to get to their Bitcoins—and neither would a hacker. "That's a big responsibility to take on," the fresh-faced CEO admits. "But I also think it's necessary to help the industry scale and make digital currency accessible to the next 100 million or billion people."

Coinbase has demonstrated a unique ability to bring the new asset class to the masses. Its base of customers, most of whom are in the U.S., has grown 50% just in the past five months, with as many as 50,000 signing up in one day; trade volume in July alone was twice as much as all last year. Coinbase, which makes money by charging transaction fees, is said to be nearing profitability, and Armstrong ranks No. 10 on this year's *Fortune* 40 Under 40 list (see page 42). But he is pretty clear about his company's limits. "The average person may at a high level think of us as a digital currency bank, but we're not a bank," he says. Coinbase doesn't lend money, as banks do. And critically: Coinbase, which is regulated as a money transmitter like PayPal or Western Union, isn't covered by the FDIC or bound by all the consumer protection laws that govern banks.

Armstrong has long taken 100% of his salary in Bitcoin; he now cashes out enough into dollars each month to cover his rent. Many of his

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employees do the same. They understand the security issues better than just about anyone, yet protecting customers is proving to be a gnarly challenge: Technically, because hackers are breaching accounts from the consumer end, exploiting weaknesses at companies like Verizon and Sprint, the hacks aren't directly Coinbase's fault. "Within the realm of reason, it's very difficult for us to prevent their account from being drained," says one executive.

Still, Coinbase can't afford to ignore the problem—literally. Even though it is not a bank, Coinbase still bears the cost of banking-system protocols, when traditional financial institutions yank back fraudulent payments induced by hackers. For example, when Dachis was robbed, a Coinbase customer support rep complained right back to him by email that "Coinbase has suffered a $1,657.41 USD loss due to bank reversals" of transactions subsequently reported as fraud. "Coinbase is left holding the bag," Soups Ranjan, the company's head of data science, said at a recent industry event. Problems like this—along with unauthorized credit card purchases of cryptocurrency—cost Coinbase a stunning 10% of all revenue it collects, a fraud-loss rate 20 times as high as PayPal's. "I firmly believe," Ranjan added, "we have the hardest payment fraud and user security problem in the world right now."

To combat that, Coinbase has been using analytics to predict which customers have the highest risk of fraud and charge-backs, and preemptively limiting their purchasing power or locking their accounts. But that method comes with a downside of its own in the form of frustrated customers—and a backlog of help-desk requests that has stretched into the tens of thousands. With about 180 employees, the company hasn't been able to hire fast enough to keep up with demand and is now looking to fill another 100 positions. Coinbase doesn't even have a phone number for customer support, though it plans to add one in September.

At the same time, Coinbase finds itself slamming headfirst into the expectations that come with being the closest thing cryptocurrency has to Goldman Sachs. The IRS has gone to court seeking Coinbase user records, after only 802 U.S. taxpayers reported Bitcoin profits on their tax returns in 2015. In June, Coinbase had its first "flash crash," with Ethereum's price collapsing to 10¢ for a brief, panicky stretch; the company said that all trades "were executed properly" but eventually agreed, as a courtesy, to reimburse traders who had lost money owing to margin calls. And in early August, when a "hard

ANATOMY OF A CRYPTOHEIST

Coinbase account holders lose up to $5 million annually to theft by hacking, according to a person close to the company. Here's how the hacks happen, and why the culprits are so hard to catch.

THE STAKEOUT
A scammer scouts a target by searching for people who work in the blockchain industry—or by combing social media for mentions of Bitcoin and Coinbase. The attacker finds the target's email address and phone number through online postings or previous data leaks.

THE SWITCHEROO
The scammer contacts the victim's mobile provider and "ports" the phone number to a device under the scammer's control.

THE DISGUISE
Because Gmail accounts often link phone numbers as a backup access method, the scammer can now log in and reset the target's email password, then do the same at Coinbase.

"I'M IN!"
Coinbase requires two-factor authentication ("2FA") in addition to a password. That 2FA now gets texted to the thief, who logs in.

THE GETAWAY
The scammer moves the money into digital "wallets" under his control. Law enforcement can easily track the movements of the stolen currency recorded on the blockchain, but they can't block transactions, and figuring out who controls the wallets is difficult.

THE LAUNDERING
To try to cover his trail, the scammer can move the currency to foreign "cryptoexchanges," or convert it to other kinds of digital currency that are harder to track. Eventually, he can convert it to cash or other assets.

BUILDING A BETTER VAULT
For better security:
> Put a "do not port" order on your phone number.
> Don't use text-message 2FA; instead, use an app like Google Authenticator.
> Use a unique password, one you don't use for other accounts or social media.

"HOW MANY PEOPLE HAVE BEEN CAUGHT FOR STEALING MONEY FROM MAJOR BITCOIN EXCHANGES? THE ANSWER IS ZERO."

fork" of the Bitcoin blockchain created another currency called Bitcoin Cash, Coinbase initially said it wouldn't support it. Hours later, a denial-of-service cyberattack—which some perceived as retaliation—knocked the exchange completely offline, and customers began threatening to sue. Coinbase gave in: Account holders will be able to withdraw their Bitcoin Cash by 2018. "We're in a period of hypergrowth, and it's superexciting and a little chaotic," Armstrong says.

FOR MANY BLOCKCHAIN enthusiasts, the Coinbase hacks have been a reminder of the danger of letting anyone else store your cryptocurrency. "If you don't own the private keys, you don't own the coin," says Jonathan Smith, the chief technology officer of Civic, a company that uses blockchain tech for identity verification. Then again, Bitcoin has a dirty little secret: For an asset that epitomizes the future, managing your coin yourself can feel like a journey into the troglodytic past.

Smart-money investors who store their own keys often resort to the most rudimentary of tactics to protect them. They're the Bitcoin equivalent of stuffing cash under the mattress: a private key printed out on a sheet of paper, cut into pieces, and distributed among family members who don't know how to put it back together; an encrypted file loaded on a USB stick and buried in the backyard; a password committed only to memory. These jury-rigged methods come with their own pitfalls, and stories of self-inflicted losses are legion: The New York man who reformatted a hard drive and erased the key to $25,000 in Bitcoin. Dominic Fogarty, a hedge fund research analyst who left his phone, storing his cryptocurrency, in a taxi after a bachelor party—then schlepped all over the Adirondacks to retrieve it. ("Yes, we missed our train, but more importantly I didn't lose my Bitcoins!" he tells *Fortune*.)

The ultimate irony is that the gold standard in security, storing private keys in what's known as "cold storage," without connection to the Internet, often means putting them in the very places blockchain advocates hoped to avoid: banks. One cryptocurrency hedge fund manager once went to check on his safe-deposit box at Wells Fargo, which stored the key to $5 million, only to find the drawer empty. (A few weeks later, the correct box was found one slot below where it was supposed to be.) Even Coinbase itself relies on banks for some of its cold storage, where 98% of customer funds are kept. "It does seem a little old-fashioned, I suppose," Armstrong acknowledges. And yet, it may also be the future, as more mainstream investors want in on cryptocurrency but without the worries of BYOB.

For some crypto devotees, this is nothing less than heresy. Says Michael Krieger, a former Lehman Brothers analyst who abandoned Wall Street for cryptocurrency after becoming disillusioned by the financial crisis, "I wouldn't trust my crypto private keys to a safety-deposit box at a bank. That's just me." But already, the walls between finance's old guard and blockchain's renegades are beginning to crumble, and a day may come where the systems meld together almost seamlessly. "It's almost ironic and funny that some of the rules and procedures we want to get rid of are almost exactly the rules we want in place to [protect] a major client," says Hu Liang, a former State Street exec who left in August to start a cryptocurrency trading platform for institutional investors. Even as they dream of supplanting the conventions that have defined banking for centuries, blockchain disciples are realizing that you can never quite escape them.

JONATHAN LEVIN IS STILL catching his breath from a six-mile bike commute as he welcomes me into his office, on the second floor of a Manhattan coworking space, early one August morning. Wearing a gray cotton T-shirt that reads "Bitcoin, est. 2009," the 27-year-old British expat exclaims cheekily, "So this is what fighting cybercrime looks like!"

Levin is the cofounder of Chainalysis, a startup that tracks virtual currency movement and investigates illicit use. Chainalysis's software assisted law enforcement with the takedowns and criminal indictments of both "dark net" marketplace AlphaBay and notorious digital currency exchange BTC-e during the span of a week in July, according to people familiar with the investigations. Previously, the company was able to locate where the stolen money from Mt. Gox and Bitfinex ended up: Bitcoin keeps an immutable record of all transactions—a literal money trail—so anyone can see the addresses of the digital wallets where funds are sent. Chainalysis's artificial intelligence "clustering" techniques mapped the funds to particular exchanges. But progress seems to have hit a dead end when it comes to determining who controls those wallets. "How many people have been caught for stealing money from major Bitcoin exchanges?" Levin asks rhetorically. "The answer is zero."

That's not entirely true, says Kathryn Haun, a former federal prosecutor who led the crackdown on virtual-currency crime and joined Coinbase's board in May. While no one yet has gone to jail for hacking into an exchange or electronically pilfering cryptocurrency, she says, the AlphaBay and BTC-e probes are the first of a wave of cases that have yet to be completed or unsealed. Because wallet addresses are pseudonymous, it can take years for investigators to link them to a person—gathering data gleaned from exchanges like Coinbase and more obscure corners of the Internet. "I liken it to more traditional crimes, like bank robberies," Haun says. "If he's wearing a disguise and has a wig and gloves, it makes it that much harder to capture the criminal. But that doesn't mean it's impossible."

Individual thefts may be too small on their own to merit a federal case, but as more victims report crimes to the FBI and other government agencies, there's more cause for hope. Chainalysis, for its part, opened a special investigations unit in July to take on personal cases after fielding pleas for help from hack victims. And experts believe the criminals who commit the robberies belong to sophisticated organizations with the technology and manpower to trawl social networks for mentions of cryptocurrency accounts—the kinds of resources that let them, say, call Verizon 28 times in 24 hours until they succeed in porting a phone number, as they did in the case of Adam Pokornicky, managing partner at hedge fund Cryptochain Capital. Efforts that ambitious inevitably leave traces, and from such clues a pattern can emerge. "Phone porting cases and schemes like it have captured the attention of law enforcement, so I would say, stay tuned," Haun says.

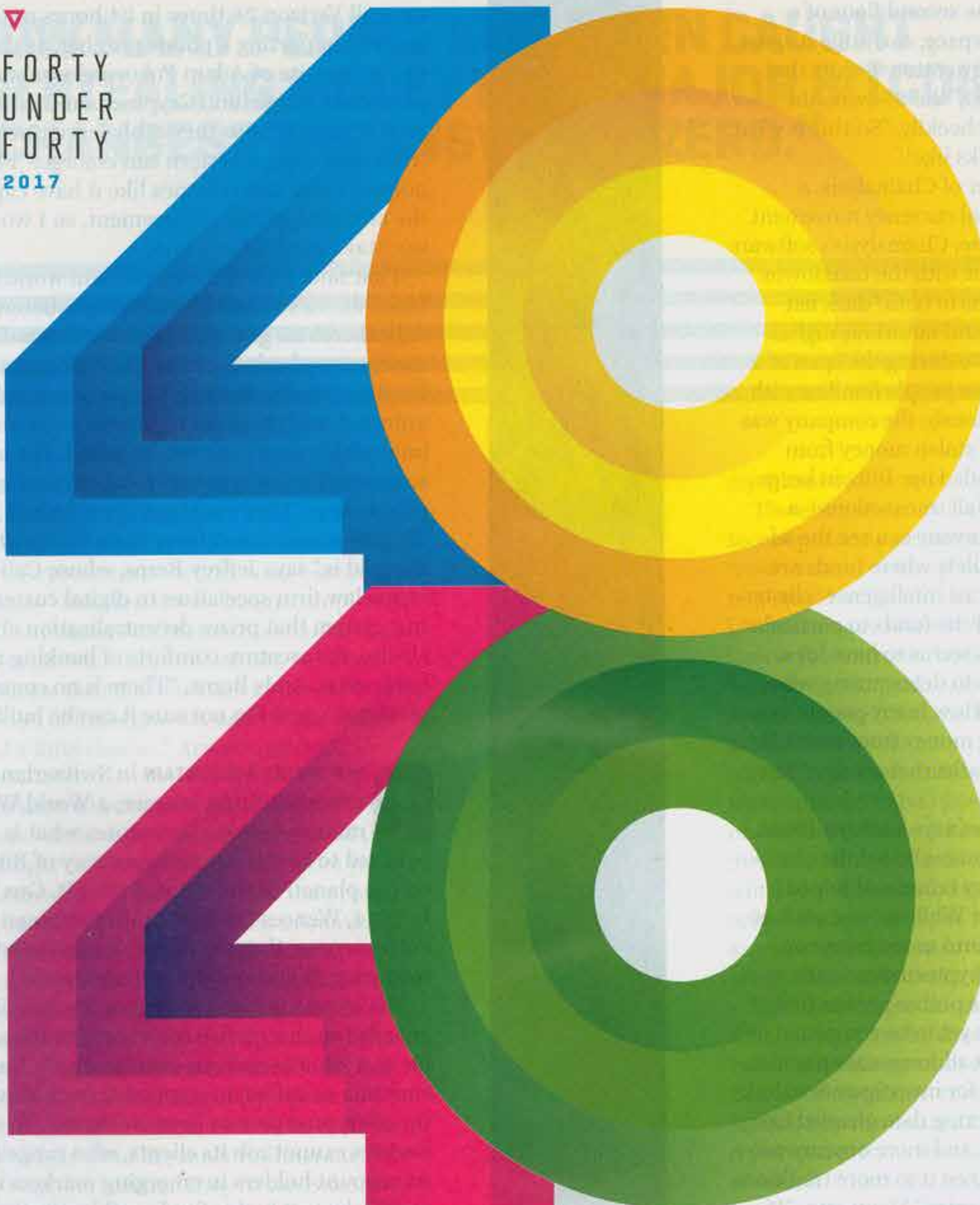
That said, even if the blockchain world's combined forces succeed in capturing cybercriminals, there's no guarantee that victims will get their money back. Some of the legal precedent for charging cryptocurrency hackers is still untested, and there are questions as to whether intangible assets can even be seized. For one, accessing the booty would require knowing the private key: "They could get the criminal, but the government can't force them to say where the gold is," says Jeffrey Berns, whose California law firm specializes in digital currency. In a system that prizes decentralization above all else, the creature comforts of banking may never exist. Adds Berns, "There is no consumer protection, and I'm not sure it can be built in."

DEEP INSIDE A MOUNTAIN in Switzerland, down a 200-meter cave, a World War II military bunker now stores what is believed to be the largest repository of Bitcoins on the planet. In the wake of the Mt. Gox hack in 2014, Wences Casares, an Argentinean tech entrepreneur, thought there was one solution to storing digital coins: Go underground.

His company Xapo now operates heavily guarded vaults, on five continents, some as far as a kilometer down into the earth. Each contains so-called air-gapped servers on which the encrypted private keys are stored. To ensure hackers cannot rob its clients, who range from $5 account holders in emerging markets to the world's largest hedge funds and institutions, agents of Palo Alto–based Xapo personally witness the manufacturing of the servers before they even come off the assembly line and escort them to the hermetic vaults, guaranteeing they never touch the Internet. "It's somewhat ridiculous," says Casares, who also sits on the board of PayPal, "the extent to which we have to go to make sure that the keys are protected."

But even that safeguard has its limits. When customers move funds into a "hot wallet" on Xapo for transaction purposes (itself a 48-hour process), the money could be vulnerable to the same hacks that Coinbase accounts are. In other words, your cryptowealth is as safe as can be—until you want to actually use it. ■

FORTY
UNDER
FORTY
2017



YOUNG PEOPLE MAY NOT RUN THE WORLD, but you could be forgiven for thinking they did. The following pages contain a litany of fresh-faced leaders upending industries and helming some of the world's most important businesses, not to mention the largest global economies. To create this roster, the *Fortune* staff scoured the ranks of the biggest public companies, the hottest unicorns, and even world governments to create what we think is a definitive list of the most powerful people under 40. From Emmanuel Macron [who stemmed the rising tide of nationalism in France], to comedy superstar Kevin Hart [who's rewriting the TV playbook], to Mark Zuckerberg [who needs no introduction], the women and men featured here have profound cultural reach, along with control over a collective several hundred billion dollars. And by all signs, they're just getting started. With ingenuity, optimism, and no small amount of youthful recklessness, these are the leaders remaking the world's business and economic landscapes. The kids, it's clear, are alright—and with any luck, the rest of us will be too.

CONTRIBUTORS: Anne VanderMey, Erin Griffith, Robert Hackett, Polina Marinova, Christina Austin, Stephen Baldwin, Barb Darrow, Laura Entis, Erika Fry, Leigh Gallagher, Tom Huddleston Jr., Kristen Korosec, Beth Kowitt, Adam Lashinsky, Michal Lev-Ram, Sy Mukherjee, Andrew Nusca, Aaron Pressman, Jeff John Roberts, Phil Wahba, Vivienne Walt, and Valentina Zarya.

▲ PHOTOGRAPH BY ED ALCOCK—EYEVINE/REDUX

1

EMMANUEL MACRON 39

President of France

▸ LIST DEBUT: 2016

FRANCE'S YOUNGEST **leader since Napoleon swept the presidential elections in May, obliterating the two-party system that had governed the country for generations. The former Rothschild banker with globalist inclinations is already drawing fire, in part for a push to overhaul labor protections and cut payroll taxes (reforms business has long sought). Macron's honeymoon may be over, but after his fledgling party's big parliamentary win in June, his grand ambitions might just be in reach.**

2. MARK ZUCKERBERG 33

CEO and founder, **Facebook**

▸ LIST DEBUT: 2009

Zuckerberg has been a titan of industry for so long now, his youth is no longer remarkable or particularly noteworthy. He's a dad, philanthropist, tastemaker (seen his book recommendations?), and seasoned businessman, admired for his strategic vision and feared for his ruthlessly competitive streak. He's even rumored to be putting out feelers for a presidential run. We're guessing he'll be on this list for years to come.

3. CHENG WEI AND JEAN LIU 35, 39

Cofounders
Didi Chuxing

▸ LIST DEBUT: 2016

Didi Chuxing made headlines last year for buying Uber's China operations, besting its American rival in the battle for the biggest taxi market on the planet. Since then, the country's homegrown ride-hailing giant and its leaders—Wei, CEO, and Liu, president—have been on a tear: a $5.5 billion funding round valuing the company at more than $50 billion; investments extending its reach into Europe, the Middle East, and Africa; and a new A.I. lab in Mountain View, its self-driving competitors' backyard. Strap in: Didi's ride to dominance is just getting started.

4. BRIAN CHESKY, NATHAN BLECHARCZYK, JOE GEBBIA, 35, 34, 35

CEO; Cofounders
Airbnb

▸ LIST DEBUT: 2012 (Chesky); 2013

Possibly the only founding trio to remain in charge of a startup of this size nine years in, CEO Chesky, chief product officer Gebbia, and chief strategy officer Blecharczyk have steered Airbnb through its most eventful year yet. It launched a new platform for "experiences"; reached a detente with San Francisco; became profitable; launched a new brand in China; and saw its valuation climb to $31 billion.

5 LEO VARADKAR 38

Prime Minister of Ireland

▸ NEW

FUN FACTS

▸ **MARK ZUCKERBERG** challenged himself to visit every state in 2017. ▸ **JEAN LIU'S** father is Liu Chuanzhi, the founder of Lenovo.

▸ **JOE GEBBIA** oversaw the launch of Airbnb's Open Homes platform, which lets people donate temporary housing to those in need.

YOUTH REVOLT

LEO VARADKAR, the just-elected Prime Minister of the Republic of Ireland, and Emmanuel Macron are the vanguard of a new generation of young globalist politicians. BY VIVIENNE WALT

IN RECENT YEARS, the stalwarts of Western democracy seem to have taken a turn for the aged. The 71-year-old Donald Trump is the oldest person ever elected President in the U.S., and in Britain, 60-year-old Theresa May is carrying out the country's Brexit mandate as the oldest Prime Minister since Margaret Thatcher. Both politicians have promised a return to a more glorious, bygone era.

But as quickly as a nostalgic political mood set in, a new one seems to be rising. This June, Leo Varadkar became the Prime Minister of Ireland. And in May, France's Emmanuel Macron (No. 1 on our list) swept aside decades of political precedent to ascend to power with an entirely new party. The two men may be separated by a few hundred miles and a language barrier, but they're bound in one crucial respect. Both are drastically new politicians: Strikingly young, they have shattered not only the age floor, but the hidebound rules and assumptions to which previous generations have clung for decades.

At 38, Varadkar, is by far Ireland's youngest-ever Prime Minister. But his age is only one notable attribute. In a country that has been devoutly Catholic for centuries, Varadkar is Ireland's first openly gay leader; his coming out in 2015, when he was the country's Minister for Health, was a key factor in clinching the law to legalize gay marriage. And after a century of mass Irish emigration, Varadkar, a doctor by training, is himself from immigrant stock: His father is a Hindu doctor from Mumbai. For all that, Varadkar says the best aspect of his rise is that Irish voters have focused on his ideas, not his identity. "I am not a half-Indian politician, or a doctor politician, or a gay politician," he once told a journalist. "It does not define me."

His victory followed that of Macron, who a month before had seized the presidency at age 39 despite never having previously run for office. Macron, a former economy minister, launched his new political party just months before the vote, exasperated at years of government dysfunction. His victory obliterated the Socialist-Republican duopoly that has governed France for 60 years. A month later, his party—including scores of amateur first-time lawmakers—crushed seasoned incumbents in legislative elections. That has handed Macron powerful leverage to drive through economic changes. Those include loosening watertight labor protections and cutting public spending. And if that were not enough, he strode on to the stage on election night not to the usual French anthem, "La Marseillaise," but to the anthem of the 28-member EU: Beethoven's "Ode to Joy." The message was clear: Europe's new champion has arrived.

Varadkar and Macron's victories have played out separately. Taken together, however, they could herald a sea change toward a dramatic a new style of politics. ▷▷

"I AM NOT A HALF-INDIAN POLITICIAN, OR A DOCTOR POLITICIAN, OR A GAY POLITICIAN. IT DOES NOT DEFINE ME." —LEO VARADKAR

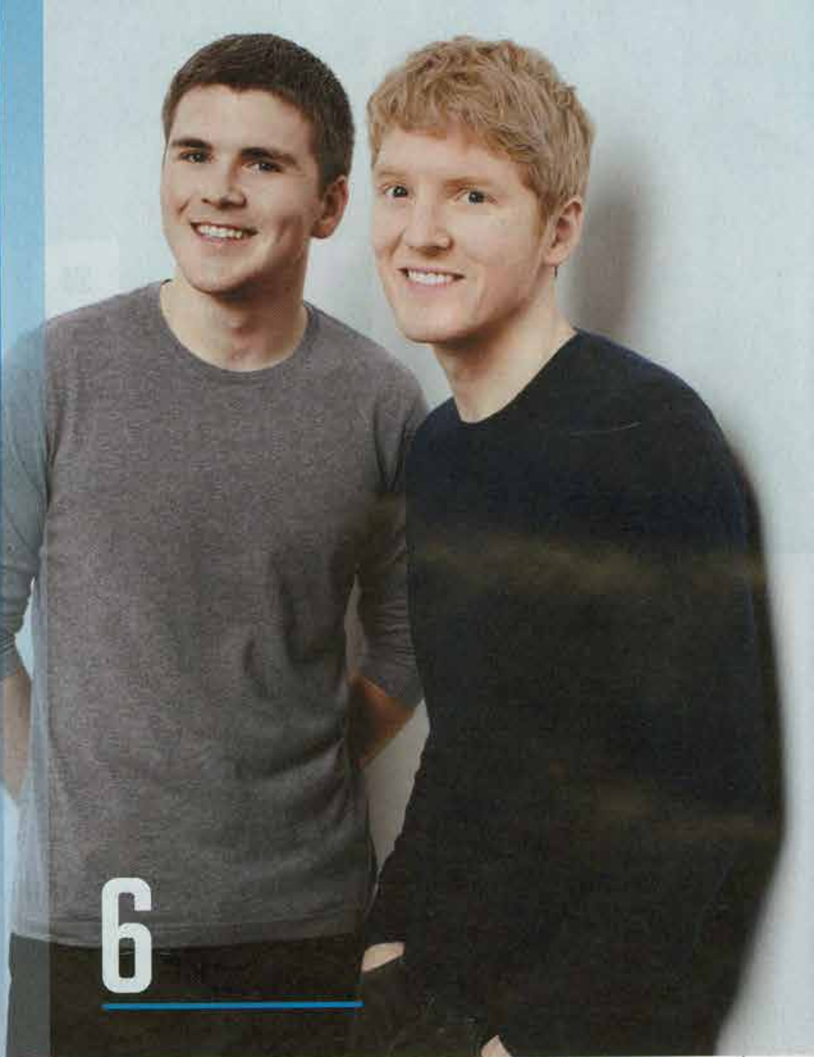
▸ **EMMANUEL MACRON** shared a 28-second handshake with President Donald Trump this summer; the tactic, he says, is "not innocent" and was intended to demonstrate that France will not make even "small concessions." Trump, for his part, noted that Macron "loves holding my hand."

▷▷ Much ink has been spilled about the global tide of nationalism, but these leaders, raised with the freedom to zip around Europe without passports, using a common euro currency, see their individual nations' interests as inextricably bound to the state of the whole world.

And the state of the world seems precarious. Climate change, a quintessential global fight, has emerged as a signature issue for both Varadkar and Macron. So too have Europe's migrant crisis and terrorist threats. And both leaders see joint action as essential, including within NATO and the EU—a stance that's at odds with the "America First" message emanating from D.C.

It won't be a smooth road, of course. Macron's proposed budget cuts have already dented his approval ratings. And Varadkar must defend Ireland's status as a low-tax destination for U.S. companies from an increasingly activist European Commission. Whether either man can shepherd a community of nations against the planet's most pressing threats is still very much an open question.

But they aren't the only ones trying. In Estonia, Prime Minister Jüri Ratas, 39, has said he similarly is determined to boost global cooperation. "We value highly the EU and its unity," Ratas said after his election last November. "Our commitment to NATO is steadfast." And Varadkar hosted his Canadian counterpart, Justin Trudeau, in Dublin, as his first official guest as Prime Minister. (At 45, Trudeau has aged out of *Fortune*'s 40 Under 40 list, though not by much.) Rather than meet in a pub, per longstanding Irish tradition, the two men laced up their sneakers and went for a run, a picture of youthful energy as they discussed shared concerns about climate change, NATO, and Europe. This generation's politicians believe they can finally turn the page on the narrow nationalist interests of past eras, and tackle their problems together—a task that is as laudable as it is immense. The good news is that time, quite simply, is on their side.



6

JOHN AND PATRICK COLLISON 27, 28

Cofounders : **Stripe**

▸ LIST DEBUT: 2015

IF YOU SHOPPED ONLINE AT ALL THIS YEAR, **there's a very good chance the Collison brothers helped complete your purchase. They're the cofounders of e-commerce behemoth Stripe, which is valued at $9.2 billion and handles tens of billions of transactions per year. The duo was born and raised in rural Ireland, and since founding the company in 2010, have become two of the youngest billionaires in the world. Now, even Amazon is on board, partnering with the company to process an undisclosed portion of its e-commerce transactions.**

O6: PAMELA LITTKY—CPI SYNDICATION/COURTESY OF STRIPE

FUN FACTS

▸ **SERENA WILLIAMS** is married to Alexis Ohanian, the founder of Reddit.

FOR MORE SPECIAL FEATURES ON THIS YEAR'S 40 UNDER 40, VISIT FORTUNE.COM.

7

SERENA WILLIAMS 35

Living tennis legend

▸ NEW

IF YOU'RE A SPORTS FAN, **or even if you're not, this has been the year of Serena Williams. In addition to setting the new record for number of Open-era grand slam titles (23) and being the highest-paid female athlete ($27 million over the past 12 months from June), the tennis pro has flexed her muscles on and off the clay court (and done it while pregnant to boot). In May, she joined the board of online survey giant SurveyMonkey, a month later she expanded her portfolio by investing in food startup Daily Harvest, and has spoken out forcefully for equal pay for women of color.**

8. JOHN ZIMMER AND LOGAN GREEN 33, 33

Cofounders
Lyft

▸ LIST DEBUT: 2014

The entrepreneurial duo has had a less eventful year than Travis Kalanick—but that's a good thing. While Uber, their much larger competitor, struggles without a leader, Lyft has hit the gas. In July, the pair announced Lyft's new self-driving division, and launched a system that could one day enable car manufacturers to develop autonomous vehicles more quickly. They also raised $600 million in a funding round at a cool $7.5 billion valuation.

9. DANIEL SCHWARTZ 36

CEO
Restaurant Brands

▸ LIST DEBUT: 2015

Restaurant Brands (the massive parent to Burger King, Tim Hortons, and Popeyes) brought in about $4.1 billion in revenue last year with a market cap in the ballpark of $15 billion. The millennial at the helm? Schwartz, a former partner at 3G who joined as CFO in 2010 when the private equity firm acquired a majority stake in the fast-food giant. Since taking the reins as CEO in 2013, he's worked to keep costs low, in part by urging employees to spend the company's money as if it was their own, a tenet he observes himself by always flying coach.

10. BRIAN ARMSTRONG AND VITALIK BUTERIN

34, 23 CEO; Creator
Coinbase; Ethereum

▸ Armstrong: NEW; Buterin: 2016

Meet the kings of cryptocurrency. Russian-born Buterin (right) is the boy genius behind Ethereum, the world's second-most-valuable cryptocurrency network behind Bitcoin. His visionary project has rocketed to a market cap of nearly $30 billion from $1 billion a year ago. Ethereum's success has also helped Armstrong, the CEO of Coinbase, which became the blockchain industry's first "unicorn" in August with a $1.6 billion valuation. (See page 34 for more.)

▸ **JOHN ZIMMER** quit his job at Lehman Brothers a month before the controversial financial firm imploded.

▸ **VITALIK BUTERIN'S** rumored death caused the price of the Ethereum cryptocurrency he created to drop by 11% this year—the news was greatly exaggerated.

7: DOUGLAS FRIEDMAN—TRUNK ARCHIVE; 8: WINNI WINTERMEYER; 9: COURTESY OF RESTAURANT BRANDS INTERNATIONAL; 10: ARMSTRONG: WINNI WINTERMEYER; BUTERIN: JULIE GLASSBERG

11. TOBIAS LÜTKE 37

CEO and founder, **Shopify**

▸ NEW

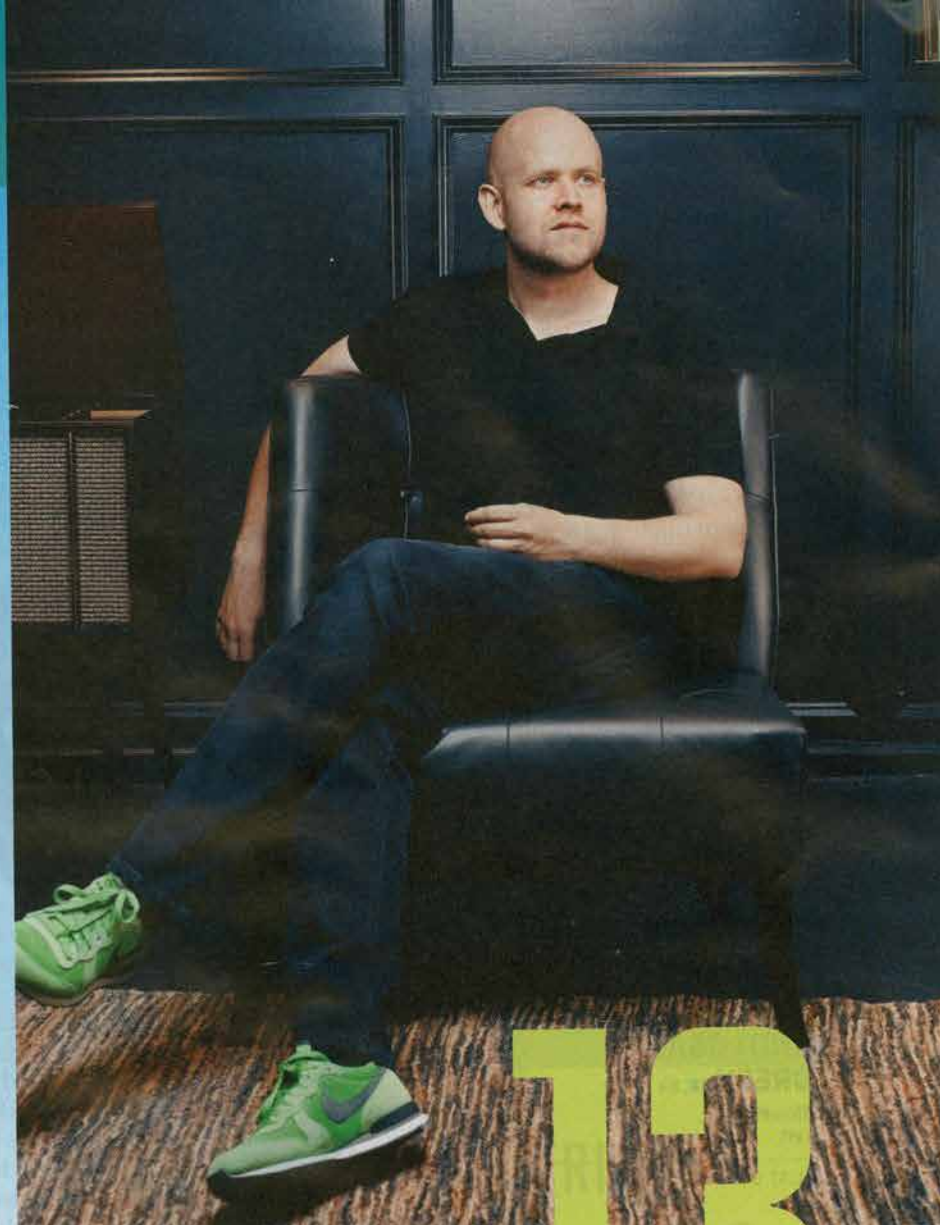
Anyone who regularly shops online likely uses the product Lütke has spent a third of his life building. Since he launched his e-commerce platform out of an Ottawa coffee shop in 2006, the low-key German-born programmer has fought to give Shopify's 500,000 merchants all of the attention. After the company's IPO in May 2016, the stock has increased by more than 100% to land at a nearly $10 billion market cap. Now, with year-over-year revenue up 75% in the second quarter, it might be Lütke's turn to step into the spotlight.

12. ADAM NEUMANN 38

CEO and cofounder, **WeWork**

▸ LIST DEBUT: 2015

Investors have been saying, WeLike to WeWork: This year Neumann and his coworking company raised an additional $2.5 billion in funding—much of which is earmarked toward aggressive expansion in Asia—at a valuation of $20 billion. Skeptics may balk at the figure, but WeWork now counts more than 160 locations and 130,000 members in 15 countries—and is increasingly luring blue chips like IBM to its vision of hipster communal coworking nirvana. Next up: expanding WeLive and WeWork Wellness, the latter quietly piloted in 2016.



13

DANIEL EK 34

CEO and founder : **Spotify**

▸ LIST DEBUT: 2011

In 2014, Ek looked like a marked man. That was the year pop star Taylor Swift pulled her music from the streaming service over concerns about royalties, sparking furious discussion about the sustainability of its business model. Fast-forward to 2017: Swift is back on Spotify, which now counts more than 50 million paying customers, and the company is renegotiating royalty rates as it plows toward an IPO. Today a majority of music consumption in the U.S., some $4 billion in sales and growing, occurs via streaming. One big reason? Daniel Ek.

FUN FACTS

▸ **TOBIAS LÜTKE'S** favorite possession is his razor: "My Japanese Feather safety razor. It does exactly one thing impossibly well. It's the only thing I own that I don't think can be improved somehow."

11: COURTESY OF SHOPIFY; 12: BENJAMIN RASMUSSEN; 13: WESLEY MANN—AUGUST

NAMES TO KNOW

Finance

KEITH COZZA, 38
ICAHN ENTERPRISES

• Cozza is one of the youngest *Fortune* 500 CEOs, at the helm of a financial giant with $16 billion in revenue.

VLAD TENEV, 30
ROBINHOOD

• Tenev, born in Bulgaria, founded a popular app that makes stock trading easy.

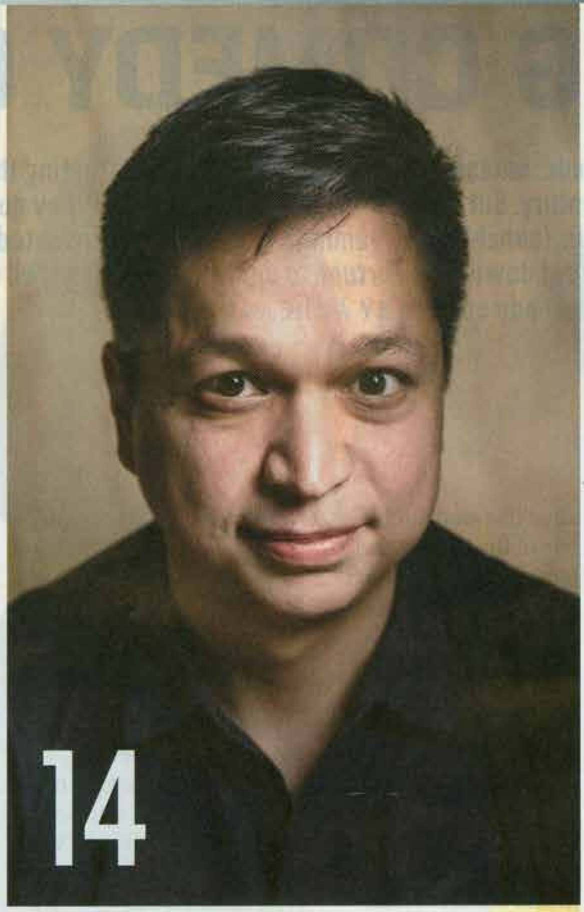
Health

IDA TIN, 37
CLUE

• Tin's Berlin-based company has developed a buzzy app for women to track their menstrual cycles.

VIVEK RAMASWAMY, 32
ROIVANT SCIENCES

• The biopharma prodigy helped lead two of the biggest biotech IPOs in recent years.



BEN SILBERMANN 34

CEO and cofounder : **Pinterest** LIST DEBUT: 2012

A soft-spoken Iowa native, Silbermann seems like an unlikely trendsetter. But he's built one of the Valley's hottest social media upstarts. Founded in 2010, Pinterest has become a vibrant repository for some of the most interesting trends on the Internet, from cars to weddings to architecture to tattoos. It's also a virtual gold mine of data for advertisers and retailers, propelling the still-private business to a valuation of roughly $12.3 billion in June. Its 175 million monthly active users have "pinned" more than 100 billion ideas to date, yet Silbermann says the company is still "only beginning to understand" how social media impacts consumers' lives. The most overrated trend of the moment? "Expensive juice."

15. PEI-CHUN TSAI 37

CEO
Pou Chen Group

• NEW

Tsai took the reins at Pou Chen, which churns out 300 million shoes per year for brands like Nike, Reebok, Adidas, and Puma, in 2012. The Taiwanese company, with revenues of more than $8 billion, was founded by the Wharton grad's father almost 50 years ago and now claims to be the world's largest manufacturer of athletic and casual footwear. Its operations are sprawling, with more than 400,000 employees in Mexico, Indonesia, China, and beyond. Even so, Tsai manages to keep an extremely low profile.

16. GERALDINE BUCKINGHAM 39

Global head of corporate strategy : **BlackRock**

• NEW

The youngest BlackRock executive reporting directly to CEO Larry Fink, Buckingham is tasked with long-term strategic thinking at the world's largest asset manager. Recently, she helped lead the firm—and its $5.7 trillion under management—to double down on algorithms making investment decisions over human stock pickers. Beyond tracking tech trends, the former emergency room surgeon also keeps a finger on the pulse of politics and regulatory changes.

• **GERALDINE BUCKINGHAM'S** best piece of advice: "It's okay to be vulnerable."

• **BEN SILBERMANN** used to collect insects, stamps, and rocks as a kid.

14: WINNI WINTERMEYER—REDUX; 15: COURTESY OF POU CHEN GROUP; 16: COURTESY OF BLACKROCK

▲ ICONS BY **MARTIN LAKSMAN**

MINING COMEDY GOLD

He's the world's hottest comic: smashing attendance records and creating the two bestselling stand-up movies of this century. But KEVIN HART, 38, is more than a funny guy. He's opened a sprawling production studio, launched a streaming TV network, and invested in more brands than he endorses. The star sat down with *Fortune* to dish about getting it all done, his costar "The Rock," and building a comedy empire. BY ANNE VANDERMEY

Q+A

FORTUNE: We tried making a list of your big projects right now. There's the production studio, the streaming comedy network Laugh Out Loud with Lionsgate, the memoir released this year, the movie *Jumanji* coming in December, partnerships with Nike, a line of nutrition supplements, and you're invested in Tommy John underwear. What am I missing?

KEVIN HART: *The Secret Life of Pets 2*. And, oh, my tour, I'm also about to go touring.

How do you get all of that done?

I love the work. I am addicted to success. And at the end of the day I want my name to have a powerful meaning. Everything you're saying I'm looking at as a building block. It's helping me become the mogul that I want to be. So when I check out, they can say, "Wow, this comedian did all of this stuff, and it was one of the biggest and most successful careers that we've ever seen."

Your mom worked as a computer analyst. Did she help foster your comfort with technology?

Not at all. As a matter of fact, I don't want it to get out there that you guys say I'm like this amazing genius when it comes to technology. I'm not. I have people around me that are great. I position myself with strong people in areas that I'm weak.

You have a combined 100 million social media followers across different platforms, that's pretty tech-savvy.

That just means I'm personable. People like the way I talk, and they think I'm funny. But if you told me to download something and then pull it up to send it to somebody. It's going to take me 20 minutes.

You launched your new network, Laugh Out Loud, online in August. Why do a streaming instead of a regular TV network?

This is where television is going. If you don't see that in a major way, you're not opening your eyes. Everything is on a mobile device and on demand. Scheduled TV and programming still exists, but it's not how people operate anymore. I mean, you can't tell me the last time that you went home to catch the 8:30 episode of a television show. It made more sense to do a digital platform.

Do you think of yourself primarily as—

As a sex symbol.

I was going to say as a businessman or a performer?

I mean, I'm all of it.

So, sex symbol, then businessman, then performer?

I'm a brand. Kevin Hart is a man of many endeavors. Business is one that has become a focus. I'm getting older. Eventually the entertainment part of [my career] will die off, and as that's dying off, the business should be growing.

You're working with Dwayne "The Rock" Johnson. Do you think he should run for President?

Uh. No. I think he should sit his ass down. We got work to do. We got *Jumanji* coming out. All this shit needs to stop.

What do you want to do that you haven't done yet? Besides run for President.

Everything. Except run for President. Everything else. If there's something to do that I can do, I'm going to. The goal is to do as much as I can before I'm 50. Then it's just going to be me on an island, checked out and relaxed.

QUICK QUESTIONS

- **A PERSON YOU LOOK UP TO?** Everybody. They're taller than me.
- **ONE THING THAT YOU HATE?** Nothing. I love everything.
- **WHAT WAS YOUR FIRST JOB?** I was a lifeguard.
- **HAS BEING A COMEDIAN HELPED YOU IN BUSINESS?** Absolutely not.

PHOTOGRAPH BY WILLIAMS + HIRAKAWA—AUGUST

17

18. JARED COHEN AND YASMIN GREEN 35, 35

President; Director of R&D
Google's Jigsaw team

▸ NEW

Cohen and Green travel quite a bit for work, but not to your typical conference destinations. The pair runs tech giant Alphabet's ambitious Jigsaw project, which aims to wipe out censorship, curb fake news, and aid free expression with online tools. "This is one of the most important challenges of our time," says Green, who recently flew to Iraq for pilot project "Redirect Method," which diverted people searching for terrorist recruitment information toward videos debunking propaganda instead.

19. DREW HOUSTON 34

CEO and cofounder
Dropbox

▸ LIST DEBUT: 2011

Houston was 24 in 2007 when he cofounded Dropbox, a company that made it drop-dead easy for nontechies to store work files, photos, and more in the cloud. The company claims more than a half a billion users of its cloud storage and related collaboration tools and is continuing its push into business accounts. To be sure, Dropbox is facing off against much bigger competitors (hello, Google), but fans say its easy interface keeps it competitive. Now, investors, who valued the company at $10 billion in 2014, are salivating over the prospect of an IPO.

20. HU WEIWEI AND XIA YIPING 35, 36

Cofounders
Mobike

▸ NEW

Hu met Xia in 2012, when she was a journalist and he was working on connected cars for Ford in China. She requested an interview—then stood him up, but they still kept in touch. Three years later, Hu persuaded Xia to pivot from cars to bikes. Along with Wang Xiaofeng (who's over 40) they started Mobike, now the world's largest bike-sharing company with more than 25 million daily rides in 160 cities worldwide, plus more than $1 billion in funding from the likes of Tencent, Sequoia, and Warburg Pincus.

21. EVAN SPIEGEL AND BOBBY MURPHY 27, 29

CEO; CTO, **Snap**

▸ LIST DEBUT: 2014

Snap is the company that Internet giants want to buy—or crush. Headed by not-yet-30 Spiegel (pictured right) and his cofounder Murphy, the company behind the popular Snapchat photo app went public in March. It's been a bumpy road since: Snap's stock fell by about half, hitting a $15.4 billion market cap in August. And Facebook, which reportedly tried to buy it for $3 billion four years ago, is building a rival product. Now there's talk that Google (which apparently considered a $30 billion bid for the startup last year) is working on a similar product of its own.

NAMES TO KNOW

Sports

SEAN MCVAY, 31
NFL HEAD COACH

● The Rams returned to Los Angeles along with McVay, who became the NFL's youngest head coach ever when he joined the team in January.

Hollywood

DAMIEN CHAZELLE, 32
LA LA LAND

● Chazelle waltzed away from the 89th Academy Awards as the youngest-ever winner of a Best Director Oscar after writing and helming *La La Land*, the smash-hit modern-musical film that ultimately won a total of six golden statues.

22. KATRINA LAKE 34

CEO and founder
Stitch Fix

▸ LIST DEBUT: 2016

It's been a busy year for Lake, founder of one of the Valley's hottest e-commerce upstarts, and it's about to get busier. Stitch Fix—her online retail and styling company—has dramatically expanded its product offerings in recent months, including adding clothing for men and plus-size women. In July, the company reportedly filed confidentially for an IPO. It's one of the most hotly anticipated public debuts coming down the pike (despite increasing competition from Amazon), with a valuation expected to land in the $3 billion to $4 billion range.

23. CONOR FLYNN 37

CEO
Kimco Realty

▸ NEW

In his 14 years at one of the country's largest shopping center operators, Flynn has rocketed through the ranks, holding both the COO and CIO jobs before landing in the corner office last January. Kimco, with an $8.4 billion market cap, has weathered retail's storm by shedding weak properties (including $5 billion worth in the last five years alone) and redeveloping high-performing ones. The result is an occupancy rate of 95.5%. Still, Flynn is focused on the next big thing. "Retail always changes, and real estate will always change along with it," he says.

FUN FACTS

▸ **JARED COHEN'S** favorite possession: "I have a small leather-bound book where I've asked every world leader I've met to write a short message for my two young daughters. It contains some funny jokes and stunning wisdom from people I've admired my whole life. I'm going to give it to my daughters when they turn 18."

O 18: COHEN: MIKE PONT—GETTY IMAGES; GREEN: BRIAN ACH—GETTY IMAGES; 19: BENJAMIN RASMUSSEN; 20: COURTESY OF MOBIKE; 21: DREW ANGERER—GETTY IMAGES; 22: BENJAMIN RASMUSSEN; 23: COURTESY OF KIMCO REALTY CORPORATIONS

24. SUSAN FOWLER 26

Editor-in-chief
Increment Magazine

▸ NEW

It was the blog post that touched off one of the most significant sea changes in the tech industry in years. Fowler's missive, "Reflecting on one very, very strange year at Uber," about the sexual harassment she experienced at the ride-sharing giant, prompted CEO Travis Kalanick to apologize and then step down. Soon, other women across the Valley were going public with their own stories of unprofessional conduct (more resignations followed). These days, Fowler is editing Stripe's new quarterly publication, aimed at engineers.

25. SETH MOULTON AND ELISE STEFANIK

38, 33
Members of Congress

▸ NEW

Moulton, a junior Democratic congressman from Massachusetts, has a résumé that's a little light. But for the Harvard-educated Iraq vet, that's kind of the point. Moulton is pushing House Democrats—whose average age is above 70—to make room for fresh faces. (Cue 2020 rumors.) On the other side of the aisle, New Yorker Stefanik became the youngest woman ever elected to Congress in 2014, and now serves on the Intelligence and Armed Services committees as a moderate force.

26. DMITRI ALPEROVITCH 35

CTO and cofounder
CrowdStrike

▸ NEW

Dmitri Alperovitch outs spies for a living. His cybersecurity firm, CrowdStrike, raised its profile last year with its investigation of the massive data breach at the Democratic National Committee, attributing the attack to Russian agents and triggering fears over election interference. Alperovitch even got a nod from President Trump when the leader (erroneously) called out CrowdStrike as "owned by a very rich Ukrainian." (It's assumed he was talking about Alperovitch, who is a cofounder and was born in Moscow to Russian parents.)

27

▸ NEW

DIVYA NAG 26

Special projects, responsible for CareKit and ResearchKit : **Apple**

BY THE TIME **Nag had joined Apple, at age 23, she had dropped out of Stanford, founded a stem-cell research startup, and begun a medical investment accelerator. Now she oversees Apple's ambitious ResearchKit and CareKit programs that encourage developers to build health-related apps. If Apple succeeds, it could transform clinical trials from isolated events at hospitals to ongoing studies that capture vital signs from omnipresent sensors. Nag's personal goal is no less ambitious. "I want to put people in charge of their health," she says. "It's not about living with a specific disease or condition. It's about living. Full stop."**

▸ **SUSAN FOWLER'S** personal library is her "pride and joy." It contains more than 2,000 books. Her best advice: "Never be afraid to stand up for what's right." ▸ **SETH MOULTON'S** favorite drink is milk. ▸ **DIVYA NAG** counts the game *Guitar Hero* among her favorite pastimes.

24: COURTESY OF STRIPE; 25: MOULTON: CRAIG F. WALKER—THE BOSTON GLOBE VIA GETTY IMAGES; STEFANIK: MIKE GROLL—AP; 26: BENJAMIN RASMUSSEN; 27: COURTESY OF APPLE

28

PHILIP KRIM 34

CEO and cofounder : **Casper**

▸ NEW

FUN FACTS

▸ **CHILDHOOD JOB:** Selling sodas at a local golf course. ▸ **AMAZON ECHO OR GOOGLE HOME?** "Alexa, order me a Google Home."

▸ **BEST ADVICE:** "No one knows your situation like you. Trust your gut." ▸ **SNACK HACK:** Four cereals, one bowl: "I like to live on the edge."

▲ PHOTOGRAPH BY BENJAMIN LOWY

DREAM WEAVER

CASPER, the mattress-in-a-box startup, has convinced thousands of buyers that its products are a crucial component of an Instagram-ready life. Here's how CEO Philip Krim and his cofounders turned a humdrum household product into a breakout brand. BY ERIN GRIFFITH

ON ANY RANDOM commute, I hear my favorite podcast host sing the praises of Casper, the online mattress company that would like me to know it is about *so much more* than boring old beds. I look up, and my subway car is wallpapered with ads featuring Casper's quirky illustrations of animals and humans sharing beds.

Mindlessly scrolling Instagram, I catch a photo of a woman hugging a fluffy white duvet, captioned, "If you're not on a Casper mattress, are you even sleeping?" *Like!* On my walk to the office, I spot Casper logos atop taxicabs and on phone booths. Later, a friend posts a Facebook link about the upcoming solar eclipse. A few lucky contestants can win a trip to witness the eclipse—the first of its kind in nearly a century—from a luxury tent in Casper, Wyo., courtesy, of course, of Casper.

Once I started noticing Casper, I could not avoid it. Thanks to a mountain of positive press, an estimated $80 million annual marketing budget, savvy social media magic and—oh, right—a product that people seem to really like, America's urban-dwelling, podcast-listening millennial professionals like me are hyperaware of the company. Put another way: A generation that's supposedly allergic to advertising is, improbably, all too happy to accept a Facebook friend request from a mattress company.

Casper is the latest and arguably most successful in a class of upstarts turning mundane, unloved consumer products like beds, toothbrushes, suitcases, water bottles, and vitamins into something covetable and cool. These companies have relationships with their customers that go beyond clean, welcoming webpages and cute Instagram posts. They make the shopping experience simple. They go over-the-top on customer service. And most important: They inject aspirations—the promise of some deeply meaningful purpose beyond the product itself—into the run-of-the-mill things we own.

Take Soma, a water-filter company with a mission to "hydrate the world." Or Bouqs, an online florist founded "with the bold intention of bringing romance and delight back to what was once a noble exchange." Or Ritual, a multivitamin startup with a mission of transparency (down to its clear pills) and the slogan, "The future of vitamins is clear." Or, most egregiously, bkr, which markets its water bottles as beauty products. "This luminous beauty essential will motivate you to drink 10x more water, and love it (like it's cake)," the company's website states. Price tag for one glass bottle: $35.

It doesn't really matter that these companies often make their products at the same factories as their uncool competitors, sometimes with barely perceptible improvements over their rivals. They're selling something totally different. Casper's beds aren't just providing a place to sleep. They're giving customers better sleep, which, the company's website declares, is "the foundation of a great life." And who doesn't want a great life?

Casper "is focused on the benefit, not the feature," says Mike Duda, founder and managing partner of Bullish, a tech accelerator and investor in Casper. "People want to buy into something better. They're buying into a set of values." ▷▷

IN THE MATTRESS INDUSTRY, SAYS KRIM, "THE BAR COULD NOT BE LOWER TO DO ANYTHING COOL, UNIQUE, OR FUN."

THE CASPER OF X*

[*WHERE "X" = SUITCASES, SUPPLEMENTS, OR SUNGLASSES]

The new direct-to-consumer startups aren't just selling products—they're selling aspirations. Everything you buy should be part of a bigger, nobler mission, or the key to a perfect life, or both.

WARBY PARKER
The pioneering startup sells vintage-inspired eyeglasses "at a revolutionary price," and sets a socially conscious example by donating prescription specs to the needy.

DOLLAR-SHAVE CLUB
The subscription razor company, which Unilever acquired for $1 billion last year, is "on a mission to build a better bathroom."

BKR
The bkr may look like a simple water bottle. But the company claims it is a beauty essential that will "change the way you hydrate forever."

BOUQS
The startup's flowers aim to "create genuine moments of emotional connection" for its customers. (Try doing that with grocery-store flowers!)

RITUAL
The supplement maker describes itself as "a new kind of health brand," selling clear, Instagram-friendly vitamins that are made "for skeptics, by skeptics."

RADEN
The "smart suitcase" maker believes travel is not a "user-first experience" and asks, "But what if it could be?"

PRODUCTS: COURTESY OF THE COMPANIES

The promise of a great life is how Casper sold $200 million worth of mattresses, sheets, pillows, and dog beds last year, its third year in business. It has allowed the more-than-300-person company to raise $240 million in venture funding, valuing it at $750 million. (The company hasn't said whether it's profitable.) It earned Casper a name-check among the "risk factors" in analysts' reports about publicly traded mattress companies like Tempur-Sealy, whose sales were 15 times that of Casper last year. It has spawned more than 100 copycat mattress startups, some of which have aped Casper's strategies down to the exact wording of its ads. And most recently, Casper's success enticed Target to float a $1 billion buyout offer, which the company quickly declined. "We didn't get that far with it," says CEO and cofounder Philip Krim. "We're a three-year-old company, and we think we can be a lot bigger than this." (Target opted to make an investment instead.)

When it launched in 2014, Casper called itself "the Warby Parker of mattresses," referencing the popular direct-to-consumer eyeglasses startup. But mattresses are only a $16 billion market in the U.S. The company's ambitions have grown. Now, Casper aspires to be "the Nike of sleep." Krim explains that athletic gear wasn't much of an apparel category until Nike turned sneakers into the core of a lifestyle. Lululemon did the same thing for "athleisure," now a $78 billion market by some estimates. "We want to create sleep as a category," Krim says. "That's a really big opportunity."

A **COMMON RÉSUMÉ** feature among successful entrepreneurs is the childhood hustle. Warren Buffett sold packs of gum door-to-door at age 6. Elon Musk sold a video game he built at age 12. Philip Krim, a straitlaced, impassive Texan who took inspiration from his entrepreneur dad, sold sodas on the local golf course. "I was the nerdy kid reading the *Wall Street Journal* in middle school," Krim, now 34, says.

In college at the University of Texas, Krim taught himself HTML and built a mini-empire of e-commerce websites for manufacturers to avoid having to get a summer job. His sites spanned everything from sports tickets and online poker software to window blinds and, yes, mattresses.

When Tempur-Pedic went public in 2003, Krim couldn't believe a company of its size wasn't doing any business online. And a decade later, Krim saw little evolution in the industry. It's dominated by just two companies (Tempur-Sealy, formed in

2012 when Tempur-Pedic bought Sealy, one of its biggest rivals, and Serta Simmons Holdings), it boasts margins as high as 50%, and the buying process, where commission-based salespeople use confusing jargon and novelties like "cooling gel beads" to pressure shoppers to spend an arm and a leg, can be unpleasant. "In an industry where everything was just terrible, the bar could not be lower to do anything cool, unique, or fun," Krim says.

Alongside Jeff Chapin, who had worked with big mattress brands at design firm Ideo, and three other cofounders, Krim cooked up a plan: He'd cut out the overhead of stores and salespeople by selling memory foam mattresses in a box, directly over the web. On April 22, 2014, they pushed Casper.com live, expecting to sell one or two beds. *Maybe* a handful in the first week. They'd lined up some press, but Krim, who is so levelheaded his cofounders have called him "Krim-bot," wasn't even sure if the reporters, investors, and family members they'd invited to their office in New York's SoHo neighborhood for the launch would actually show up.

As guests trickled in and took turns flopping onto a mattress set up in the Casper loft's back room, the company's tiny staff remained glued to a computer screen showing site activity. People were buying mattresses. Sight unseen. Online. From them. "We were shocked that people woke up, read an article, and said, 'Ah, fuck it, I'll buy a bed,'" Krim says, a hint of surprise in his voice three years later. "Sure as shit, it was like, order, order, order, order." And so on, until Casper sold 40 beds—its entire inventory for the first six weeks—in a single day.

To thank its early customers, the team inserted leather-bound vintage books from Strand Book Store into each box. They spent every waking moment live-chatting, emailing, and talking on the phone with customers. The company's website even had a button that said, "Chat with a founder." When the wait for a bed stretched past a month, they bought Aerobeds on Amazon and sent them to customers while they waited.

That extra care, along with the novelty of Casper's delivery method (a queen-size mattress smushed into a box the size of a mini-fridge), earned the company outsize positive buzz. Today's consumers have sky-high expectations for service, and little tolerance for inconveniences like being put on hold. Casper's customer service representatives are encouraged to send baby gifts to customers who mention they're expecting, or to pay to ship beds overnight if an order gets lost in the mail. Casper and its direct-to-consumer peers "solve user problems in a completely effortless way," says Aaron Shapiro, CEO of Huge, a digital agency. "That's rapidly becoming how business is done in the modern economy."

Casper's team pairs that responsiveness with an obsession with improving their product. That first winter, customers told Casper their beds felt firmer than they had before, which led the company to discover that a hydrogen-bonding issue in the bed's Visco memory foam caused it to harden in colder weather. To fix it, they created a custom foam. Now, with a team of 35 engineers, industrial designers, ethnographers, and a contracted polymer chemist working at "Casper Labs" in San Francisco, the company is on its 14th iteration of the bed. "If there is one thing that makes it into the product for the customer, there are 50 things they do that don't and 1,000 iterations they obsess over," says Tony Florence, a Casper board member and general partner at venture firm New Enterprise Associates.

Eighteen months ago, Casper was planning to expand into Germany, where people prefer firmer mattresses. That forced the company to learn more about the ergonomics of its mattress's foam construction. The team wound up developing a five-layer bed design that featured a new kind of foam, and uses "channel cutting" to vary the firmness in different zones of the bed. Testing showed customers loved it, but the materials were too expensive to use at Casper's current price point ($950 for a queen). On Aug. 15, Casper unveiled the Casper Wave, its first premium bed, featuring the new materials and construction. A queen costs $1,850. It's a big departure from the company's message of "one perfect mattress," says Chapin, the head of product, but "we just wanted to put some of this more advanced thinking out into the market."

That market has woken up to Casper. At first, big mattress companies dismissed the "bed-in-a-box" trend as a niche phenomenon, hardly worth acknowledging; but that was before the startups grabbed 9% of U.S. market share. In August 2016, Sealy launched Cocoon by Sealy, a bed-in-a-box brand boasting minimalist fonts, an uncluttered scrolling webpage, and a price point half that of Casper's. "It's been a delayed reaction, but now they all have bed-in-a-box products," says Seth Basham, senior vice president of equity research at Wedbush Securities. As for Casper, Basham adds: "They've already got a foothold. Now it's a matter of how big they'll grow."

ON LABOR DAY 2015, the heat was so cruel that before I even boarded the 105-foot sailboat moored in New York's harbor, a mix of sweat and sunscreen was dripping into my eyes. But the scalding sun didn't spoil the mood on the *Good Ship Casper*, where a bevy of young Casper mattress owners sipped rosé, bounced around on a mattress, dabbed at their faces with Casper-branded handkerchiefs, and Instagrammed their heads off as we glided around the Statue of Liberty. Casper had invited the bed buyers on a boat ride—some pun about a Labor Day Mattress "Sail"—and hey, why

▷▷ not? It sounded cool! It *was* cool!

I told myself that I'd write about this moment if the current tech bubble ever came violently crashing down. A mattress company was burning investor money on pun-themed boat parties for people who had already bought a mattress from the company (meaning they weren't likely to be repeat customers for several years). But Casper followed the Mattress "Sail" with the Insomnibot-3000, a chatbot it built to entertain people who can't sleep. And the Late Night Snap Hacks, a tool for posting videos from dance clubs, concerts, dinner parties, and taxi rides to "trick your friends into thinking you're out getting turnt. From bed." And the napmobile, a semitrailer outfitted with four bed pods resembling hipster cruise cabins, which took a 120-day road trip to 36 cities last fall.

All the while, Casper's sales kept growing, making what had seemed like excess look savvy. "We love leaning into the crazy stuff," Krim says. "It's how we built a brand." The company doesn't worry about whether stunts convert people into customers. It's more about keeping the brand top-of-mind, even for people who already have a Casper mattress. "If one person we take on this boat tells a dozen of their friends about it, that's an amazing [return on investment]," Krim says.

And remember, Casper is not selling a rectangular pile of memory foam, but the dream of a better life. The brand appeals to people because of how simple, aspirational, and, ugh, "authentic" the company seems. In the Instagram era, everything we do, eat, and own is designed to be cropped, filtered, and hashtagged into a neat little tribute to Our Just-Perfect-Enough-to-Be-Believable Lives. Consumers want better, more beautifully designed things, and they want those things to make them better, more perfect humans. So they buy ethically sourced T-shirts from Everlane and vitamins made with better "nutrient forms" from Ritual. And even if a customer doesn't buy into the mission, she can use it to justify the splurge.

Casper's trippy animated TV ads, its Labor Day Sails, and its striking blue-and-white packaging hit every note: a sleek, well-designed product that gives you better sleep, which gives you a better life, but not such a good life that you can't laugh at yourself when the company tweets, "You're following a mattress on Twitter. 2017, man." Perfect, but not too perfect! Authentically perfect.

Ben Lerer, a managing partner at the first firm that invested in Casper, Lerer Hippeau Ventures, was initially hesitant about the team's ability to build a strong brand. (Consider the fact that the company's original name was Duke's.) But Casper's modern simplicity, in a category full of traditional, loud, garish marketing based on discounts and novelty, has become a "magnet" that other brands want to be associated with, and that people want to buy into, Lerer says.

•

STILL, KRIM SAYS brand recognition remains Casper's biggest obstacle. New York City's millennials might be hyperaware of Casper, but its market share is just over 1% nationwide. My Midwestern mother was unenthused the first time I suggested she check out the mattress-in-a-box startups. "I'll just call 1-800-Mattress," she said. "They come and set it all up for you." But that could change. With its latest retail partnership, Casper is taking aim at the skeptics.

In mid-June, 1,000 Target stores began selling Casper's $55 coated fiber pillows. The retailer sold "thousands and thousands" in the first week, according to Krim, far exceeding expectations. But the pillows are just one piece of a new partnership: Target is also featuring Casper's sheets, bed protectors, and exclusive lounger support pillow in its back-to-college promotions. It will incorporate the products into its baby and kids displays, home displays, and health initiatives. Target is selling Casper's dream, live in bricks and mortar, to 30 million visitors a week. "Our guests now have everything they need in one convenient place to get a better night's sleep," Target CEO Brian Cornell tells *Fortune*, saying he admires Casper's "vision for the sleep ecosystem."

Krim and his team are now plotting what role Casper could play throughout the home. That includes products that elevate the quality of sleep, possibly through temperature or sound controls, and others that could address the emotional side of sleep, like products that ease the anxieties that keep people up at night. Eventually, they hope to expand beyond the bedroom. "We want Casper to be one of those handful of brands that people are proud to showcase in their home," Krim says.

Unlike many well-funded startups, whose offices boast well-manicured plant walls and meticulously curated stacks of knickknacks and books, Casper's office, while stylish, is, well, a little bit messy. Many of the plants are dead or dying. A naked mattress leans against one wall in a corner filled with various out-of-use promotional display items. Inspiration boards burst with Post-it notes bearing phrases like "hug a pillow," "pillow fort," "body envelope," and "body bed." A large bookshelf sits empty, save for a lonely handful of titles. Not exactly Insta-worthy.

I point to a copy of *The Interpretation of Dreams*, Freud's treatise on dreaming and wish fulfillment, and joke that it's the only book Casper needs. Ever the business nerd, Krim can't resist calling out the more important book below it. "That," he says, "and *Value-Added Selling*." ■

29. CHANCE THE RAPPER 24

Musician and rule breaker

▸NEW

The Chicago native has been subverting the music industry's traditional business model since he was a teenager, declining to sign with a major label and instead releasing his own streaming-only mixtapes, featuring unique strains of hip-hop splashed with sunny spirituality. Last year, he won the first-ever Grammys (three of them) for a streaming-only album and received $500,000 to debut the tracks exclusively on Apple Music. He's also a celeb endorser for Nestlé, Nike, and even Twitter. Up next: He's set to star in the movie *Slice* as a pizza-delivery driver/werewolf.

30. BRYAN SHEFFIELD 39

CEO and founder
Parsley Energy

▸NEW

Sheffield is no stranger to volatility. He founded his Austin-based oil and gas company in 2008, and expanded it during the ensuing economic down years, leasing thousands of acres in the Midland Basin. It's been a wild ride since, with a successful IPO in 2014 that made Sheffield a billionaire, followed by years of sinking oil prices. Today, the price of a barrel is floundering around the $50 mark. But Parsley Energy is ramping up production. Optimism, Sheffield says, is a double-edged sword.

31. AMBER BALDET 35

Executive director and blockchain program lead **JPMorgan**

▸NEW

Baldet is here to smash any preconceptions you might have had about the banking industry. She leads the team at JPMorgan that's developing Quorum, one of the most exciting corporate blockchain projects around. The open-source code is based on Ethereum (see entry No. 10), and is designed to cater to big-business's needs—like scale, performance, and privacy. A regular at hacker conferences, Baldet handily bridges the divide between Wall Street and the crypto set. (For more on her work, see this issue's cover story.)

32. ERNEST GARCIA III, RYAN KEETON, AND BEN HUSTON 34, 29, 34

CEO; cofounders
Carvana

▸NEW

Garcia was working at an auto-financing company when he saw an opportunity in online sales that was "so big and so clear" he jumped. Three years after spinning out of DriveTime, Garcia, along with cofounders Huston and Keeton, have turned Carvana into a publicly traded company valued at more than $2 billion. This self-described "Amazon of cars" now has 1,375 employees and operates in 33 U.S. markets—a fourfold increase in less than two years.

33

▸NEW

TRISTAN WALKER 33

CEO and founder : **Walker & Co. Brands** ▸LIST DEBUT: 2014

AFTER CREATING A SENSATION **a few years ago with Bevel, a line of shaving items for black men that reduces razor bumps, serial entrepreneur Walker is back with Form, a line of shampoos, conditioners, and other products aimed at a wide array of hair textures. Walker & Co. Brands, seeking to fill a segment overlooked by major consumer-goods product makers—people of color—landed Sephora as Form's retail partner, enabling it to burnish its beauty credentials and move past the one-size-fits-all approach of the category. Says Walker: "Hair care just hasn't changed for 20 years."**

▸ **CHANCE THE RAPPER** doesn't just win Grammys, he was also nominated for an outstanding original music and lyrics Emmy this year.

▸ **AMBER BALDET** says the most overrated trend of the day is the Internet of things: "Not every doodad and gizmo we own needs to be networked."

29: NOAM GALAI—WIREIMAGE/GETTY IMAGES; 30: COURTESY OF PARSLEY ENERGY; 31: BENJAMIN SPRADLEY; 32: COURTESY OF CARVANA

▲ PHOTOGRAPH BY **BENJAMIN RASMUSSEN**

34. MICHELLE ZATLYN 38

COO and cofounder
Cloudflare

▸ NEW

Cloudflare tangles with some of the nastiest people on the web, defending its massive customer base from cyber-bad guys of all stripes. So it's no surprise that Zatlyn credits grit as her most critical personal quality: helping propel her from a small town in Saskatchewan, Canada, to Harvard Business School, and on to build one of the most important security firms in the Valley (rumored to be heading toward an IPO). Zatlyn also has an idealistic streak, particularly when it comes to the open Internet, which she calls "the greatest invention in the last 30 years."

35. RYAN COHEN 31

CEO
Chewy

▸ NEW

At just 31, Cohen has already made history. He dropped out of college to build Chewy, alongside cofounder Michael Day, and quietly built the Florida-based online pet retailer into one of the fastest-growing e-commerce websites in the world. At first ignored by VCs, Chewy drew the notice of the Valley once it started smashing growth targets. Besides the millions in funding, Chewy raked in nearly $900 million in revenue last year, and in April sold the company to PetSmart for $3.35 billion—in the largest e-commerce acquisition of all time.

NAMES TO KNOW

Food

JOSH HIX, 35, NICK TARANTO, 33, ELANA KARP, 31
PLATED

● **With Blue Apron's dud of an IPO, Plated has an opening to be the startup that proves the meal-kit model works. With more than $90 million in funding, it doubled the size of its headquarters in June and has expanded its offerings.**

LAUREN EVANS, 37
FRIENDS OF WHOLE FOODS MARKET

● **Evans spearheads Whole Foods' store-within-a-store concept, seeking out hot third-party brands to operate inside its supermarkets. It's a critical job as Whole Foods pushes to differentiate by making grocery shopping an experience rather than a chore.**

JAMES ROGERS, 32
APEEL

● **Rogers wants to solve the country's food-waste problem and prolong the shelf life of produce by applying an edible substance that keeps water from getting out and oxygen from getting in.**

JULIA HARTZ 37

CEO : **Eventbrite**

▸ LIST DEBUT: 2015

HARTZ HAS WORN MANY HATS **at Eventbrite. Together with her now husband, Kevin, she cofounded the online ticketing startup in 2006. In those early days, she fielded customer support calls (often late at night). As the company grew, she played a role in its marketing and recruiting efforts, before becoming CEO last year. Since she became chief executive, the unicorn company—which raised $200 million in funding and generated $8 billion in gross ticket sales—has officially reached profitability.**

FUN FACTS

▸ **MICHELE ZATLYN'S** hardest-ever decision: "Giving up a job offer from LinkedIn—when it was 300 people—to start Cloudflare. It's hard to pass up a job opportunity that people would kill for to go out and chase a dream that may never come true. It was scary and completely changed my life."

34: COURTESY OF CLOUDFLARE; 35: C.M. GUERRERO—MIAMI HERALD/TNS/ALAMY LIVE NEWS; 36: TIMOTHY ARCHIBALD—THE FORBES COLLECTION/GETTY IMAGES

We Knew Them When

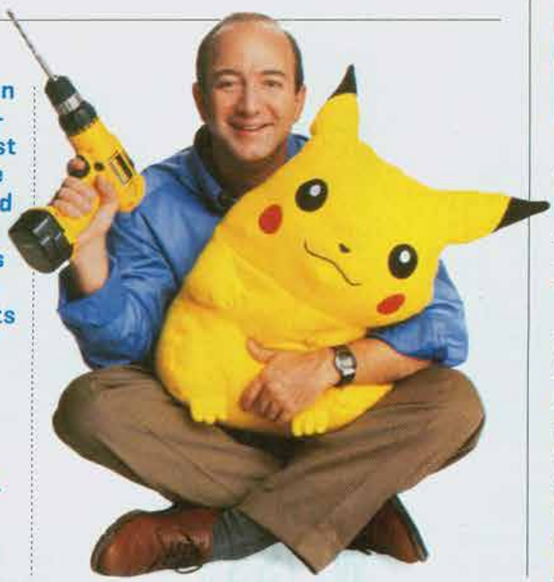
A look back at some of our most famous (and infamous) 40 Under 40 listees when they were fresh-faced and new to the spotlight.

Jeff Bezos

CEO : **AMAZON**

▸ LIST DEBUT : 1999

Bezos was No. 2 on *Fortune*'s inaugural 40 Under 40 list in 1999, when the ranking was based solely on wealth. At the time, Bezos told us he carried these four gadgets everywhere: a vibrating email pager, a cell phone, a digital camera, and a Swiss Army knife. He was 35 and already worth $5.74 billion.



Mark Zuckerberg

CEO : **FACEBOOK**

▸ LIST DEBUT : 2009

Zuckerberg first appeared on the 40 Under 40 list in 2009 (after the list relaunched in its current format). His *Fortune* magazine debut came earlier, though, in 2005 when he was 21 and still carried business cards that said "I'm CEO ... bitch." At the time, he told us, "I'm in this to build something cool, not to get bought."

ELON MUSK
LIST DEBUT: 2002

Now an electric-car magnate, Musk first made *Fortune*'s list of 40 luminaries in 2002, after PayPal, a company he had a hand in getting off the ground with his startup X.com, went public. He was 31 and founded SpaceX the same year. Tesla wouldn't come along until the year after that.

IVANKA TRUMP
LIST DEBUT: 2014

Years before anyone thought her father had real political ambitions, the poised 32-year-old landed on *Fortune*'s list. At the time, she was the face of a successful fashion line, and had just spearheaded the deal to redevelop the Old Post Office in Washington, D.C., into a Trump hotel.

MICHAEL DELL
LIST DEBUT: 1999

The original entrepreneur to hold the top 40 Under 40 spot, Dell, a college dropout, started tech giant Dell Computer from his dorm room. At 34, he was the richest person on our debut ranking by far—with a net worth of $21.5 billion. He would go on to make many (many) more appearances on the list.

ELIZABETH HOLMES
LIST DEBUT: 2014

In one of the most spectacular business flameouts in decades, Holmes's blood-testing startup flew high (Holmes made the list when she was 31 with a company valued at $9 billion), but came crashing down to earth over questions about its technology. Now, Holmes is trying to rebuild it, albeit on a much smaller scale.

▸ **CRYPTO CRAZY:** We asked some of the leaders on this list if they were bullish or bearish on cryptocurrency. Eight out of 10 said bullish.

▸ **"ALEXA, ORDER A GOOGLE HOME":** Three listees reported preferring Amazon Echo, four favored Google Home, and three said they cared for neither.

BEZOS: CHRIS CARROLL—CORBIS VIA GETTY IMAGES; ZUCKERBERG: JONATHAN SPRAGUE—REDUX; MUSK: AP; TRUMP: BOBBY BANK—WIREIMAGE/GETTY IMAGES; DELL: HARRY CABLUCK—AP; HOLMES: STEVE JENNINGS—GETTY IMAGES

37. HELMY ELTOUKHY AND AMIRALI TALASAZ

31, 38

CEO; Cofounder
Guardant Health

▸ NEW

Guardant's founders Eltoukhy and Talasaz want to remake cancer screening with their "liquid biopsy" technology, which can sniff out DNA fragments in the blood that indicate cancer-related biological markers. The method has drawn plenty of interest—and capital—despite initial skepticism. Guardant raised $360 million in May, and aims to sequence more than 1 million cancer patients' DNA within five years.

38. RISHI SHAH AND SHRADHA AGARWAL 31, 32

CEO; President
Outcome Health

▸ NEW

This more than 10-year-old health-tech firm, helmed by CEO Shah—a college dropout—and president Agarwal, raised the kind of money that unicorns dream about earlier this year, bringing in over $500 million at a valuation of more than $5 billion. Outcome says it has already outfitted more than 40,000 doctor's offices with touch screens and tablets that can deliver meditation apps, relevant medical information, and [of course] advertising to patients.

NAMES TO KNOW

Scions and Heirs

STEUART WALTON, 36

● The grandson of Walmart founder Sam Walton, Steuart joined the company's board last year. He's also CEO of Game Composites, which makes small aircraft, and [along with his brother] has a majority stake in bikewear brand Rapha.

JORDAN HEWSON, 28

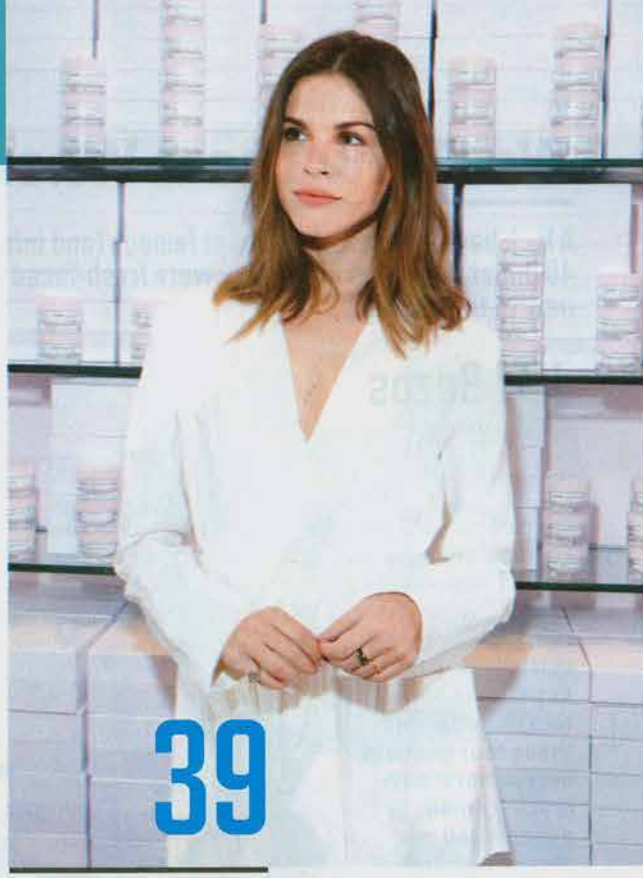
● Bono's daughter has launched a social activism company of her own, a platform that allows people to easily donate time, money, or their voice to worthy causes.

ADRIAN CHENG, 37

● The Harvard grad is poised to take over his family's conglomerate, a Hong Kong-based multibillion-dollar empire spanning from real estate to the world's largest jewelry business.

KELLY ZONG, 35

● The outspoken daughter of China's beverage tycoon, Zong Qinghou, is being groomed to succeed him.



39

EMILY WEISS 32

CEO and founder : **Glossier**

▸ NEW

THE BRAINS **behind the beauty upstart Glossier, Weiss has built her company into a millennial obsession, offering an array of natural-looking products on a tech-savvy platform. Announcing the company's fresh $24 million Series B fundraising round, Weiss wrote, "Glossier is cult, it's not niche." In July, Weiss announced plans for international expansion, adding, "Those French lessons are really coming in handy."**

40. LEILA JANAH 34

CEO and founder
Samasource

▸ NEW

Janah's Samasource is on track to pull in $15 million in revenue this year by setting up workers in Kenya, Uganda, India, and other underprivileged parts of the world as remote freelancers for the tech sector, an arrangement that boosts their average wages from less than $2.50 a day to more than $8. Janah, who also founded a skin-care line that employs women in Uganda, stresses the importance of work—not charity—in fighting global poverty. Her new book, *Give Work*, which outlines that philosophy, comes out this fall. ■

FUN FACTS

▸ **LEILA JANAH:** The best advice she ever got came from her grandmother, who fled Belgium during WWII: "Trust the world."

▸ **RISHI SHAH'S** top productivity tip: "Having a chief of staff in every meeting I'm in to track every follow-up and manage my time."

37: ELTOUKHY: DAVID PAUL MORRIS—BLOOMBERG VIA GETTY IMAGES; TALASAZ: COURTESY OF GUARDANT HEALTH; 38: STEVE BECKER; 39: EMILIANO GRANADO—REDUX; 40: DAVID YODER—FORTUNE GLOBAL FORUM

WHEN GUANGZHOU MEETS FORTUNE

A city of international exchange in prime

On the last day of June 2017, Time Inc. and the city of Guangzhou formally announced the first-ever *Fortune Brainstorm TECH International* will be held in Guangzhou from December 5-6 2017, being co-located and timed to coincide with the 2017 *Fortune Global Forum*. And what's more, Guangzhou will remain the permanent venue for the event together with the China Award for Innovation.

As noted in *Fortune*'s official website, "Guangzhou will be a spectacular setting for *Brainstorm TECH International*: a place of international commerce for many centuries, it is China's southern gateway to the world and an emerging center of tech innovation. "

And what's furthermore, the city will also be the host city of the 2018 World Route Development Conference, 2019 World Ports Conference and 2020 Metropolis World Congress.

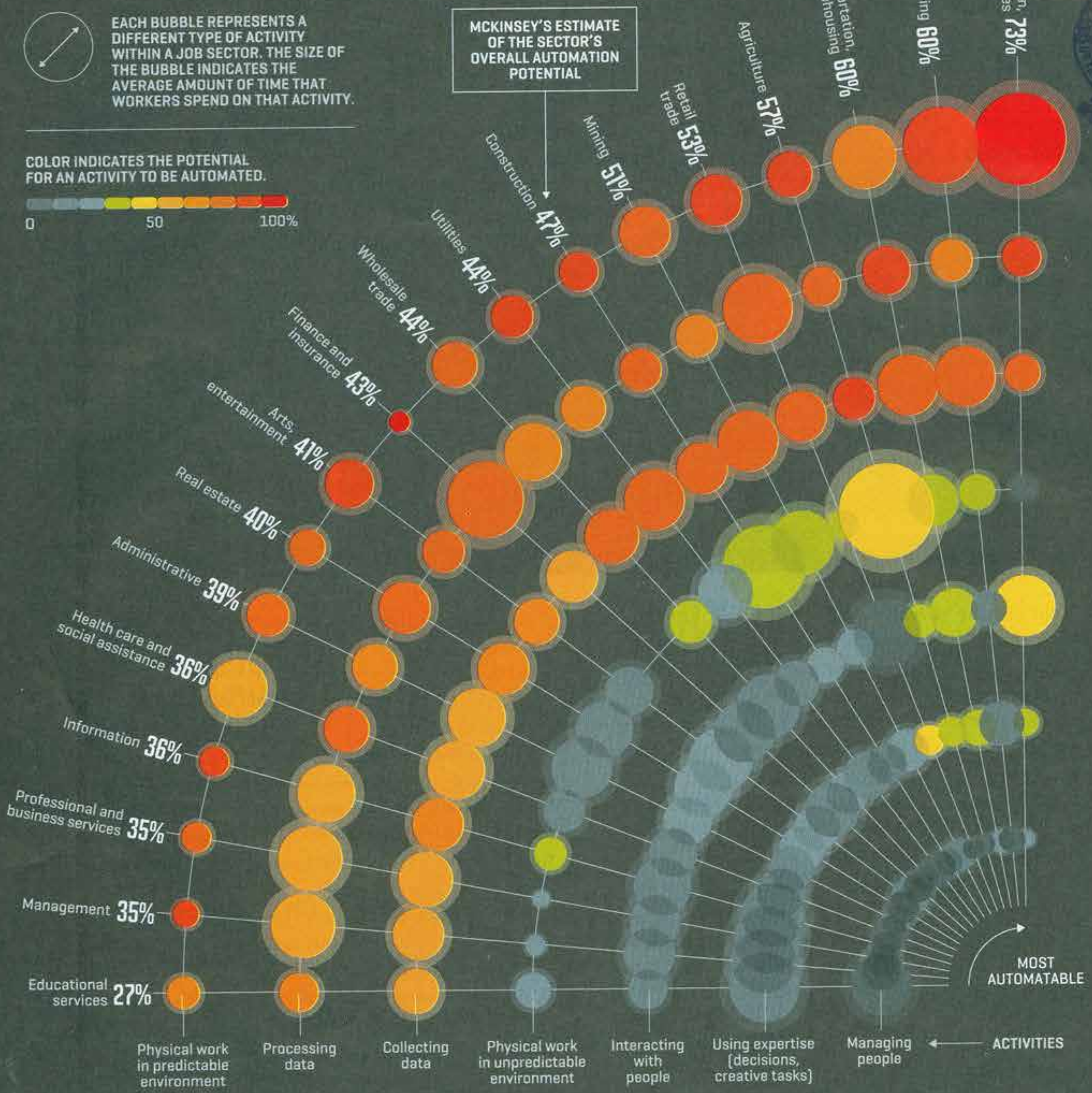
As an important trading port city along the ancient Maritime Silk Road, Guangzhou has thrived over its 2,200 years of history with a vibrant international flavor and spirit of openness. Guangzhou, the biggest city of South China is also home to 59 foreign consulates. And starting from 1957, the twice annually China's Import and Export Commodity Fair was launched in Guangzhou. With this China's No. 1 exhibition, also called Canton Fair, Guangzhou has been destined and closely associated with high-end international conferences, exhibitions and large-scale events. Especially after convention of the 16th Asian Games of 2010, Guangzhou has attracted a large number of high-end international conferences with a frequency of two large events monthly from 2015 to 2016.

Guangzhou also produces a clustering effect as the host city of important international events by cooperating with world-class international exchange platforms like *Fortune Global Forum, World Economic Forum, Boao Forum for Asia and United Cities and Local Governments.*

In the meantime Guangzhou also develops its own brand of international events. The Guangzhou International Award for Urban Innovation is the highest award for urban innovation in the world. In 2016, the third biennial award attracted 301 projects from 171 cities in 59 countries and regions to showcase their experiences in urban innovation.

All these have helped Guangzhou cultivate a brand and an exchange center of international conferences of high standards, wide range and diversified formats. And with the brand effects, Guangzhou has developed itself into a magnet city, attracting high-end resources, talents, technologies and capital as well as creating a new driving force for its economic development. And being selected as the host city of 2017 *Fortune Global Forum*, Guangzhou is confident to demonstrate to the outside world as an international exchange center as well as a hub of international aviation, shipping and technological innovation.

To build Guangzhou into an international exchange center not only represents the ever growing global role of the Chinese economy, but also offers an important means for the city to participate in global collaborative governance and tell the world Guangzhou's globalization story. Guangzhou will take itself as an example to give appropriate interpretations of China solutions with concrete and richer content.



AUTOMATION AHEAD

THE ROBOTS ARE coming for our jobs—and we should welcome them. Why? Automation may help the U.S. economy break out of its productivity malaise. From 2007 through 2016, according to the Bureau of Labor Statistics, U.S. nonfarm business productivity grew just 1.2% annually, or well below past performance. In the 1990s, for example, nonfarm productivity grew 2.2% per year. A recent report by the McKinsey Global Institute argues that technologies such as A.I. and robotics offer a solution. Automation alone, McKinsey estimates, could boost global productivity growth by 0.8% to 1.4% annually. Here, jobs where automation can have the biggest impact. —BRIAN O'KEEFE

SOURCES: U.S. BUREAU OF LABOR STATISTICS; MCKINSEY GLOBAL INSTITUTE

GRAPHIC BY NICOLAS RAPP

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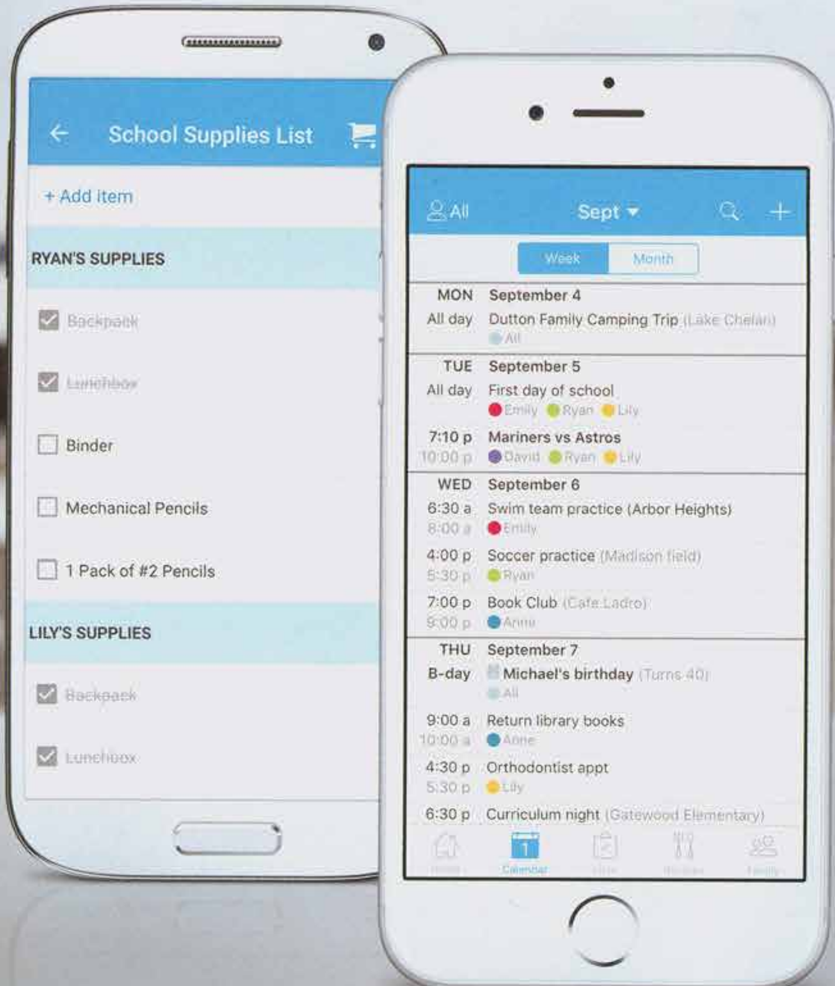

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