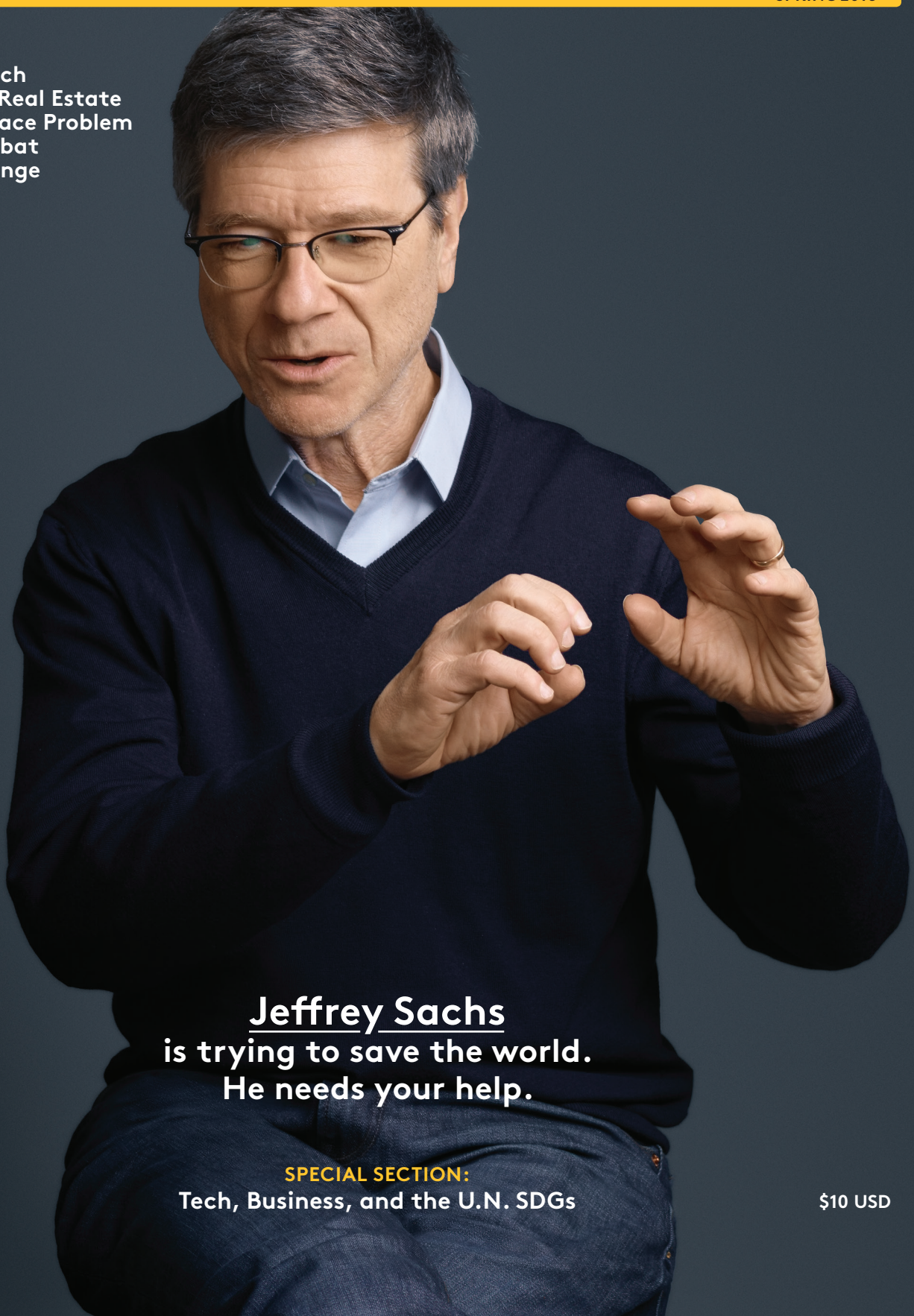
TECHONOMY

SPRING 2018

ALSO:
- Reining in Tech
- Remodeling Real Estate
- Genomics' Race Problem
- Tech to Combat Climate Change



Jeffrey Sachs
is trying to save the world. He needs your help.

SPECIAL SECTION:
Tech, Business, and the U.N. SDGs

$10 USD

Life-changing technology for a healthier world.

At Johnson & Johnson, we see how technology can transform people's lives by giving people everywhere better care for a better life. That's why we are a proud sponsor of **Techonomy**.

Johnson & Johnson

Why We Believe in Harnessing Tech for Inclusive Growth

For me, getting a tattoo has always been anathema. Marked for a lifetime? Give me a break. But the other day, thinking about the United Nations' Sustainable Development Goals for 2030, I had an epiphany: For this, I could get inked. It doesn't hurt that the circular multi-colored logo for the SDGs (at right) is exquisitely handsome.

Working to achieve the SDGs is, as much as any project we can think of, existential. It is not a challenge that could or should wear out, even by 2030. If the entire human race cannot come into the modern world and economy, it will do more than just shame us all. For those of us in the minority of humanity who already have so much, failure will jeopardize our ability to keep it. And rightly so. Real inclusive growth necessarily includes everyone.

As the climate changes, cataclysmic weather events worsen and changing global temperatures will alter conditions for agriculture and the management of human health.

These environmental changes make efforts to empower the world's poor to achieve better health, nutrition, and quality of life, which felt near overwhelming anyway, even more complicated. For business, a commitment to the targets in the SDGs around all these issues means thinking more consciously about tradeoffs, and ensuring that future profits flow from activities that benefit people.

Techonomy is a media and events business with a strong community. Our collective purpose is to better understand how to harness tech to achieve solutions of all sorts, for business and society. The priority now is finding ways to grow our economy even as we make it more inclusive and sustainable. There is no question tech can help, and that's what we emphasize in this issue of Techonomy Magazine, as in all our activities.

Here you will find an entire section on tech and the SDGs. It includes an interview with Columbia Professor Jeffrey Sachs, a key progenitor of the goals. Another section is devoted to the gigantic challenge of "reining in tech." For all our belief in tech's potential, we also see that some tech companies and technologies appear to be escaping society's control. We also examine how tech is changing industries like real estate, and why inclusion has become a problem in genomics, as it gallops forward.

Here, too, you'll find highlights from our Techonomy conference. We hope seeing the amazing things that go on there will prompt you to join us at the next one.

It is exhilarating to be alive right now, even as it's so often confusing and overwhelming. The pace of change is a daily challenge. But it helps us cope, and succeed, to immerse ourselves in the ideas and technologies that are at the heart of change. In all we do, that is our mission.

This logo represents the United Nations' Sustainable Development Goals for 2030. Each color represents a goal: No Poverty, Zero Hunger, Climate Action, etc.

IMAGE COURTESY OF UNITED NATIONS/UN.ORG

DAVID KIRKPATRICK
Founder & Editor-in-Chief

Illustration by **Emmanuel Polanco**
Cover Photo by **Wesley Mann**
Publication Design by **Rob Hewitt**

Mary Kan,
Executive Assistant - Editorial and Programming

Jeff Pundyk,
Chief Strategy Officer & Editorial Director

Nora McNulty,
Executive Assistant

Kirsten Cluthe,
Program Director

Josh Kampel,
President

David Kirkpatrick,
Founder & Editor-in-Chief

This is Us

We love what we do, and think it's urgent

Like many in our community, we at Techonomy Media believe the time has come for business to step up and engage directly with the challenges of the world. Otherwise, we may not have a world to step up to. That's why our programs and content focus on how technology can be a lever towards social progress. We're lucky to have great partners who agree with us. The proud crew above, holding signs for the global goals they care most about, put together this magazine and our events. We look forward to Techonomy 2018, November 11-13. Half Moon Bay, CA. Stop by our offices on Manhattan's West 43rd Street if you're in the neighborhood!

PHOTOS: EMMA MCINTYRE AND MARY KAN (CLUTHE)

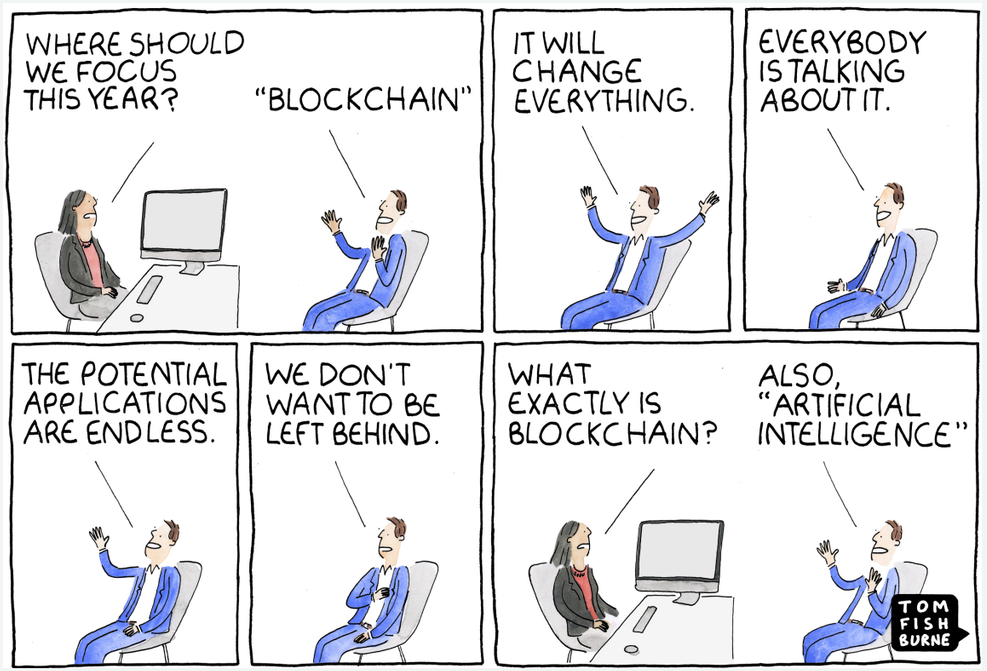


IMAGE COURTESY OF TOM FISHBURNE, MARKETOONIST.COM

AI and Blockchain for Dummies

By Josh Kampel

Good news for those of us scratching our heads about the buzziest of the current crop of tech buzz words, blockchain and artificial intelligence: There's no shortage of people ready to try and educate us.

In the first months of 2018, I made the circuit through a thicket of industry events. No conversation was complete, in all my travels, without at least a mention of both artificial intelligence and blockchain. And for those seeking a more formal education, there was plenty to choose from.

Of the hundreds of sessions at CES, nearly 10 percent mentioned artificial intelligence. They included *The State of Artificial Intelligence*, as well as a separate one entitled *The Future of AI*. The relationship between man and machine was a hot topic, with *The Future of Work for both Humans and Machines* and *The Future of Robots at Work and Home,* not to be confused with *Rise of Machines—Future of AI*.

In Barcelona at Mobile World Congress, just one afternoon offered: *IoT Security & the Blockchain, ICOs: The Issuance of Tokens as a New Way of Financing,* and *State of the Crypto, Token and Blockchain Market.*

SXSW in Austin took on numerous related topics including *AI Creativity in Art, Neuroscience, and the Law, Design for Personality Neuroscience & Emotional AI, Blockchain and Civil Liberties,* and even a few that got both in the title, like *Diplomacy vs. AI: Foreign Policy, Bots & Blockchain*.

And yet very few people I spoke with had a handle on either. The jargon itself is overwhelming—distributed ledgers, computer vision, cryptocurrency, machine learning, decentralized databases, and neural networks. But we've all heard exhortations from tech media, platform providers, and management consultants that lead us to believe we're doomed if we haven't already developed a strategy for this stuff.

These technologies will have great impact, but it sure seems the industry is trying to create a frenzy rather than finding use cases that uniquely leverage these complex advancements.

If we've learned anything from the ghosts of technology past, it is that there are no silver bullets. My advice? Start with the problem, not the solution.

Don't Hold Your Breath Waiting for Creative Computers

For music, art, or design, people still have the decisive edge

By Josh Kampel

Back in 2003, *The Boston Globe* wrote a story about a Spanish company, Polyphonic HMI, which had developed an algorithm it claimed could predict hit songs. It analyzed decades of Billboard charts in order to write software that took into account variables like tempo, pitch, and melody, and correlated those to the likelihood of a song's commercial success. It was intended to be a tool for songwriters and producers to use during writing and recording. In the article, *The Globe* highlighted a band using this technology, Elcodrive. In those days, I was in the music business and I happened to be Elcodrive's manager.

As you can imagine, the music community was appalled that someone would suggest you could boil a song down to data and remove the 'magic.' And maybe rightly so. While the software determined that many of the songs on the album would be huge radio hits, the band never signed a major label deal and eventually broke up. We were, to say the least, disappointed.

Software improves the efficiency of making many creative products, but it still requires people to use it. Tech tools have made it easier to record, distribute, and market music, but software has not given us great songwriters; Microsoft Word won't ever create great journalists on its own; Final Cut Pro has not produced Academy Award-winning filmmakers; and PowerPoint certainly has not thrust any presenters into the firmament of great artists.

When people try to get computers to do truly creative tasks, the results are often more amusing than inspiring. If you have ever stood in a paint store, looked at the thousands of color samples, and read the color names, you probably didn't think about the people whose job it is to think those names up. But it turns out that they, too, are much better than computers.

In 2017, Janelle Shane, a research scientist with a Ph.D. in electrical engineering who trains neural networks, decided to see how a machine would do at naming paint colors. She trained the AI software by feeding it with 7,700 Sherwin-Williams paint colors and their associated RGB (Red/Green/Blue) values. Some of the results are on this page. Decide for yourself how Shane's AI did. Probably none of those color-naming people would have named a shade of gray "Flower."

The success of any creative output ultimately depends on human acceptance and consumption, which is a good part of the reason humans have to play the key role. At least for the time being.

JOSH KAMPEL *is Techonomy's president.*

> When computers do creative tasks, the results are often more amusing than inspiring.

What happens when a neural network is given a list of 7,700 Sherwin-Williams paint colors and their color values, asked to invent new colors, and give them attractive names? Some, er, interesting results. Courtesy of aiweirdness.com

DORKWOOD

CATBABEL

GRADE BAT

STONER BLUE

TURDLY

STANKY BEAN

FLOWER

Voices from the Techonomy 2017 Stage

Ethics, morality, and fairness arose often

A TECHONOMY CONFERENCE IS A SYMPHONY OF VOICES. Here are some of the more than 90 speakers we convened for two November days in Half Moon Bay, California, at our annual Techonomy retreat. What emerged was a growing chorus of concerns about how tech is altering society. A major conference takeaway: a consensus is arising that we have let tech change us too quickly. We have too little concern for unintended consequences, as Beth Comstock noted.

1. "You have no stability in a country when 90 percent of your income is in the top 1 percent."
JOHN CHAMBERS

2. "We're moving into an age of automation. And as tech companies we have a responsibility to do this ethically, morally, and in a way that benefits society."
ANDREW ANAGNOST

3. "There's huge reason to be optimistic...But I worry [that] business isn't set up for some of the unintended consequences of what technology is going to do."
BETH COMSTOCK

4. "Folks today [spend their] life doing different gigs, whether it's Care.com, Upwork, or DoorDash ...[But] our United States system does not support them, in terms of how we do paychecks, insurance, benefits."
SASAN GOODARZI

PHOTOS: PAUL SAKUMA PHOTOGRAPHY

5. "We need to create opportunities for people who are really knowledgeable in technology to be serving in government."
PENNY PRITZKER

6. "Within neuroscience there are a lot of discoveries that are likely very relevant to AI, but the two fields have diverged...So how should they come together?"
ANNE CHURCHLAND

8. "When more than 60 percent of people under the age of 35 think socialism is a better model, we've got a bit of a problem...Right now the capitalist model rewards too few people."
MARK BERTOLINI

9. "5G will dramatically change the way people use wireless devices...[You'll get] a hundred times more speed on your device. And we'll be able to connect a hundred times more devices to the network."
LOWELL MCADAM

1 JOHN CHAMBERS, *Former CEO & Executive Chairman, Cisco*

2 ANDREW ANAGNOST, *CEO, Autodesk*

3 BETH COMSTOCK, *Former Vice Chair, GE*

4 SASAN GOODARZI, *Executive Vice President, Small Business Group, Intuit*

5 PENNY PRITZKER, *Founder, PSP Partners & Former U.S. Secretary of Commerce*

6 ANNE CHURCHLAND, *Associate Professor, Cold Spring Harbor Laboratory*

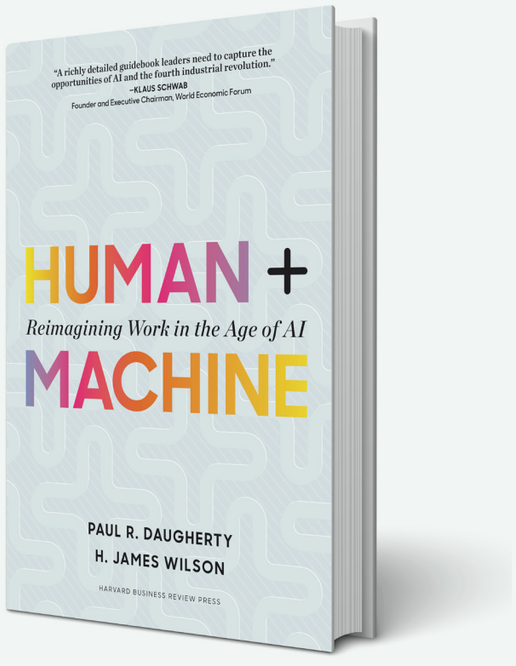
7 SELINA WANG, *Journalist, Bloomberg News*

8 MARK BERTOLINI, *CEO, Aetna*

9 LOWELL MCADAM, *CEO, Verizon*

Human + Machine: Reimagining Work in the Age of AI

Paul Daugherty is Accenture's Chief Technology Officer and H. James Wilson is Managing Director of Accenture Research. We publish this excerpt from their new book as part of our partnership with the company.



It's a widespread misconception that AI systems, including advanced robotics and digital bots, will gradually replace humans. Self-driving vehicles, for example, are expected to replace taxi, delivery, and truck drivers. That may be true for certain jobs, but what we've found in our research is that the technology's greater power is in complementing and augmenting human capabilities.

In insurance claims processing, for example, AI isn't replacing the need for humans. Instead, it's doing the tedious grunt work, collecting data and doing a preliminary analysis, and freeing human claims processors to focus on resolving complex cases.

Machines are performing repetitive tasks, analyzing huge data sets, and handling routine cases. And humans are doing what they do best: resolving ambiguous information, exercising judgment in difficult cases, and dealing with dissatisfied customers. This kind of emerging symbiosis between man and machine is unlocking what we call the third wave of business transformation.

The first wave of business transformation involved standardized processes. Henry Ford deconstructed the manufacture of automobiles so they could be made on an assembly line. Each step in that process could then be measured, optimized, and standardized to achieve gains in efficiency.

The second wave consisted of automated processes. It emerged in the 1970s and peaked in the 1990s with business process reengineering. It depended on advances in information technology: desktop computers, large databases, and software that automated various back-office tasks. Walmart rode this wave to become a worldwide powerhouse. UPS transformed itself from a package-delivery service to a global logistics company.

Now the third wave involves adaptive processes. It will usher in entirely new types of jobs and innovative ways of doing business. The leading firms in many industries are now reimagining processes to be more flexible, faster, and adaptable.

This adaptive capability is being driven by real-time data rather than by a presumed sequence of necessary steps. The paradox is that although these processes are not standardized or routine, they can repeatedly deliver better outcomes. In fact, leading organizations have been able to profitably bring to market individualized products and services (as opposed to the mass-produced goods of the past).

AUTHOR PHOTOS AND BOOK COVER COURTESY OF ACCENTURE

Authors Wilson, left, and Daugherty

In our research, we found that leading companies in various industries—9 percent of our surveyed sample—are already riding the third wave. They have maximized automation and are now developing the next generation of processes and skills to capitalize on human-machine collaborations.

They have succeeded by adopting five crucial principles, having to do with organizational mindset, experimentation, leadership, data, and skills.

Mindset: assuming a radically different approach toward business by reimagining work so people can improve AI and, in turn, smart machines can give humans superpowers.

Collaboration between humans and machines is leading to the reinvention of many traditional processes. Rigid assembly lines are giving way to flexible teams of augmented humans and smart machines.

We foresee that AI technologies will be critical in helping companies bring work closer to the markets they serve, improving responsiveness to consumer demand. To achieve that, however, executives must embrace an action-oriented mindset to reimagine operations.

They initially should focus on developing the full potential of their employees by applying automation to routine work; then they can proceed to concentrate on human-machine collaborations.

Experimentation: actively observing for spots in processes to test AI and to learn and scale a reimagined process. The age of standard business processes is coming to an end, and companies will no longer be able to rely on a strategy of replicating best-in-class practices from leading firms. So experimentation is crucial. Executives must continually conduct tests. Trial and error will help determine what work should be done by humans, and what would best be done by a collaboration between humans and machine.

Leadership: making a commitment to the responsible use of AI from the start. Executives must always consider the ethical, moral, and legal implications of the AI technologies they deploy, and the systems must generate explainable results, promote algorithmic accountability, and eliminate biases. Firms also need to ensure that employees working with AI systems don't lose a sense of agency. In addition, companies must provide employee training and retraining. Investing in people must be a core part of any company's AI strategy.

Data: building a data "supply chain" to fuel intelligent systems. AI requires extensive amounts of data, both in volume and variety. This includes "exhaust data"—data created as a byproduct of another process (for example, cookies from customer web browsing). Accumulating and preparing such information for use is one of the biggest challenges for organizations that deploy AI systems. Moreover, an organization's data should be able to flow freely, unencumbered by departmental silos.

Skills: actively developing the "fusion skills" necessary for reimagining processes in the "missing middle" (where computers work with people). The growing power of AI is fundamentally transforming the human-machine relationship.

In the second wave, machines were generally used to replace humans—automation has decimated the ranks of factory workers, administrative assistants, bookkeepers, bank tellers, and travel agents. But in the third wave humans are needed more than ever. The era of adaptive processes requires humans in the loop not only to design, develop, and train AI systems, but also to collaborate with them and achieve step-level increases in performance.

Companies that use AI to augment their human talent while reimagining business processes achieve step gains in performance, propelling themselves to the forefront of their industries. Firms that continue deploying AI merely to automate in a traditional fashion may see performance benefits, but those improvements will eventually stall. We predict that within the next decade there will emerge a vast difference between the winners and losers.

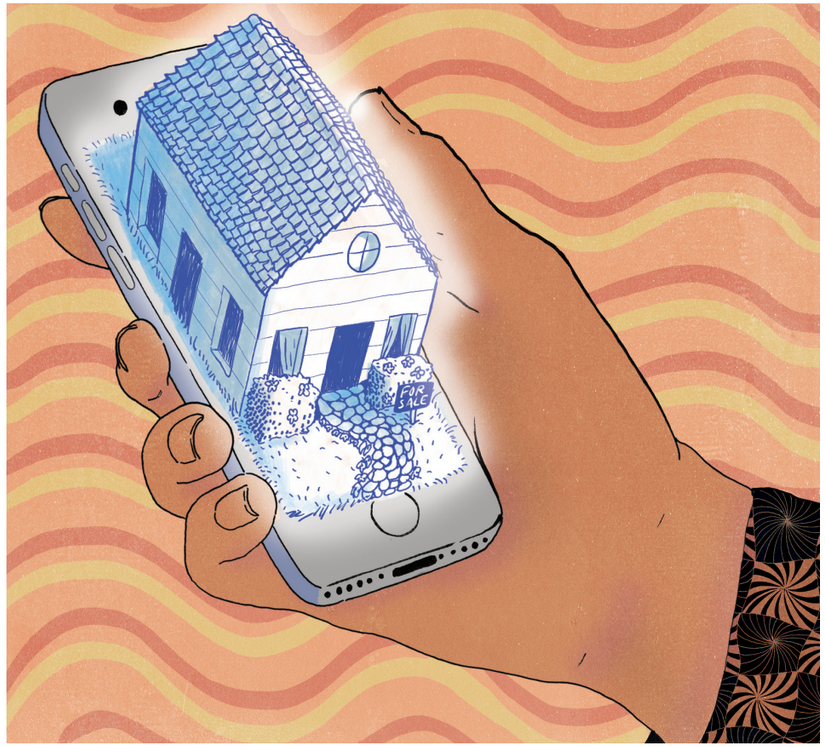
AI has the potential to re-humanize work, giving us more time to be human.

AI gives people powerful tools to do more, to perform with "superhuman capability." AI thus has the potential to re-humanize work, giving us more time to be human, instead of, like so often today, using our time to work like machines.

A Tech Tsunami is (finally) Transforming Real Estate

The sheer scale of the American real estate industry helps explain why so many tech innovators want to overhaul the business.

By **Teke Wiggin** Illustration by **Clara Kirkpatrick**



IN 2017, OVER $1 TRILLION IN U.S. residential real estate changed hands, as well as over $450 billion in commercial properties, according to the National Association of Realtors. Plus, the industry is data rich, labor-intensive, and tradition-bound—just the sort of environment that tech investors and entrepreneurs love to shake up. So in 2017 they ploughed $3 billion into real estate tech companies, far more than the $468 million of 2013, according to research firm CB Insights.

So far, startups have mostly worked to empower consumers by unlocking previously hidden data, and equip professionals with a range of new productivity tools. But now, aggressive and well-funded entrepreneurs are finally starting to really transform how we buy and sell homes. Some are building tech-focused brokerages that balance efficiency with hands-on assistance. Others are putting home flipping on steroids, using technology to offer sellers a fast and certain sale at a competitive price. Fueling the rise of these upstarts are new visualization tools and software that promise a faster, fully digital transaction.

EARLY ADOPTERS: AGENTS

Over the last decade, Zillow Group, realtor.com and Redfin have changed the way people find and research properties by publishing listings, home value estimates, and other real estate data online. Much industry innovation has also catered to agents. Listing sites sell ads to them, while transaction management software—provided by the likes of DocuSign, dotloop (owned by Zillow Group) and SkySlope (owned by Fidelity National Financial)—has made it easier for agents to oversee mounds of paperwork. Companies like Commissions Inc. (acquired by Fidelity National Title for $250 million in 2016), RealScout and BoomTown, meanwhile, have made it easier for professionals to market their services and manage contacts.

Innovation has wrested listing data from agents even as it has solidified their role as transaction sherpas. But it has not disrupted the traditional brokerage model or meaningfully impacted commission rates.

But a new generation of well-funded startups may transform the transaction process over the next decade, predicted Pete Flint, the former CEO of Zillow-owned Trulia, at a recent real estate tech conference called Inman Connect. He says most of the traditional brokerages will die slow deaths.

THE RISE OF IBUYERS

High-tech home flipping companies known as "iBuyers," such as Opendoor and OfferPad are showing one way that models can shift. With pricing models powered by artificial intelligence, these homebuying machines let homeowners enter their address online, receive a quick offer, and, if they choose to accept it, sell their home in mere days.

Unlike a traditional home flipper, Opendoor claims to buy at market value, and charges an average service fee of 6.5 percent—roughly 1 percentage point more than a typical real estate commission. Drawing on more than $1 billion in equity and debt financing, it tries to buy and resell properties as quickly as possible. The company often makes only light repairs and applies tech wherever possible. For example, smart locks and motion sensors enable homebuyers to tour listings all day, seven days a week. The fast-expanding startup claims to be buying 500 homes a month in Phoenix, Dallas-Fort Worth, and four other markets. It has also added mortgage products, title services and a "trade-in" option, which allows homeowners to simultaneously sell their old home to Opendoor and buy a new one from it.

Atlanta-based Knock puts a different spin on the iBuyer model, aiming to reduce the complexity and brinksmanship consumers have to endure when navigating the transition between selling one home and buying another. It helps homeowners find a new home and then purchases the property on their behalf, often securing a discount by paying cash, explains CEO Sean Black. Knock will then move customers into the new home, and try to sell their old one. Once Knock sells their original home, customers take a preapproved mortgage lined up by Knock to purchase the new one they are already living in. Knock charges a 6 percent commission, plus the cost of upgrades it makes to both old and new homes.

Aggressive and well-funded entrepreneurs are finally starting to really transform how we buy and sell homes

Questions loom over whether iBuyers may end up costing sellers more than their advertised fees, and how these tech-powered homebuyers might cope in a down market. It's too early to confidently generalize about the business model. But Zillow Group has validated it, launching a marketplace on its own site to help consumers request and evaluate offers from iBuyers.

New technologies could further streamline the transaction and alter the broker's value proposition. Numerous homesellers and agents are installing smart locks, such as those provided by August Home ($75 million raised), to allow potential buyers to tour listings on their own. Meanwhile, digital 3-D home tours will "very likely shrink the number of homes that buyers need to visit because they'll feel like they've seen it," said Sam Debord, a Seattle real estate broker who has advised many real estate tech investors.

A growing number of lenders and software providers, such as Blend, Better Mortgage, Quicken Loans and loanDepot are bringing borrowers closer to all-digital mortgages. Timelines will shrink as federal mortgage guarantors embrace innovation and a "much more predictive, data-driven approach takes hold," predicts Andy Taylor, co-founder of mortgage software maker Approved.

The title transfer process, too, could undergo game-changing innovation. Startups including Propy, velox.RE and Ubiquity are hoping to use blockchain technology to automate it. Says Moderne Ventures CEO Constance Freedman: "If you have a single source of truth for information, you don't need things like title insurance." But replacing or working around the current U.S. property records system—beset by fragmented databases and controlled by a strict legal framework—would be a monumental task.

"HYBRID" BROKERAGES EMERGE

All these innovations will help fuel a wave of tech-powered brokerages, known as "hybrid brokerages." They leverage websites, digital communication and transaction systems and teams of specialists to offer lower fees. And they aim to bundle mortgage, title and other ancilliary services into one seamless experience.

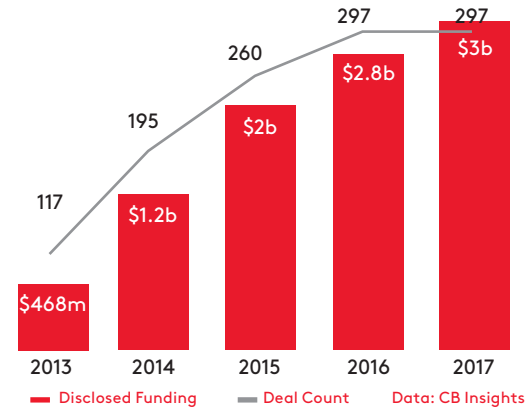
Redfin has been a trailblazer, using its popular listing site and tech-powered agents to offer discount rates for nearly a decade. It charges homesellers a roughly 3.5 percent commission, compared to the 5 percent or more that is otherwise typical. Clients who are buyers receive a portion of the commission Redfin is paid by a listing broker. Redfin, which assisted with 14,000 transactions in the third quarter of 2017, may have found the sweet spot between technological efficiency and hands-on service, though some longtime observers remain skeptical.

Zillow Group CEO Spencer Rascoff certainly takes the commission cutter seriously. He called Redfin "a threat to organized real estate," in an August earnings call. Agents would have less money to buy advertising from Zillow if Redfin gobbled up market share and led other brokerages to cut commission rates to stay competitive. Redfin, meanwhile, is innovating furiously. Its latest projects include a showing-scheduling tool, an offer-generation app, iBuyer service, and a newly launched integrated mortgage service.

Hybrid brokerages Homie and Trelora may also have bright futures. Both combine an online platform and limited but efficient services to offer even lower rates than Redfin. They are under fierce attack from the industry, which sees a threat to prevailing commission rates. Incumbents accuse these startups of subpar service and fighting dirty. Says Trelora CEO Joshua Hunt: "We have plates stolen from our cars, letters sent to sellers, broken windows, egged cars, hate mail...and daily aggression from agents." Nonetheless, Hunt claims his Denver-based brokerage closed more than 1,000 transactions there last year. Like the similar Salt Lake City-based Homie, Trelora has plans to expand nationwide. One way Trelora reduces costs is by encouraging agent-chaperoned communication between buyers and sellers using a proprietary messaging system on its listings site, blurring the lines between a for-sale-by-owner service and a brokerage.

This has also been a core feature of Purplebricks, a cut-rate brokerage that has become one of the largest brokerages in the UK since its start in 2014. Traded on the London Stock Exchange, Purplebricks has raised an extra $131 million in special funding to break into the United States. It recently launched in California and says it will debut soon in the New York metro area. "We're looking at every ancillary service we can integrate into our offering, so we can control the consumer experience and make it more efficient," said Erik Eckardt, who heads up Purplebricks' U.S. division. Homebuyers can make offers on Purplebricks listings online and view competing offers. This sort of online auction bidding could become increasingly common. Redfin is considering something similar.

VC FUNDING OF REAL ESTATE TECH COMPANIES



SOFTBANK PUMPS UP COMPASS

Compass is a curious case in real estate tech, for the extraordinary financial support it has garnered from SoftBank and others. The Japanese tech investing colossus recently ploughed a $450 million investment into Compass, bringing its total funding to $775 million. When the New York City-based brokerage (then known as Urban Compass) launched in 2013, it set out to disrupt brokerage for rental units and homes by using tech to improve home searches and pay agents based on customer satisfaction. But when it shifted from rentals to sales, Compass began charging typical commissions so it could attract top talent. Some industry analysts speculate that Compass may use the SoftBank money to finally design breakthrough technology. In any case, Compass will use its war chest to seize market share across the country and globally.

Some believe the new crop of tech-powered challengers could unseat incumbents like Realogy and Keller Williams Realty—which collectively oversee hundreds of thousands of agents. But Keller Williams is actively countering the threat. It recently set aside $1 billion to invest in technology and released an AI assistant for its agents. Meanwhile, Realogy is acquiring startups and hired a new tech-savvy CEO.

Keller Williams founder Gary Keller told agents at the company's most recent annual conference that agents must find ways to counter tech companies. "We're losing so slowly we think we're winning," he said. It's smart to be scared. But all the innovation and competition guarantees consumers, at least, are the real winners.

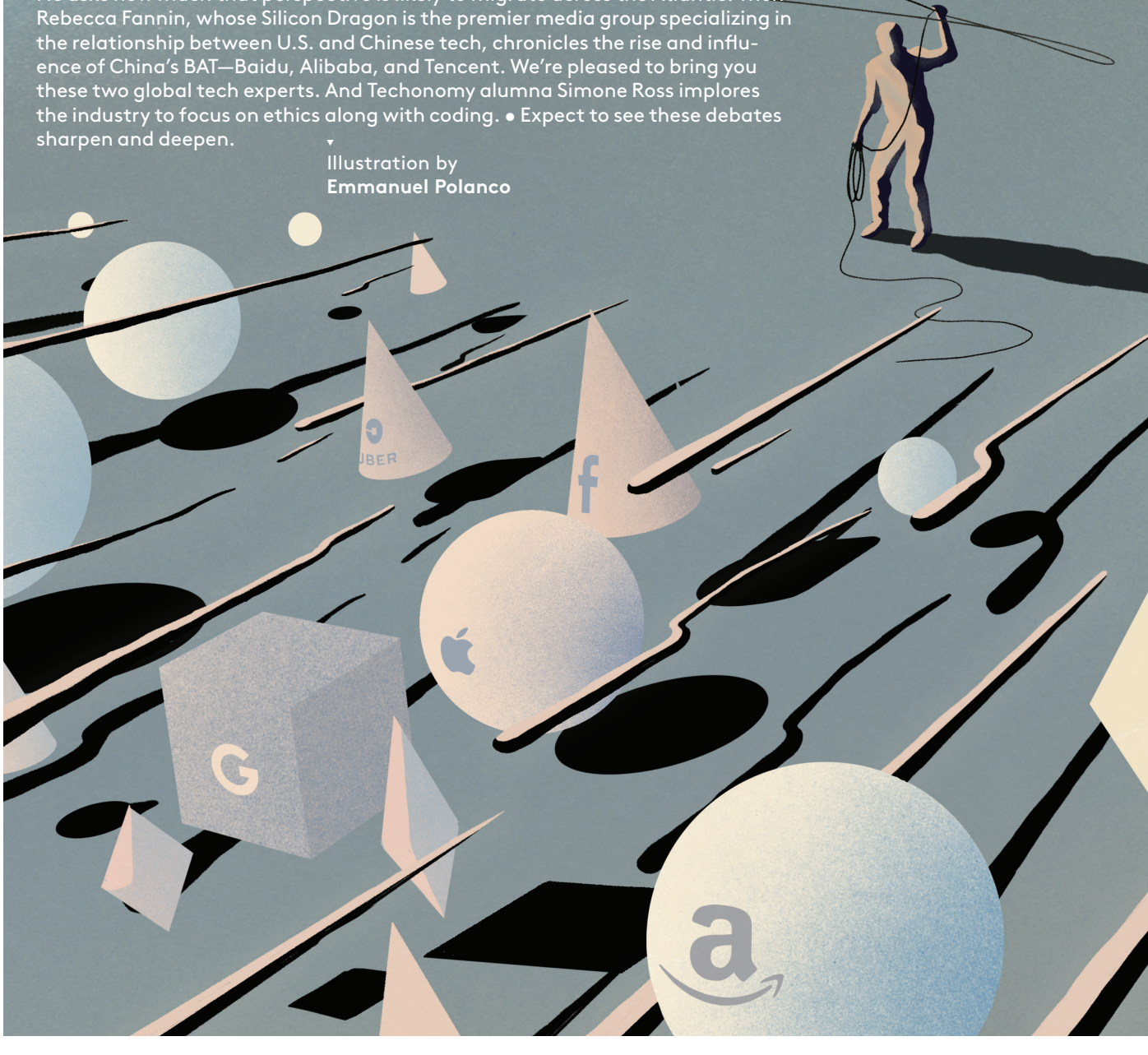
TEKE WIGGIN *is a Brooklyn-based reporter who covers technology, labor and housing.*

SPECIAL SECTION:

Reining in Tech

Silicon Valley has been getting a free pass. The recent pushback against Facebook, Uber's reset, and the end of the Tesla/Wall Street love affair are signs of a new caution. Companies in all industries need to meditate on what the changing mood means, in large part because the consumer mindset about tech is changing in real time. • In the following special section, we examine how the position of tech companies is shifting. Techonomy's editorial director Jeff Pundyk starts by asking why they have been allowed to occupy such a privileged perch in the economy. • One critical factor influencing the shift is the genuine globality of tech's presence and influence. Our contributor Chris O'Brien, who lives in Toulouse, France, explains the growing urgency and concern of European regulators. He asks how much that perspective is likely to migrate across the Atlantic. Then Rebecca Fannin, whose Silicon Dragon is the premier media group specializing in the relationship between U.S. and Chinese tech, chronicles the rise and influence of China's BAT—Baidu, Alibaba, and Tencent. We're pleased to bring you these two global tech experts. And Techonomy alumna Simone Ross implores the industry to focus on ethics along with coding. • Expect to see these debates sharpen and deepen.

Illustration by
Emmanuel Polanco



Too Bad You're Not a Tech Company

Every company is driven by technology, so why are only certain "tech companies" afforded special privilege?

by **Jeff Pundyk**

Illustration by **Emmanuel Polanco**

In

January of 2000, America Online merged with Time Warner in a deal that valued the combined company at $350 billion. AOL, the tech company that dominated the dial-up era, used a stock that was worth twice that of Time Warner, the legacy media company, though it had less than half the cash.

Soon after the merger, the dot-com bubble burst, the broader economy went into recession, and AOL-Time Warner was just a media company, and an old-school one at that. New broadband and internet providers already offered better technology. The company took a write-off of nearly $99 billion in 2002 and its stock eventually fell all the way to $20 billion.

Today, AOL-Time Warner is the poster child for what can go wrong in a merger. But it also shows what can happen when a tech company loses that designation and all its privileges.

As the current crop of internet giants and unicorns relentlessly push often-uncomfortable boundaries, they position themselves as technology platforms free to operate outside the norms and constraints of legacy competitors. But at the same time, companies in every industry are embracing transformative technologies, speed to market, and new business models as keys to their survival.

It all raises a question: "What is a technology company?" Strictly speaking, it should mean a business that principally sells technology or technology services. Unambiguous tech companies include IBM, Oracle, Cisco, and Intel, for instance. By this definition, of the big five internet-era giants—Amazon, Apple, Facebook, Google, and Microsoft—only Apple and Microsoft are actually tech companies.

But to be a tech company brings with it a cultural cache, a license from Wall Street to spend freely and enjoy an outsized valuation on the presumption of near-endless growth, and permission from society to break established rules.

Tech is at the very core of many insurgents in industries including taxis, news distribution, grocery, or payroll services, just to name a few. Easy-to-use mobile applications confer a competitive advantage on prominent successes including Uber, Lyft and Airbnb. They, too, call themselves technology "platforms." But isn't tech equally critical to companies like FedEx, Comcast, and Marriott, considered respectively to be in logistics, media, and hospitality? Such "non-tech" companies get little special consideration from Wall Street, lack generous valuations that make capital cheap, and may feel like dinosaurs to recruits and customers.

Traditional industry distinctions, too, are becoming blurred as companies take on multiple revenue streams and enter new markets. Amazon is no longer just a humble bookseller but rather a retailer, media company, services colossus, grocer, and even a healthcare company.

The mythology of the tech company puts a premium on speed. To be one signifies an innovation mindset. It suggests risk-taking, the potential for industry domination, and a reliance on software created by engineers. These champions of "agile development" turn their backs on old-fashioned waterfall workflows and five-year planning cycles.

But today, so does everybody else. There is no well-run business that is not racing to keep up with the pace of change, recruiting tech talent, and retooling business models.

So, what happens when we peel away the "tech company" label? What happens when companies are defined by what they do, not by how they do it, and are scrutinized by parties who do not adore them?

Late last year, the European Union's highest court began to suggest an answer. It ruled that Uber was nothing more than a transportation business. "The service provided by Uber is more than an intermediation service," the judges said. "The ride-booking company must be classified as 'a service in the field of transport.'" It must, therefore, employ licensed taxi drivers and meet strict safety regulations. (For more on European regulation, see page 20.)

What kind of company Facebook is has become a subject of intense dispute. In 2014 Mark Zuckerberg called it "a perfect personalized newspaper"—in other words, a media company. That would suggest it has responsibility for its content. The remark was a notable deviation from Facebook's usual positioning that it is a mere platform, which its executives see as inoculating it from the regulatory restraints that come with being a media company. Now Facebook is being told to take responsibility for content as part of the full-blown and multi-faceted backlash buffeting it in the aftermath of the 2016 U.S. presidential election, when manipulators used personal data and "fake news" aiming to alter the election's outcome.

In October 2017, Facebook Chief Operating Officer Sheryl Sandberg took one giant step back: "At our heart, we're a tech company," she told Axios. "We hire engineers. We don't hire reporters. No one is a journalist. We don't cover the news."

This "neutral platform" defense landed with a thud. Zuckerberg himself then pivoted. As 2018 began, he vowed to "fix" the company, making his personal challenge for the year "protecting our community from abuse and hate, defending against interference by nation states, [and] making sure that time spent on Facebook is time well-spent." But he framed the challenge as a technical one, saying the company would now emphasize content from a user's friends over news articles and marketing material.

Zuckerberg's pivots generally ignore the engine that drives its revenue: advertising. Much as Facebook may want to avoid being grouped with media companies, it enjoys enormous profit using media's business model, a choice that has exposed the platform to widespread abuse. (note: Zuckerberg was preparing to testify before congress as this issue went to press.)

Clearly, it's convenient to be considered a tech company. But even the general public appears to have stopped buying the mythology. This year's Edelman Trust Barometer, announced in early 2018, showed that people worldwide think social platforms and search engines are part of "the media," right beside traditional journalists and news organizations. What's more, trust in traditional journalism was up, while trust in platforms was down—dramatically. Nearly half of those surveyed said they did not trust the platforms, even as 65 percent said they rely on them for news. In a separate study, conducted by Quartz last summer, nearly 80 percent of respondents from around the world said they did not trust Facebook with their personal data. Some regulators now see that decline in trust, combined with the real dangers of electoral manipulation, as an opening to scrutinize big tech's business practices.

The threat of regulation for the net giants is real. They have reached their lofty, quasi-monopoly positions thanks in part to legal exemptions, tax breaks, and minimal accountability for what takes place on their platforms. Regulation has been lax because it was seen to encourage innovation.

Facebook enjoys enormous profit using media's business model, a choice that has exposed the platform to widespread abuse.

Now, as the companies try to protect their dominance and continue to grow, they are increasingly seen as a barrier to innovation. They are snapping up adjacent companies and leaving much of the rest of the economy little choice but to utilize their services as critical infrastructure. As a result, in 2018 no less than Bill Gates, who knows something about the threat of regulation, warned the net giants that they could bring government intervention on themselves. And pure tech company IBM, viewing regulation as a way to even the playing field, is advocating for legislation to regulate digital ads and to keep liability protections out of new trade agreements—proposals aimed directly at the social platforms. The prospect of regulation became even more likely in the wake of the Facebook data breach, which has the attention of regulatory bodies around the world.

Perhaps the "tech" designation is losing some of its superpower. That would be welcome news for numerous "non-tech" competitors who must play by a different set of rules, especially in media and retail.

Is being a "tech company" keyed to a company's culture? Its industry? Its business model? The meaning of such distinctions is diminishing. Today every company relies on technology, even as the global growth of new tech-enabled models is creating vast new challenges for society. It is time to retire the idea that high-growth, tech-driven companies are in a special class. The rules and responsibilities of society should apply to everyone.

JEFF PUNDYK *is chief strategy officer and editorial director of Techonomy Media.*

As the EU Targets Tech, Will its Rules Come to the U.S.?

Regulation, that dirty word, is creeping closer and closer to the tech industry and especially its giants. Privacy-conscious and regulation-happy, Europe is leading the way.

by **Chris O'Brien**

Illustration by
Emmanuel Polanco

With

fears growing over Google's economic and cultural might, the European Parliament decided in 2014 it needed to send a strong signal that the tech giant should watch its back. Lawmakers voted overwhelmingly for a resolution that encouraged EU regulators to consider breaking up the search giant. In Silicon Valley it was seen as an idealistic gesture, provoking chuckles and eye-rolling. Oh, those kooky Europeans and their fear of the future!

Four years later, Silicon Valley has stopped laughing. The largest U.S. tech companies find themselves facing a tidal wave of regulatory scrutiny in Europe across a dizzying range of topics. Privacy. Antitrust. Taxes. Fake News. Dominance of e-commerce. The list of proposals and investigations by the European Union and its member countries seems to grow by the day. The Cambridge Analytica scandal faced by Facebook early in 2018 only heightened worries in Europe and worldwide about the power and misuse of data by global net companies.

Behind this regulatory assault lies what has historically been fundamentally different views in Europe and the United States on the relationship between government and business. Europeans see regulation as essential for fair and free markets. The government's job, they say, is to be the referee who makes sure everyone follows the rules. But in the U.S., there are far more people, including in government, who believe that if you are for regulation then you must be a protectionist who is afraid of competition and the future. The Cambridge Analytica scandal may have begun to bridge the disparate regulatory cultures, since the data may have been used both in political campaigns to elect Donald Trump and in support of the Brexit vote in the United Kingdom.

Nonetheless, the two regions remain distinctly different. Margrethe Vestager, the European Commissioner for Competition, summarizes the European view: "We don't see regulation as an obstacle to innovation or to businesses." The EU under Vestager also takes a relatively aggressive view of antitrust enforcement: "If you have a situation where a company can use their dominant situation to win in another market, that can be a barrier to other companies to invest or be innovative. What we are trying to do is get the right balance."

WORRY IN THE U.S.

But now concerns about the power of the internet giants has dramatically risen in the United States. The worries span a range of issues—electoral manipulation, a seeming disregard for consumer privacy, putting traditional media in jeopardy, and concerns about the sheer scale of three companies in particular: Amazon, Google, and especially Facebook. Could Europe's hardball approach become a model for American action?

In Europe, regulators are steadily becoming more aggressive, despite a vast campaign of lobbying and economic investments by American big tech designed to soften its image (see page 24). This culminated in the record €2.4 billion antitrust fine announced by Vestager against Google last summer.

That decision was a regulatory shot heard 'round the world for company critics, who hope it will inspire U.S. regulators to investigate antitrust violations by Amazon, Apple, Facebook, and Google. Yelp is a company that has complained for years about its mistreatment in Google search. Luther Lowe, its vice president of public policy, had been pressing the EU to take action, and now calls Vestager's ruling "a reset button [for] the entire zeitgeist around big tech."

THE TALK TURNS TO REGULATION

A more suspicious and punitive mood is now developing in the United States too. Editorials calling for restraint or regulation of the net giants are becoming common in major newspapers. Senators including Mark Warner of Virginia and Amy Klobuchar of Minnesota have called for new laws to regulate online political advertising in response to electoral manipulation on Facebook, Twitter, and YouTube. Conservative commentators like Tucker Carlson, too, are angry. "Google should be regulated like the public utility it is," he said on Fox News.

And it's now acceptable even to advocate more radical action. NYU professor Scott Galloway, speaking in Munich at January 2018's DLD conference, said bluntly: "It's time to break these companies up." The sentiment was all the more remarkable since Galloway has long admired and advocated for these companies. Galloway said he came to this conclusion because of sins including tax dodges, privacy abuses, and trafficking in fake news.

More recently, all three Republican nominees for the U.S. Federal Trade Commission, an agency that under President Obama investigated Google and rejected recommendations to take action, indicated they were open to cracking down on tech. "Companies that are big and influential can use inappropriate means to stay big," said Joe Simons, Trump's nominee to be FTC chair. "No company is above the law."

Is there a connection between the European crackdown and changing American attitudes? If not already, then soon, said Robert Atkinson, president of the Information Technology and Innovation Foundation, which has fought against the European regulators. "There is going to be contagion coming to the U.S.," he said.

EUROPE'S CULTURE OF PRIVACY

If the U.S. is indeed heading toward a regulatory course correction, then it's worth understanding what's happening in Europe. For one thing, support for the approach is not unanimous there. Plenty of economists, entrepreneurs, and investors fear that the pursuit of big tech by both the EU and its member states is running counter to the growing efforts in the region to encourage startups and innovation.

"I don't see it as a positive, to be honest," said Martin Mignot of London-based Index Ventures, one of Europe's biggest VC firms. "If you look at history, going after companies at their peak, [regulators are] always one generation behind what is happening. I think the market is much faster at disrupting. The time frame of regulation is so much slower."

But cultural norms really are different. Control over privacy has traditionally had greater currency among average citizens in Europe. As early as 1995, the EU began to establish what later became known as the "Right to be Forgotten", a right formalized by a European court in 2014. Americans may instinctively react against the notion that newspaper articles about things like divorce proceedings or lawbreaking should be removed from search results if the person written about asks for it. But in February, Google announced that it has already complied with 800,000 such requests in Europe.

This concern about data and privacy, meanwhile, evolved into the General Data Protection Regulation, passed by the EU in 2016 and going into effect May 2018. Tech companies everywhere are scrambling to understand and comply with these new rules, which define how personal data should be used and secured. If they don't they risk massive fines.

The GDPR is the kind of extraordinary, landscape-shifting decision that would be hotly debated in the U.S. And yet in Europe, it's just one corner of a massive regulatory march. EU tax haven investigations have resulted in a demand for Apple to pay €13 billion to Ireland, and for Amazon to pay €250 million to Luxembourg (The two countries are appealing, in effect on behalf of the companies). U.S. chipmaker Qualcomm was fined €997 million in January for abusing its market power and colluding with Apple to limit competition.

GDPR is the kind of extraordinary, landscape-shifting decision that would be hotly debated in the U.S.

There is a formal EU proposal to introduce a new tax of 3 percent of revenues on tech giants, an almost completely unprecedented approach, which underscores the frustration European governments feel about foreign companies reaping vast profits from activities inside their borders on which they pay few taxes. There is an ongoing e-commerce competition investigation. And this spring, the EU is expected to introduce broad rules around digital platforms, including e-commerce sites, search, and app stores.

The goal is to level the balance of power between tech giants and small businesses by, most likely, requiring more disclosure about how algorithms operate and creating a mechanism to file complaints if a service is demoted, delisted, or removed from an online store.

"Today, platforms have more influence and market power than anyone could have imagined," said Andrus Ansip, the European Commission's vice president of its Digital Single Market initiative, in a February speech. "It is only natural that in this position they will need to become more transparent in their dealings."

Similar or even more aggressive efforts are being undertaken by individual European countries. While Vestager insists there is no anti-American bias, for U.S. tech giants it sure can feel that way. Companies such as Apple, Amazon, Facebook, and Google seldom comment on the record about such issues. But Google Executive Chairman Eric Schmidt has long argued that European governments should instead focus on reforming their own markets to make them more competitive.

And one inescapable fact is that Europe has mostly failed to create its own internet giants. That has led to a fear that the continent's digital

destiny is out of its hands. The feeling of powerlessness is exacerbated when companies like Netflix or Uber arrive, threatening to disrupt and dominate other European economic strongholds such as entertainment or transportation. (Uber is banned in many European cities.)

And Europe's own failures lead critics to see the EU's regulatory reflexes as protectionism, a big basket of politico-economic sour grapes. "They can't compete, so let's regulate," said Roslyn Layton, an American researcher at Denmark's Aalborg University Center for Communication, Media, and Information Technologies. "I don't see any evidence that those regulations are going to create new European firms and jobs."

Layton said European regulators tend to ignore the unintended consequences of their actions. In telecommunication, for instance, national and EU regulations created low consumer prices in some countries for wireless and broadband services. However, they also diminished the incentive for investment in networks. The result: while 87 percent of the U.S. had access to 4G LTE networks in 2017, according to OpenSignal, such networks only reached 66 percent of the U.K., 58 percent of France, and 57 percent of Germany.

Likewise, with the looming GDPR. The Googles and Amazons of the world can easily afford the large expense of compliance. However, the data-sharing rules could blunt the growth of Europe's own promising AI ecosystem. "The GDPR ticks the box to tell Europeans that, hey, we're protecting you," said Jakob Kucharczyk, vice president for competition & EU regulatory policy in the Brussels office of the Computer & Communications Industry Association, which mostly represents U.S. companies. "But the more regulation you create for the market, the more barriers to entry and costs you make for these young companies."

Fines don't seem to deter U.S. tech giants. Google's stock actually went up the day after the ruling it should pay €2.4 billion. But what may make more of a difference is the very fact of ongoing investigation. When the U.S. government went after IBM in the 1970s for antitrust violations, and later for Microsoft in the 1990s, the investigations, rulings, and appeals dragged on for years. Meanwhile, both companies lost their dominant position as they failed to adapt to new tech trends. In some sense, being under a microscope was a kind of restraint. It was in the middle of Microsoft's epic antitrust trial against the Department of Justice that Google launched in September 1998.

Now, it's Google's turn. The antitrust case that led to the fine last summer actually began in 2010 and continues as Google appeals. And the search giant must simultaneously deal with another EU antitrust case involving its Android mobile operating system, along with hints that another investigation could be launched around local search services. In addition, Google settled a Russian antitrust case last year for $7.8 million but was just slapped by a $21 million antitrust fine by the government of India in February. "In these fast-moving markets, when the product managers are insecure and all these micro-decisions are being checked by the lawyers, that's when oxygen is brought into the market place," Lowe of Yelp said. "And that's when you can have real competition. Sometimes the trial is the remedy."

CHRIS O'BRIEN *is the European correspondent for VentureBeat.*

U.S. TECH COMPANIES COURT EUROPE'S REGULATORS

There is no simple way to quantify the increasing tension between European regulators and U.S. tech giants, but the massive expansion of lobbying by tech companies at the European Commission (EC) is a telling barometer.

According to data compiled from public filings by Transparency International EU, a nonprofit government corruption watchdog, the amount spent by U.S. tech companies lobbying the EC jumped 147 percent from 2014 to 2017. And the number of U.S. tech companies registered to lobby has grown to 30 last year, from 11 four years ago.

"We definitely see a very stark increase for budgets and presence on the ground from U.S. tech companies," Daniel Freund, head of advocacy for the organization, said.

The total tech EC lobbying spending of €22.345 million ($27.71 million) by these 30 companies in 2017 is just over half of what the Big 5 tech companies spent on U.S lobbying in 2017. Indeed, Google and Facebook combined spent more in the United States than the total U.S. tech lobbying in Brussels.

On the other hand, the European numbers don't include direct lobbying of member nations because many don't require such public disclosures.

Still, it's the rapid growth and aggressiveness that's turning heads in Europe, Freund said. The charge has been led by Google, which topped all U.S. tech lobbyists in Europe last year with €5.25 million in spending, up 320 percent since 2014. Last year was the first time Google outspent Microsoft, a company that learned the hard way not to ignore Europe when it was slapped in 2004 with a then-record antitrust fine.

In Europe, Google has so far been the most scrutinized company by regulators, in large part thanks to the multiple antitrust cases it is fighting, but Facebook is clearly under increasing scrutiny since the news of the Cambridge Analytica data breach.

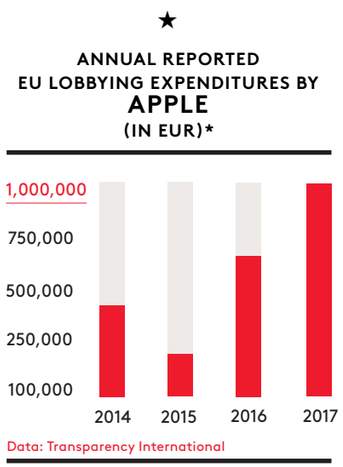
Proposed European regulations around privacy, fake news, copyright, intellectual property, and transparency for online platforms could have profound impacts on the way American tech companies do business in the vital European market.

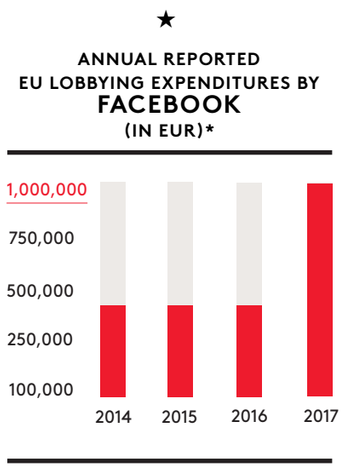
Facebook and Apple have been slower to engage, a decision both may yet regret in the face of this regulatory wave. Both spent €1 million each last year. On the other hand, Uber only registered in 2015, but has seen its spending rise 1300 percent to €700,000 last year. It also recruited former EC digital commissioner Neelie Kroes to be a paid member of its public policy advisory board.

As happens in the U.S., tech firms are hiring staff members from the European Parliament to work on their lobbying teams. And they are also deploying so-called "soft power" strategies, such as making various donations to public programs, funding research organizations, as well as academics, and highlighting the economic contributions they make in terms of employment and taxes paid.

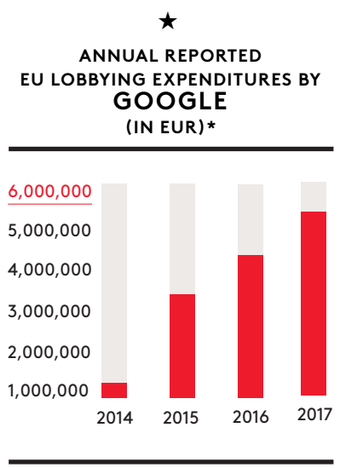
By Chris O'Brien

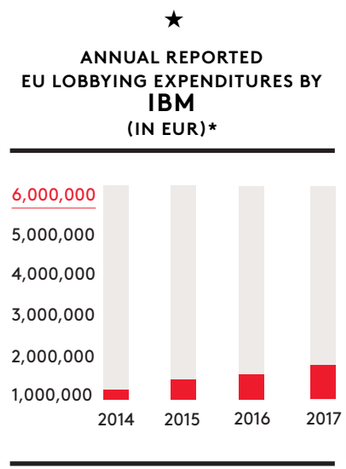
NOTE: Scale for these two charts is different than for those to the right.

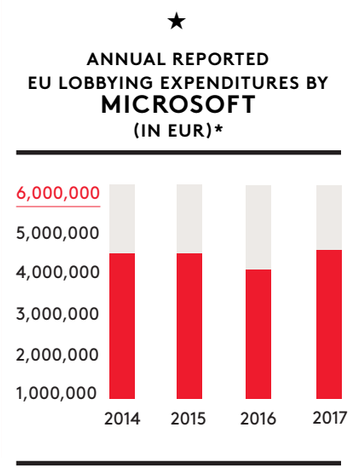


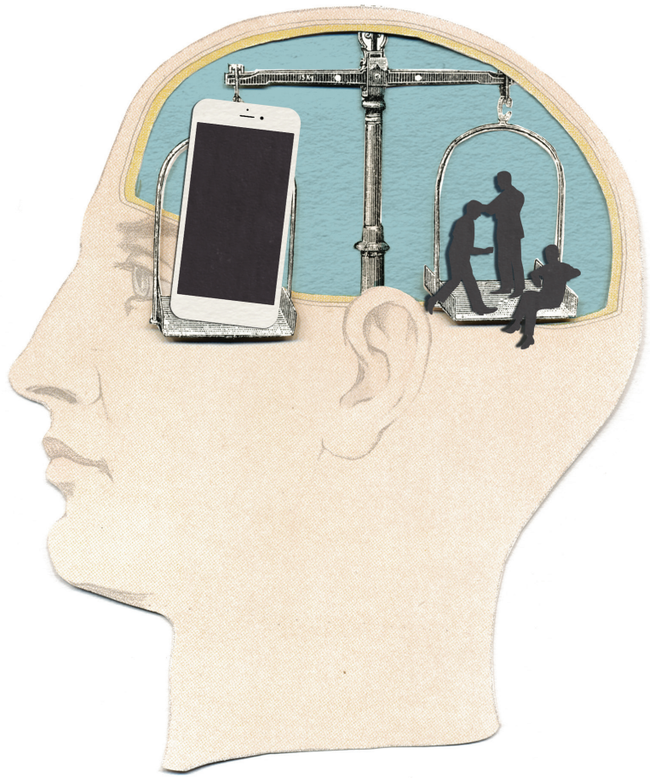


Data: Transparency International









If Society is Governed by Computer Code, How Will Coders Understand Ethics?

By **Simone Ross** Illustration by **Nicole Natri**

TECH IS NOT NEUTRAL. Human values are being coded into our machines and the implications are vast. We can barely keep up with where tech is taking the economy, society, and our institutions. But all computer code embodies to some degree the assumptions and beliefs of its makers. So as technology extends ever further through tools like artificial intelligence, we need to ensure that the people writing the software—the computer scientists—are educated in ethics.

More attention is now being paid to the issue of ethics education for computer scientists, but it so far remains generally inadequate for the challenges we reckon with today. That's why we are seeing biases, discrimination, and inequities emerge in the digital world that echo what we see in the real one. It shouldn't be this way.

Algorithmic bias has real-world consequences. It leads, for example, to gender and racial discrimination. Google's ad software has presented higher paying jobs to men than to women, and has been more likely to serve up criminal justice-related products alongside searches that include names likely to belong to a black person. Latanya Sweeney documented this in her 2013 paper, "Discrimination in Online Ad Delivery."

Artificial intelligence is also finding its way into the criminal justice system, through predictive policing and machine testimony, often in ways that actively preclude transparency and accountability. It's one thing to use AI to fight a parking ticket; it's another when courts use AI to recommend sentencing and bail. It's clear that our information economy infrastructure is easily manipulated. And when bias is not actively avoided, it can get built into machine learning systems over and over.

Technologists need to integrate ethical concerns into every project. But without an understanding of the impact of their work, can engineers be expected to be socially responsible? Is it even fair to ask them to be?

Thankfully, societal awareness is shifting and a sense of responsibility among programmers is growing. There's the well-known world of "white hat" hackers, who help detect and prevent cybercrime and attacks. Programmers and coders are starting to refuse to work on certain projects. At Google, thousands of employees signed a letter urging the company not to work on AI technology for the Pentagon. Others come out as whistleblowers. DJ Patil, who was chief data scientist for the Office of Science and Technology under former President Barack Obama, recently started crowdsourcing a code of ethics for data science. Some Stanford computer science undergraduates created a group called "Stanford Students Against Addictive Devices" and began protesting outside Apple's headquarters and Apple stores. There is growing research on this topic in academia, and we're seeing new organizations like the AI Now Institute at NYU, which examines the social implications of AI.

So how do we get more socially responsible software engineers? Ethics should be a core topic in university computer science programs. Some tech companies are trying to develop their own ethics programs to address the fact that few of their engineers have had substantive ethics training. The question of what to teach and how to build a curriculum is complex. Does new technology create new ethical issues? Who defines what is right or wrong? Does industry have a role?

The field of computer ethics has a long history, even if it has not been heeded. It was founded in the early 1940s by MIT's Norbert Wiener. In 2006 Michael J. Quinn, then at Oregon State University, wrote an important paper entitled "On Teaching Computer Ethics within a Computer Science Department," and Stanford University has had ethics and technology courses for 30 years. In order to be accredited by the Accreditation Board for Engineering and Technology, computer science programs are supposed to include programs for "an understanding of ethical issues." But that requirement is broad and undefined. Many universities require an ethics course for their computer science degrees, but there is little uniformity in what is taught. In some schools, you can fulfill the ethics requirement with a course that doesn't focus heavily on ethical issues. Some classes are taught in the computer science department (Ethical Foundations of Computer Science, University of Texas, Austin), sometimes they are interdepartmental (Intelligent Systems: Design and Ethical Challenge, Harvard University, co-taught with the philosophy department). The University of Washington offers a course in the communication department called Exploring the Ethical Questions of New Technology, built around episodes of *Black Mirror*.

There is little doubt that the world needs more explicit, relevant educational programs in ethics for engineers and programmers. And they cannot offer a simple, one-size-fits-all solution to complex problems. The ethical considerations for military applications will be very different from what would apply in medical software. The ethical principles for a companion robot must be different from those for a self-driving car.

Artificial intelligence and machine learning continues its relentless advance; the cyberization of institutions and communities continues; the Internet of Things connects pretty much everything. And now as technology enters our cells and neurons, allowing us to update not just the software in our devices but in our biology, the question of what's right for society and humanity cannot be left to computer scientists alone. We need an educational system and ethical framework that helps them.

We won't get it right immediately. But as neurobiologist Rafael Yuste of Columbia University says: "When the medical code of ethics was first created we were still learning...and it's held up pretty well."

PHOTO COURTESY OF SANJAY KANNAN, STANFORD STUDENTS AGAINST ADDICTIVE DEVICES

These Stanford computer science majors are not content just coding. They're engaged with social issues, particularly smartphone addiction. From left to right, seniors Cameron Ramos, Divyahans Gupta, and Sanjay Kannan protest outside the Apple store in Palo Alto in March 2018.

Imbuing society's computer code with more ethical frameworks will be an ongoing process, but we need to act with urgency.

SIMONE ROSS *is the former director of programming at Techonomy Media.*

China Unleashes a Tech Dragon: the BAT

Isolated from American competition, Baidu, Alibaba, and Tencent dominate China and have grown remarkably for a decade. Now they are legitimate rivals to the American tech giants.

by **Rebecca A. Fannin**

Illustration by **Emmanuel Polanco**

Baidu made a splash at this year's

Consumer Electronics Show in Las Vegas when COO Qi Lu showcased the Chinese internet search leader's new push into artificial intelligence. Dressed in the requisite jeans and black shirt and cued by a teleprompter and bold slides, he bragged about "innovating at China speed." Baidu debuted innovations ranging from autonomous driving technologies to a suite of voice-powered speakers, lamps, and projectors dubbed by Baidu as the "Alexa of China." It was a critical moment as Baidu, itself known as the "Google of China," faces growing pressures on its command of Chinese search.

Baidu is one of China's three tech kings, collectively known as the BAT—Baidu owns search, Alibaba leads e-commerce, and Tencent dominates gaming and social communications. The power of these three is daunting and growing, but like their American superpower counterparts—Amazon, Facebook, and Google—they face growing pains. Even as the BAT expand their ambitions to more and more industries, well-funded newcomers threaten to overshadow them, and an all-powerful government is making moves to keep their power in check.

For now, they have entered the rarified ranks of the world's largest and most valuable companies, right up with America's tech giants. The market capitalization of Tencent has recently exceeded that of Facebook, which like Alibaba hovers around half a trillion dollars. Apple recently exceeded $900 billion, as Alphabet, Amazon, and Microsoft hovered around $750 billion. Baidu remains substantial, recently a bit below $100 billion, but formidable.

Isolated from American competition thanks to the Chinese government's ban on Google, Facebook, and Twitter, as well as repeated market failures by Amazon and eBay, the BAT have chalked up remarkable double-digit growth rates for a decade. They have soared to be among the world's largest networks—Tencent's ubiquitous communications and payment product WeChat has 1 billion users, Alibaba sold to 515 million retail consumers in 2017, and Baidu claims 665 million mobile search users. (For more about WeChat, see the feature article in *Techonomy Magazine*'s last issue.)

The backdrop is the Chinese people's voracious uptake of apps, digital payment services, and social media—and a concerted nationalistic drive to win the tech race globally. Over the past 15 years, China has pivoted its central long-term economic strategy from manufacturing and exports to tech innovation. And it's working. Today, Chinese internet companies spend less time copying Google, Facebook, YouTube and Amazon, and instead seek to score the next, new thing in emerging sectors like artificial intelligence and fintech.

The ascension of China's tech titans has been nurtured by their home market's size and growth. China claims the world's largest number of users of the internet (about 710 million) and smartphones (663 million) plus the biggest online commerce market—more than $1 trillion in 2017. Spending is projected to grow annually by 23 percent, reports Goldman Sachs. And further huge potential remains untapped, since internet penetration is only 52 percent compared with 88.5 percent in the United States, a report by the Boston Consulting Group notes. And China has way more of the always-on millennials and Gen Z young people who turbo-charge the latest fads. They account for 54 percent of China's population compared with 37 percent in the U.S. Another advantage for China is that its relentless, entrepreneurial tech industry work ethic and startup culture can make Silicon Valley look downright sleepy. Company teams routinely work 12 hours a day, six days a week.

As tech burgeons, China has emerged as the globe's second-biggest venture capital investment market—$65 billion last year and closing in on the $76.4 billion in the U.S., according to London-based data tracker Preqin. Four of the six largest venture deals of Q4 2017 were in China: ride-sharing service Didi Chuxing at $5.5 billion, China Internet Plus (the merger of group-buying sites Meituan and Dianping) at $4 billion, bike-sharing startup Ofo at $1 billion, and electric-car maker Nio at $1 billion. No wonder China has nurtured so many unicorns—last year it accounted for 29 percent of startups valued at more than $1 billion, according to Crunchbase.

The BAT companies are powering forward with multi-function super apps and a sprawling reach into new industries. Alibaba seeks to conquer the world's retail market while powering into related fields such as financial services, gaming, healthcare, and online travel. "The speed and range of new services at Alibaba is as good, or better, than Amazon," says Hans Tung, managing partner at U.S. & China venture capital firm GGV Capital, an early investor in Alibaba. He adds that Tencent's super app WeChat, which wraps together chat, shopping, reservations, gaming, and banking, has more advanced functions than do Facebook's two giant chat services, WhatsApp and Messenger.

But continued dominance is by no means certain for the BAT if they don't innovate and invest quickly. The next generation of net players that have popped up is so potent it has earned its own local acronym—the TMD. These three companies include AI-empowered news aggregator Toutiao, group-buying giant Meituan-Dianping, and ride-hailing service Didi Chuxing. All are growing quickly.

A more delicate but perhaps even more potent challenge to the BAT's staying power is a government leery of their growing social weight. "The biggest thing to watch is [whether] the government identifies them as a risk to its power," says Ann Lee, author of *Will China's Economy Collapse?* She says government crackdowns could impair the companies' credibility, hobble them with censorship, or even shut them down.

As government pressures increase, the BAT are already acceding. Tencent recently limited the hours youngsters can play its smartphone game *Honor of Kings* after the government became alarmed about the risk of addiction. Baidu labeled paid ads more clearly in search link results in response to concerns about deception. All the sites are spending more time sanitizing politically sensitive content, pornography, and "excessive" celebrity gossip. And recent media reports suggest the government in Beijing wants even more oversight and plans to demand small equity stakes in China's social media giants, including Tencent and Alibaba-owned video site Youku Tudou.

PHOTO CREDIT: VISUAL CHINA GROUP/VCG VIA GETTY IMAGES

The iconic leaders of all three Chinese tech giants appeared together In April 2017 at the government's official China IT Summit in Shenzhen. Left to right: Tencent CEO Pony Ma, Alibaba chairman Jack Ma and Baidu CEO Robin Li.

The BAT are all eager to grow internationally, and have been encouraged by the government to do so. But they are late. Only 11 percent of revenues for NYSE-traded Alibaba come from international markets, and it's working hard to change that. In its first corporate ad push outside China, it was a major sponsor of the 2018 Winter Olympics in South Korea. International revenues for NASDAQ-listed Baidu stand at a measly 1 percent while Hong Kong-traded Tencent checks in at 5 percent. By comparison, their American rivals are vastly more international. Non-American revenue in 2017 was 53 percent for Google, 56 percent for Facebook, and 32 percent and growing for Amazon.

So Baidu, Alibaba, and Tencent are using money to expand, investing in tech companies around the world and doing acquisitions. The BAT inked a stunning 95 U.S. tech deals worth $27.6 billion in the past five years, according to research firm S&P Capital IQ. Last year, Tencent invested in Uber at a $48 billion valuation and took a 5 percent stake in Tesla. In 2016, Tencent paid $8.6 billion for Finnish game maker Supercell and a year earlier bought LA-based Riot Games. Alibaba invested in artificial reality startup Magic Leap and ride-sharing business Lyft, and made a string of buys into other Silicon Valley-based tech startups. Baidu invested early in Uber, and lately has gone after startups in deep learning, big data, analytics, and computer vision. It also recently opened its second R&D lab in Silicon Valley for self-driving car research.

Meanwhile, up-and-comer Toutiao moved aggressively into the U.S. market last year by buying video apps Musical.ly and Flipagram. But don't expect the BAT to go mainstream in the U.S. any time soon.

Standing in the way are cultural differences, lack of recognition, and

A challenge to the BAT's staying power could be a Chinese government leery of their growing social weight.

regulation. "Going global is going to be a long, tough haul for these Chinese brands," says China expert Ann Lee. "There is a lack of trust of Chinese brands in the U.S. It's psychological and emotional."

AI is becoming a geopolitical battleground. China and the U.S. are the world's biggest rivals.

It's also political. The Committee on Foreign Investment in the U.S. (CFIUS) rejected an attempt by Alibaba affiliate Ant Financial to pay $1.2 billion for transfer service MoneyGram. CFIUS worried the Chinese government might access personal information, even though Alibaba promised the data would remain in the U.S. More Washington constraints could be coming, as a bill to expand the range of CFIUS works its way through Congress. Under the increased scrutiny, Chinese tech deals in the U.S. slowed to $13 billion last year, from a peak of $16 billion in 2016, according to Capital IQ data.

But the BAT remain aggressively on the lookout. All of them have moved into Menlo Park's Sand Hill Road with their own venture investment units, where they are regarded as premium buyers. "They can have their pick of the litter," says investment banker David Williams of Palo Alto's Williams Capital Advisors. "They have a VC-like perspective and are fast-moving."

And founders of U.S. tech companies often see deals with Chinese giants as an entrée to the huge China market. Kansas City-based security technology upstart Zoloz (previously EyeVerify), for example, was acquired by an arm of Alibaba in 2016 for an estimated $100 million. The American company then became the global center for mobile biometrics used by the Alipay payment service.

China's tech titans all know that what matters most is their staying power. Baidu is advancing in both mobile search and AI. "Having missed out on the social, mobile, and e-commerce waves of the past few years, Baidu is trying not to repeat the same mistake by going all in on AI," observes Chris Evdemon, partner at Sinovation Ventures, the influential Beijing-based venture capital firm. Baidu is angling to close a large talent gap with Google.

AI is becoming a geopolitical battleground, with China and the U.S. the world's biggest rivals. The Chinese government has set the goal of becoming tops by 2030. Last year, 48 percent of the $15.2 billion in global AI funding went to China, surpassing the U.S. Since the size of AI data sets confer intrinsic advantage, China's sheer scale could give it the upper hand, concludes a recent paper by the Eurasia Group and Sinovation Ventures.

Alibaba, for its part, faces increased competition from Chinese e-commerce rival JD.com, which recently teamed up with Tencent to buy into popular online fashion retailer Vipshop. Forging ahead, Alibaba is going all-in on what visionary founder Jack Ma calls the "New Retail," a broad strategic concept for digitizing merchandising and shopping using artificial intelligence and data from sensors and smart devices. Alibaba leads the world with its new Hema stores—automated, cashless, cashier-less operations that combine groceries with a fresh food market, a restaurant, and speedy nearby home deliveries. Some 25 stores have opened already in major Chinese cities and Alibaba plans a total of 60 this year. Hema was introduced months before Amazon's less ambitious Amazon Go cashier-free store, which is so far only in Seattle. "There's really nothing as advanced as Hema in the U.S.," says Michael Zakkour, who heads the China/Asia practice at supply chain consulting firm Tompkins International.

Alibaba is also making strides with its Ant Financial subsidiary and its affiliated mobile-payment platform Alipay, now used by roughly one-third of all Chinese consumers to pay for just about anything, including cinema tickets, phone bills and groceries. At a recent conference in Silicon Valley, Hu Xi, VP and chief architect at Ant Financial, detailed how the bank and payments platform has diversified into services like microloans, wealth management, insurance, and internet banking. Another successful Alibaba spinoff, Yu'e Bao, has become the world's largest money market fund, with 370 million account holders who can open accounts with as little as 15 cents, and $211 billion in assets in just over four years. It promises returns of more than four percent.

At Tencent, the focus is on maximizing WeChat, the super app in China that has become a way of life, while continuing a winning streak with online games. Staying on top can be tough in China's fast-changing market, though, where 43 percent of apps are tried only once, according to Boston Consulting Group. Only 15 percent of apps are used more than 10 times.

What's next for Baidu, Alibaba and Tencent? They all want to get into huge economic sectors where technology is increasingly central, such as healthcare, enterprise systems, education, and robotics. For example, Tencent recently led a $15 million investment in medical AI startup VoxelCloud in Los Angeles and invested in biotech startup Locus Biosciences in North Carolina. Observes venture investor Evdemon of Sinovation Ventures, "There is no aspect of technology that is not of interest to the BAT."

REBECCA A. FANNIN *is founder and editor of publishing and events business Silicon Dragon.*

SPECIAL SECTION:

Committing to the Global Goals

Techonomy's theme for the year is "Harnessing Tech for Responsible Growth." We have found that many businesses are manifesting their own commitments by using the United Nations' Sustainable Development Goals for 2030 as their guide. Others have yet to embrace the goals or for that matter a larger responsibility to society.

The following pages include a blockbuster interview with one of the main architects and champions of the goals, Professor Jeffrey Sachs of Columbia University. Reading his words may help brace us all for the scope of the task we face.

At our conference last November, we asked speakers to select a global goal they cared most about, so a wonderful photographer from Getty Images, Emma McIntyre, could shoot their portraits and mark their commitment.

The final article in this special section, by climate activist Eric Pooley of the Environmental Defense Fund, offers encouraging news. Technology can help environmental groups and businesses willing to make the commitment now achieve things that would otherwise have been impossible.

COURTEST OF UNITED NATIONS/UN.ORG

"TO MAKE
7.6 BILLION PEOPLE LIVE VIABLY
ON THIS PLANET,
WE NEED SYSTEMS"

JEFFREY SACHS IS UPSET

WE DON'T TAKE THE U.N. SUSTAINABLE DEVELOPMENT GOALS SERIOUSLY ENOUGH. TECH IS INDISPENSABLE FOR ACHIEVING THEM. BUT SACHS IS UNIMPRESSED WITH BUSINESS SO FAR, ESPECIALLY THE TECH GIANTS, HE TOLD TECHONOMY IN THIS EXCLUSIVE INTERVIEW.

BY **DAVID KIRKPATRICK** | PHOTOGRAPHY BY **WESLEY MANN**

JEFFREY SACHS IS ONE OF THE WORLD'S TOP DEVELOPMENT ECONOMISTS AND HAS BEEN A GLOBAL ANTI-POVERTY CRUSADER FOR DECADES. HE IS SPECIAL ADVISOR TO U.N. SECRETARY-GENERAL ANTÓNIO GUTERRES AND A MAJOR CHAMPION OF THE U.N.'S 17 SUSTAINABLE DEVELOPMENT

Techonomy's David Kirkpatrick sat down with Jeffrey Sachs at his home in Manhattan to discuss how tech and business can supercharge the U.N.'s global goals.

Goals (SDGs) for 2030—a comprehensive set of targets and methods for improving life on earth. The SDGs put special emphasis on helping the world's least powerful people, ending poverty and hunger, and improving health, as well as reducing inequality, bolstering justice, and especially combating climate change and environmental degradation.

Techonomy founder David Kirkpatrick sat down with Sachs in March 2018 in his New York apartment for a wide-ranging conversation about how tech could bolster progress towards the global goals for 2030, and the role of business. He is a scathing critic of those who do not take these goals seriously and is willing to embrace radical new methods in order to tackle some of the world's previously intractable problems. Sachs is University Professor at Columbia University and directs the Center for Sustainable Development at Columbia's Earth Institute. He is author of many influential books including 2005's *The End of Poverty* and the recent *The Age of Sustainable Development*.

ON BLOCKCHAIN AND BITCOIN

Regarding blockchain, I'm mildly excited because a lot of people that I admire are excited. I haven't seen reality to it yet. And I'm not at all a fan of bitcoin. In fact, I think it's a shocking mistake. I do know something, because I'm a monetary economist. And the cryptocurrency angle I find all wrongheaded. I hate that we're mining bitcoin with so much waste of energy and CO2 emissions. But that's different from blockchain. A decentralized ledger could be promising. I'm not enough of a techie to know whether the hype is real. Some people say it's the most important thing to come out of this area. I'm all ears. I'd love to see a case of it.

TECHONOMY: *How would you assess progress towards the SDGs?*
SACHS: Well, we're not directed enough or focused enough to actually achieve these goals, and that's quite frightening because these goals are not a luxury. They are a need for humanity. The SDGs are about reorienting the way a vast and increasingly dangerous world economy operates. It's creating inequalities of wealth and poverty that are astounding and dangerous for our democracy in the United States, and dangerous for the world. And it is relentlessly destroying the environment through global warming and the loss of biodiversity.

The idea of the sustainable development goals is to say that with all of this wealth and technology and knowhow and skills, we could reorient the way we do things, locally to globally, so that we could have it all—economic prosperity, social fairness, and environmental sustainability. That's the purpose of the SDGs. Many governments are trying to orient around them. Our own in the United States, in Washington, pays zero attention. I don't really want to tell Trump about them, because he would try to destroy them.

But it's shocking for me. I visit probably 50 countries every year. Most of the world is worried about global warming, worried about the instability of the food supply, water crises, extreme storms, heat waves; most of the world is worried about wealth increasingly concentrated in a few tech companies and a few billionaires and leaving a lot of the rest of humanity outside. But in the United States unfortunately, our political circles are not part of that.

TECHONOMY: *When you speak and write about the many reasons for optimism, you often mention the information revolution, new materials, and genomics. But then you said recently, "But none of them are entrained for these challenges." What do you mean?*
SACHS: We have a remarkable technological revolution, one of the greatest in human history. Everything around computation, AI, and connectivity I'd put on par with the greatest scientific revolutions we've had, with the steam era, or electrification itself. But we need to use this in a way to solve problems, to make the environment safe, to address renewable energy, to address the needs of the poorest people, to address social inclusion.

Our system, especially the U.S. system, is market-based. You look at how technologies are evolving, to stream movies, to capture eyeballs for advertising, to sell data profiles. It's all for market purposes. You look at a lot of the innovations. In healthcare, they're oriented towards the next drug with a 20-year patent and a markup of 1,000 times production cost. The system works very powerfully, by the way, to put a lot of money into innovation, but it directs the innovation towards monetizable outcomes, whereas what we need are two other kinds of innovations. One is innovations for poor people to help them have better healthcare, housing, nutrition, and so forth. A second is education. This is the knowledge revolution, after all.

TECHONOMY: *So how would you assess the role of business so far in embracing the SDGs?*
SACHS: Parts of business are totally on the case, like the renewable energy business—the future for them is sustainable development. Or some in the food sector see that their supply chain is going to disappear if we don't get climate change under

control. Then there is the part of the business community for whom this agenda really is a harsh message. I would put the coal, oil, and gas industries in that list. The message for them is, "You're going to have to close. We don't need you. You're dangerous." Of course, they're fighting back. They've got a lot of wealth. They're trying to deny what is obvious to almost everybody, that the climate is changing dangerously and rapidly. They're liars and they're creeps.

TECHONOMY: [LAUGHS] *I love how you mince your words...But we also have things happening like the statement by BlackRock CEO Laurence Fink, who said business leaders must make societal progress and responsibility central to their business plans. He's the head of the world's largest investment management firm. You must have been heartened by that.*
SACHS: Absolutely heartened. Wonderful. And real, by the way. And the influence of that approach is already percolating through a lot of the pension funds and insurance industries. But then another part of industry is just relentlessly bottom-line oriented. It has blinders to any social issue. And that's a lot of Wall Street. That's the hedge fund industry. They want to make money, and don't care if it's from jacking up prices of drugs or a new pipeline or whatever. And unfortunately, to my shock, a lot of the tech industry has become that. I wouldn't have thought that Larry Page and Sergey Brin would be just relentlessly bottom line, thinking only of who they can sell more ads to. Facebook—some kid in a dorm getting the Harvard class online, but now his highest aim in life in the end turns out to be, again, selling personal data? They've got the tools to change the world for the good, but right now they're basically trying to figure out how to sell more ads. And that is a profound disappointment.

TECHONOMY: *Mark Zuckerberg himself has talked about the company as the hub for global community in highly aspirational, idealistic ways. And you also talk a lot about the importance of human well-being, which he, too, raises.*
SACHS: I haven't seen it from them. What I've seen is, first, an opaque business model. We don't really know what they're doing. We don't know how our identities, our online data are actually being used.

I went to Facebook at one point and said, "You're connecting so many people, why don't you get into the SDGs, SDG 4 for example, on education?" "Well, that's not our priority." I said: "I don't care if it's your priority. It's the world's priority and you have a contribution to make." "Well, that's not our priority." Okay, I'm not impressed by that.

TECHONOMY: *So you don't really buy "doing well by doing good"?*
SACHS: I think it's nonsense for half the challenges we face. It is a convenient, ignorant, nonreflective, non-experienced vision. The mentality in this country has been formed by that lousy novelist and pseudo-philosopher Ayn Rand. People think there's a business case for everything. But that's leading us farther and farther from sustainable development.

We used to have a government that could regulate business. Now we have business that regulates government. Mitch McConnell is a weak person. He's not an agent looking for the public good. He really is just a pawn in a corporate game. And then we've got 2,200 billionaires now worldwide, many in the tech sector. They've got $9.1 trillion of wealth. Come on. They alone could fund the solution to the world's problems. A few are trying. Bill Gates, I give him credit. Most of the rest, no.

TECHONOMY: *But companies exist to make money. And you're saying you need to harness them and harness the technologies they create. How do we make the leap to real social engagement and human action?*
SACHS: You know, one of the things you learn in economics—it's actually the core of serious study—is what things can be left to the market and what things cannot be solved by the market because they are market failures. It could be climate change; it could be preserving biodiversity; it could be disease control. I know from my career-long work on poverty, if we just go with market forces, millions of people will die of extreme poverty. And businesses will be doing just the right thing, quote-unquote. From the business perspective, these people have no money so what are you going to do? And this is technically not a market failure. It's markets working. It's a human failure. It's a moral failure. All those people could be saved, and they could be put on a path of a decent life, but not by businesses alone.

TECHONOMY: *Should government play a bigger role, whether you call it regulation or not, in essentially forcing companies to take action?*
SACHS: Of course. For example, will consumers go for electric vehicles? I find that a ridiculous question, because the answer is: We can't go on with internal combustion engine vehicles. We need electric vehicles, or we need zero-emission vehicles. Government should say after 2025, or some other date, you can't sell internal combustion engines. In the U.S., all this got completely twisted out of shape. We've lost recognition of the most basic fact—that markets can't solve all problems.

TECHONOMY: *In your book* The Age of Sustainable Development, *you talk about interconnectivity being central to the logic of the age of sustainable development. Why is that so?*
SACHS: We are 7.6 billion people in the world now. That's a very crowded world. It's increased tenfold since the start of the Industrial Revolution. But a billion people don't have reliable access to safe water, a billion people don't have basic electrification that is at all reliable. To make 7.6 billion people live viably on this planet, we need systems— for

ON UNIVERSAL BASIC INCOME

The concept is right. It's more involved than simply—we're going to hand everyone some cash. But the basic idea that we're rich enough to ensure dignity and material life for everybody on the planet is correct. It is absolutely correct that AI and related breakthroughs could lead to a massive loss of market earnings for a significant part of the population. I've studied that as a macroeconomist. I'm going to be writing more about it. Robotics and AI absolutely will impoverish a lot of people in terms of their market earnings.

But your disposable income is not equal to your market earnings. Your disposable income is your market earnings plus the transfers you receive, minus your taxes. To use fiscal transfers funded by taxation to ensure everybody a basic improving condition of life is absolutely correct. Where I disagree is that rather than handing a check over, which is kind of the libertarians' thrill, I would like a properly funded healthcare system, a properly funded education system, and investments in modern infrastructure. In other words, I wouldn't do it just via cash transfer. I'd say: Everybody can have a quality of life because the following array of services are universally available. I would also say that every person is entitled to a certain number of vacation days and certain parental leave and other basic labor standards.

"I WENT TO FACEBOOK AND SAID, 'YOU'RE CONNECTING SO MANY PEOPLE, WHY DON'T YOU GET INTO SDG 4, FOR EXAMPLE, ON EDUCATION?' THEY SAID 'WELL, THAT'S NOT OUR PRIORITY.'"

transport, energy, health, water, food supply. And the great gift of the information revolution is we have the means to do that.

TECHONOMY: *What priority do you give to getting everybody online?*
SACHS: It's absolutely central. It is double edged and controversial though. I'll give you my favorite current conundrum—India's Aadhaar system, the online biometric identification system. It's a fundamental breakthrough. And yet it's under attack, pretty heatedly right now, by civil society in India. Now, from my point of view, India doesn't stand a chance without something like Aadhaar. Millions of people will not have access to services if government cannot be made to work through a mechanism like this. So these technologies are pivotal, brilliant. On the other hand, there really are challenges of privacy, surveillance, systems biases, built-in discrimination, and all the other areas that are causing angst and controversy in the connectivity and AI community right now. But let's solve those problems. These systems are vital to make the world work properly.

TECHONOMY: *What about just the basic notion of internet connectivity for everyone, do you embrace that as a goal?*
SACHS: I do, but with one big caveat. When I went to Facebook and was kind of rebuffed, they said, "Our interest is connectivity." I said, "Yeah, but the content matters a lot." Just being connected is not going to make your online curriculum; it's not going to solve the problems of schools or healthcare. Nandan Nilekani [who spearheaded the creation of Aadhaar and previously was CEO of Infosys] has a concept called societal platforms. It's the idea that you need a system that sits on the internet, sits on connectivity, in order to make health or education or digital payments, finance, or e-government work. Investments should be made so the connectivity actually means something. Without the content directed at the needs of poor people and the needs of the environment and other public goods, we're not getting to where we need to go. You need a framework. You need systems and content, not just connectivity.

TECHONOMY: *But the very gripe against Facebook on supposed net neutrality grounds in India, when they launched their Internet.org Free Basics program there, could be seen as contradictory to what you're saying. Facebook would say, "We were giving them stuff that's good for them."*
SACHS: I believe in politics to serve the public good. If Facebook wanted to do something good for India, then it should have dealt with the government and said, "We're at your disposal to help support a national plan for online education or online curriculum or online healthcare. But you're in charge, not us." But arrogantly, they didn't do it that way. They said, "We're doing it. We're Facebook." That's the mistake. The psychology in Silicon Valley is that all politics is retrograde—"We don't have to pay taxes, we don't have to listen to government." And the result is this kind of libertarian naiveté that ends up not solving the problems of those in need.

TECHONOMY: *How could we build what you have called "supranational" institutions that could, among other things, impose some restraints on these companies and help enforce the systemic thinking you advocate? Do we have the institutions we need?*
SACHS: The one line I hate hearing in development is 'We have to do it through existing organizations.' Every breakthrough in the world is with startups, with new organizations. I helped get one going 17 years ago that I'm very proud of, called The Global Fund to Fight AIDS, Tuberculosis and Malaria. I said, 'Don't go to the World Bank; they can't do this.' Now we need new organizations for education, new organizations for the SDGs. But I face two kinds of challenges. One is that the incumbents, even the governments, the U.N. agencies, say "No, no, no, no, we're handling it," which they're not. And then the other argument back to me is, "Well, why set up something new when it has no resources? No one wants to fund that kind of thing." And that's where I start looking at the 2,000 billionaires or how rich the world is, if we only cared to put the resources that we need into it.

We should have a global fund for education. Ghana recently said, "We want universal secondary education and we know online is critical for that. We want to develop a program. We need help." There should be a fund that provides the help.

TECHONOMY: *You talk about models in human capital for sanity and kindness. Zuckerberg, as we mentioned, thinks he's helping. You don't agree. Could technology help?*
SACHS: A lot of psychologists are telling us that screen time is really adverse for mental well-being.

ON TECH FOR ENVIRONMENTALISM AND SUSTAINABLE FOOD PRODUCTION

SACHS: Tech will be decisive for energy production as well as environmental remediation. We will have smart systems, smart grids, renewable energy, and smart devices monitoring everywhere. There's a Chinese government initiative called Global Energy Interconnection Development and Cooperation to build a global grid of renewable energy both for long-distance transmission and for the balancing you need in an intermittent energy system. Tech is going to be fundamental.
TECHONOMY: *Are you optimistic we could make major leaps in sustainable food systems because of technology? Will things like automated indoor agriculture be important?*
SACHS: I believe, broadly speaking, food should be grown outside, in rural areas, sustainably. I don't think, by the way, that the transport of food is as big a deal as it's made out to be. I'm very happy that the coffee I'm drinking has come from Colombia and Guatemala and Ethiopia.

Tech has a big role to play in monitoring deforestation, in enforcing sustainable practices, in tracking soybeans so that they're not coming from deforested areas of the Amazon, in stopping illegal fishing on the high seas, in monitoring ecosystems, in monitoring soil moisture so that we're not wasting water in irrigation, in microfertilization. I also believe that in the future there will be very few jobs in farming. The main purpose of agriculture should be healthful, nutritious diet, sustainably produced, not jobs in farming. In this sense, I'm a big fan of tech.

Sachs is a passionate exponent of the many ways governments, business and society need to up their game to help achieve the goals by 2030.

Where I see tech playing a different role is giving us more leisure time. I'm persuaded in general that machines are good for us. People don't like backbreaking labor. I've tried it. I don't like it. Most people who are suffering it right now want to get out. I don't think there should be miners in the future, because it's dangerous, dirty work. Being on an assembly line is no great shakes, so that's better for a robot than a person. It raises the question that everybody asks every day now, "Well, what about us? What will we do?" And the answer that was classically given by Keynes 90 years ago was, "We'll have more leisure time." And I find that still a persuasive answer.

TECHONOMY: *Do you feel that in the end we're facing a spiritual crisis?*
SACHS: Well, we are facing definitely a moral crisis because we're in an absolutely insane situation where we have everything going for us and we're still at the edge of self-destruction. We've become so rich, so capable, so knowledgeable, so clever scientifically, yet we can't handle the success. America could not be richer; we couldn't hope for more, and yet the country is falling apart in many ways. And that's a bizarre reality that we haven't been able to come to grips with. We're so frenzied and focused on short-term profits that we can't even take a deep breath and get a grip on our own destructive activities. So that's a moral crisis. Aristotle said that the highest human activity was contemplation, to have the time to be able to think, to reason about the human good. That's what we're missing right now. ■

ON E-GOVERNANCE AND DIRECT DEMOCRACY

SACHS: I really like e-governance. I like the idea of legislation being wiki drafted. I'm not sure we need a congress once this gets developed, because I actually think public participation over time could replace the need for representation.
TECHONOMY: *You mean direct democracy?*
SACHS: I think it could happen. And one reason I'm interested in it is that I don't believe our representatives represent us right now. They represent lobbies. They represent vested interests. And I would like them to represent the American people, who are not represented in most decisions right now. There are a lot of issues to get there, I'm fully aware. But I'd like to see automatic online registration, online voting, and online deliberation through group drafting of documents.

1.

2.

3.

4.

5.

6.

7.

1. **BETH COMSTOCK**
GE

2. **BENJAMIN BRATTON**
University of California, San Diego

3. **PENNY PRITZKER**
PSP Partners

4. **AGNES BINAGWAHO**
University of Global Health Equity

5. **MARK ANDERSON**
Strategic News Service

6. **MARK BONCHEK**
Shift Thinking

7. **MARC CARREL-BILLIARD**
Accenture

8. **MARK MAHANEY**
RBC Capital Markets

9. **REBECCA MACKINNON**
Ranking Digital Rights at New America

8.

9.

It's hard to pick just one goal that's most important—the U.N. SDGs range across poverty, health, climate action, and economic growth, even well-being. Of course, they're all important. But we asked speakers at Techonomy 2017 to select one anyway. As you see here, quite a few went ahead and selected two. But whether you're a security analyst or a human rights activist (you can find both at lower right), it's not hard to see how much change we need to bring to the world. At a time when it often seems governments are stymied in achieving progress, it's heartening that individuals still care so much.

Which SDG Matters Most to You?

1.

2.

3.

4.

6.

5.

9.

7.

8.

10.

11.

1. **DENISE MORRISON**
Campbell Soup Company

2. **XIAONING QI**
C-SKY Microsystems

3. **ALISON TAYLOR**
BSR

4. **STEVE CARLIN**
SoftBank Robotics

5. **ANNE CHURCHLAND**
Cold Spring Harbor Laboratory

6. **SHEILA MARCELO**
Care.com

PHOTOS BY EMMA MCINTYRE FOR GETTY IMAGES

12.

15.

16.

18.

19.

13.

14.

17.

7. **MARK BERTOLINI**
Aetna

8. **JUSTIN SANCHEZ**
DARPA

9. **MICHAEL MARKS**
Katerra

10. **J. GALEN BUCKWALTER**
PsyML

11. **JEFF GOODELL**
Rolling Stone

12. **INA FRIED**
Axios

13. **PETER PETRE**
Author

14. **DIANA FARRELL**
JPMorgan Chase Institute

15. **CHRIS URMSON**
Aurora

16. **DANAH BOYD**
Data & Society

17. **JEFFREY WELSER**
IBM

18. **MARY LOU JEPSEN**
Openwater

19. **BETSY COOPER**
UC Berkeley Center for Long-Term Cybersecurity

1.

4.

5.

7.

8.

2.

3.

6.

9.

1. **LINCOLN WOOD**
Turner Construction Company

2. **DAVE MORGAN**
Simulmedia

3. **TESSA LAU**
Savioke

4. **JOYCE VANCE**
The University of Alabama

5. **TRACY YOUNG**
PlanGrid

6. **MELISSA CEFKIN**
Nissan

7. **TONY PARISI**
Unity Technologies

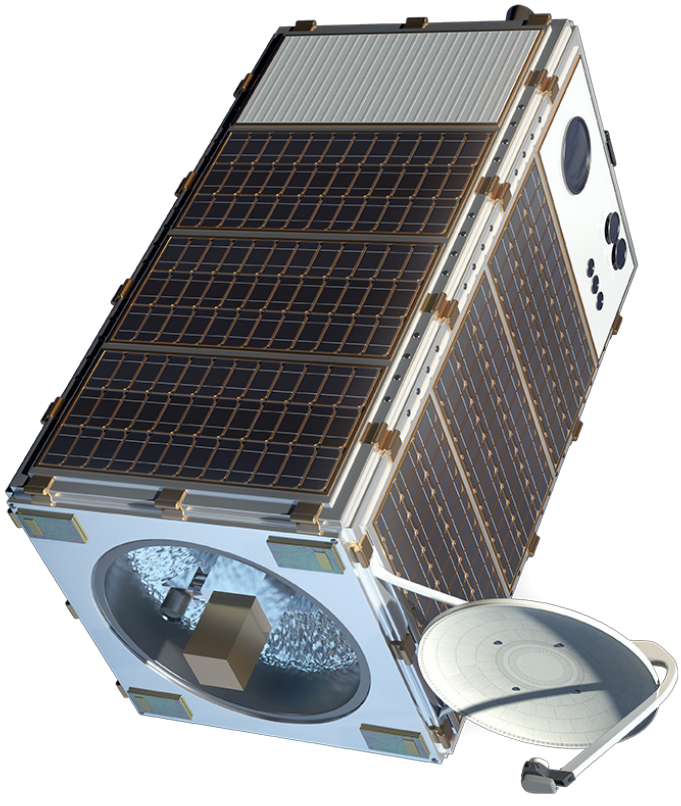
8. **JOHN CHAMBERS**
Cisco

9. **MARIO SCHLOSSER**
Oscar

How Tech is Driving Environmentalism's Fourth Wave

Satellites that track greenhouse gases and deforestation. Blockchain tools to manage solar grids. Even facial recognition for fish. Tech transforms how we solve environmental problems.

By Eric Pooley



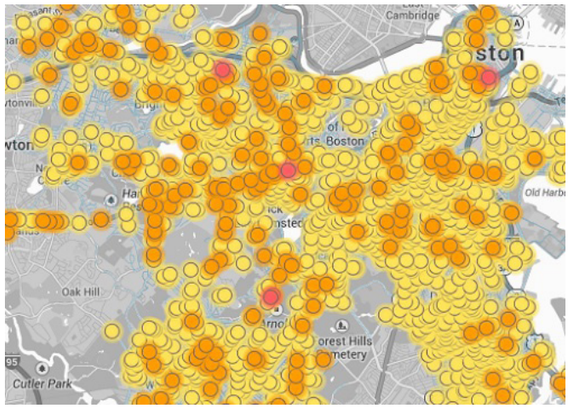
The Environmental Defense Fund is innovating by launching its own satellite called MethaneSAT to measure one of the most potent greenhouse gases contributing to climate change. It will monitor methane emissions from the oil and gas industry and other sources anywhere on Earth, enabling more focused action to reduce them.

SATELLITE RENDERING BY EDF.

In the past several years, people working in corporate sustainability and environmental policy have begun to feel a new wind at their back—one I believe will prove more powerful and long-lasting than today's political headwinds. Recent technological breakthroughs are poised to transform the way we solve environmental problems. They include cheaper and more precise pollution sensors and satellite instruments, more powerful data analytics, and the game-changing innovations of blockchain and machine learning. This megatrend is already providing a broad array of people and groups with powerful ways to drive progress. It helps create new ways for environmentalists to partner with corporations. And it gives NGOs like Environmental Defense Fund, where I work, a set of capabilities once reserved for governments. Consider these recent examples:

EDF scientists partnered with researchers from more than 40 academic institutions and energy companies to use a new generation of sensors—carried by drones, planes, helicopters and Google Street View cars—to measure methane emissions across the U.S. oil-and-gas supply chain. Results from the five-year project, published in 35 peer-reviewed papers, demonstrated that emissions of this potent greenhouse gas were significantly higher than the EPA had estimated. The work led to stronger federal methane emissions standards.

Because methane is a global problem, we're working with the Netherlands Institute for Space Research to derive global methane emissions data from the European Space Agency's Sentinel-5P satellite, sent into orbit last year. But we need better data than even it can provide, so we're working with scientific partners to launch a compact satellite of our own, called MethaneSAT. It



Google and EDF partnered to map America's cities for methane leaks from pipes, using sensors on Google Street View cars. ***Boston****, an old city with old pipes, shows extensive leakage. The greenhouse gas is roughly ten times worse than CO_2 in causing climate change. It also harms people at ground level.*

will let us map methane pollution with exacting precision so oil and gas companies, governments, and citizens can all see it, and act on it. We have an aggressive target of three years to launch.

Satellites also track deforestation. The World Resources Institute is using one to monitor forest loss in the Amazon, displaying data on a web site that can help alert local authorities and the public to fires.

The Nature Conservancy is working to help fishermen in Indonesia track their catch using facial recognition technology for fish. It identifies not an individual fish, of course, but their species. Since it's hard to stop overfishing when we don't know what's being caught where, the group is designing a smartphone app that will detect species from photos, enabling fast, accurate sorting and reporting of fish at sea or in processing plants.

Retailers, consumer brands and tech companies are working together to use the digital ledgers known as blockchain to improve traceability and accountability across supply chains—from verifying the sustainability claims of tuna supply chains in Indonesia to managing energy trading across a solar-fed microgrid in Brooklyn.

As corn growers rapidly invest in precision agricultural tools, they are not only increasing farm yields but measuring fertilizer application with pinpoint accuracy. These tools enabled Smithfield Foods, the world's largest pork producer, to commit to reducing fertilizer use on the farms that supply it with feed. Smithfield buys 2 million tons of corn each year and has a goal of cutting supply-chain greenhouse gas emissions 25 percent by 2025. The company is the first in the industry to set such a target.

EDF put high-resolution sensors on Google Street View cars to map air pollution threats in West Oakland, CA on a block-by-block basis. Local citizens are using the data to help make the case for emissions reductions under California's new air quality law. We also challenged entrepreneurs to develop cost-effective, stationary, continuous methane monitors, and they responded with sensor and laser technologies, now being piloted in oil and gas facilities owned by Statoil, PG&E and Shell.

We call all of this the Fourth Wave of environmentalism. The First Wave started at the turn of the last century, with national parks and forests to preserve America's natural heritage. The Second Wave broadened the focus to protect people and nature from pollution, starting with Rachel Carson in the 1960s. It led to the creation of the Environmental Protection Agency and the passage of the Clean Air and Clean Water Acts. During this period, EDF was launched in 1967 by three scientists who soon succeeded in banning domestic use of DDT, which is widely credited with saving our populations of bald eagle, osprey, and other great birds of prey.

Two decades later, EDF helped usher in a Third Wave, which focused not only on addressing the immediate causes of an unhealthy environment, but on solving underlying problems through corporate partnerships and market-based policies.

Now, in this Fourth Wave, technological innovations are supercharging those approaches by letting us measure pollution and understand its impacts—making the invisible not only visible but actionable. That can create both greater accountability for environmental laggards and greater rewards for environmental stewards. By harnessing the power of transparency and precision measurement, these tools can help improve operations across corporate supply chains, build trust in voluntary corporate actions, and ensure that we use the least intrusive rules to get the job done.

The Fourth Wave enables broad coalitions. For example, more than four hundred companies in Walmart's supply chain are contributing to its ambitious effort to reduce a billion tons of annual greenhouse gas emissions—more than the total emissions of Germany.

By driving down the cost of acquiring information, the Fourth Wave levels the playing field. No longer can government alone reveal—or choose to conceal—serious environmental problems. Sensors, big data, and instant communications put that power in the hands of the people.

At this moment, when the federal government is stepping away from its responsibility to protect public health and the environment, advocates are putting these tools to work and channeling them for good.

As a result, the Fourth Wave can help restore public trust in the power of scientific evidence. These tools personalize information in a way that spurs action, as when local groups identify and fight pollution hotspots in their own backyards. And they can help us meet the challenge of the U.N.'s Sustainable Development Goals—for climate action, air and water pollution, species survival, and urgently needed advances in public health.

We're trying to take all of our knowledge and expertise and enable people to take care of themselves better.

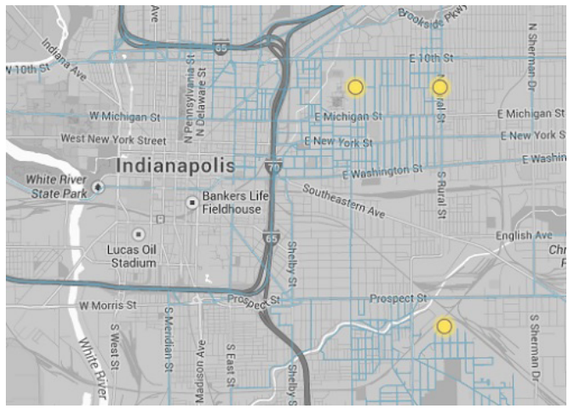
As former New York City mayor Michael Bloomberg likes to say, you can't manage what you don't measure. Yet measurement on its own does not ensure proper management. It remains to be seen whether Fourth Wave tools will help us stabilize our environment or merely allow us to monitor its steady deterioration in exquisite detail. The outcome is up to us.

Our challenge is clear: to use Fourth Wave tools not only to document damage, but to drive action. Business leaders have a role to play, and increasingly, they know it. A recent EDF survey of 500 business and technology executives found that 72 percent are seeing greater alignment between environmental goals and business objectives. The survey also showed that the leaders see technological advancements as the key driver of this alignment.

In the industrial age, environmentalists and forward-thinking business people used the corporate and regulatory levers of their time to meet environmental challenges. Now we must embrace the flexible, networked methods of a global digital era to build partnerships and devise policies that solve today's complex problems. Cooperative action between companies, citizens, and civil society will be the glue that links Fourth Wave tools to the progress we so urgently need.

ERIC POOLEY *is senior vice president for strategy and communications at Environmental Defense Fund. He was formerly managing editor of* Fortune.

IMAGES COURTESY OF EDF



Indianapolis *is a much newer city than Boston, whose methane leaks are shown on the facing page. The sensors on Google Street View cars found far fewer leaks in the Indiana city.*

"We're a Science and Technology Company"

A Conversation with Johnson & Johnson's Sandi Peterson

SANDI PETERSON IS PLAYING A transformational role at Johnson & Johnson—a company with one of the world's 10 largest market capitalizations and the largest company in healthcare. She oversees a broad portfolio, including the company's global supply chain, technology, and operating infrastructure, as well as consumer products and medical device businesses that generate approximately $40 billion in revenue. That's more than half of J&J's total revenue. She also leads J&J's efforts to transform healthcare using technology and design thinking—including partnering with the world's leading technology companies. Sandi spoke with Techonomy's David Kirkpatrick onstage at the 2018 CES conference in Las Vegas.

Johnson & Johnson's Sandi Peterson sat with Techonomy's David Kirkpatrick at CES in January to talk about how the company is using technology to keep more people healthy, globally.

PETERSON: J&J has been around for about 135 years. We actually started out solving one of the biggest problems in surgery, which is that people were dying from infections. We've had to reinvent ourselves multiple times. But what most people don't know is that we are one of the largest, most successful pharmaceutical companies in the world. We are one of the largest, most broad-based medical device companies in the world—we're in every operating room anywhere around the globe. And we're a very large, successful consumer products company. We have these three very large, connected businesses. We're using technology to fundamentally change how people are cared for around the world. We are a science and technology company.

KIRKPATRICK: *Talk a little bit about how technology's digital tools span across your businesses.*

PETERSON: It's not about widgets, apps, and gadgets. We've made massive breakthroughs in the last ten years in oncology, immunology, infectious diseases, and the microbiome. But we would not be able to get those breakthroughs without computational power, visual image processing, and machine learning. Our R&D organizations include biologists, statisticians, scientists, physicians, and tons of deep experts in technology.

We are completely reimagining what a surgery looks like. And there are 7.5 billion people in the world, but 5.5 billion of them have no access to safe surgical care. We now have a very different way of thinking about training surgeons. We have ways of optimizing and improving the process of an OR like in racetracks. It's a highly automated, optimized pit process where steps are tracked and managed. We also help people before they show up for surgery be better prepared. On the back end of the process we help as well. When you left a surgical procedure in the old days, you were groggy, they gave you a couple pieces of paper, and said good luck and call if you have a problem. We now are able to track and monitor people after surgery and make sure they are doing the things that they need to get well quickly. And last, but not least, we use 3-D printing. We have lots of relationships with the key 3-D printers. We can now print products—whether they're bespoke or in smaller lots—for implants, for instruments, for a variety of different things in the surgical suite. It's reimagining how surgeries happen.

KIRKPATRICK: *The 3-D printing could be especially important in extending the healthcare capabilities to literally the whole planet. You can print state-of-the-art tools in the most remote places of the world?*
PETERSON: Yeah, and for that exact human being. We're all very different. And then obviously consumers are changing how they engage with brands and products. For example, we are democratizing dermatology. We're taking light therapy out of the dermatologist's office and putting it in the hands of consumers. We are also giving skin diagnostics to consumers, so they can actually track and manage things—whether it's acne, pores, or even the early detection of melanoma.

KIRKPATRICK: *Much of what you're doing is changing the relationship between the patient or the consumer and the healthcare professional.*

PETERSON: We're trying to take all of our knowledge and expertise and enable people to take care of themselves better.

KIRKPATRICK: *It seems like we are on the threshold of a new level of understanding of the human being.*
PETERSON: That's a pretty bold statement, but it's the right way to think about it. We've also learned that you need to understand what motivates a person. It's not just the chemistry in your body that impacts your health. Our mental and emotional state, that also has an impact. We take a holistic view of the person. We also do not believe you should cut out the healthcare professional. We keep them in the mix.

KIRKPATRICK: *Adhering to your medications is something people aren't very good at.*
PETERSON: Why don't they do it? There's things about that person that become a barrier to them doing it. If you can understand what's going on with a person and what matters to them and engage with them in a different way, that makes the difference. Where lots of tech companies have made mistakes is the classic: "Here's the answer. Let me just give you the information."

KIRKPATRICK: *There is not a big tech company that does not believe it can have a giant impact in healthcare. How do you think of J&J's relationship to those companies? J&J's market cap is almost $400 billion dollars. It's pretty much the only company in the world that is valued like Facebook, Google, Amazon, and Microsoft.*
PETERSON: Each of them has specific technologies that are valuable and helpful to us. We have relationships with all the big guys, with mid-market tech companies, and we acquire tech companies when it makes sense.

KIRKPATRICK: *You've been hiring people from Silicon Valley.*
PETERSON: We have a lot of people on our team from all of the big tech players.

KIRKPATRICK: *You've invested in Grail—a fascinating company that has raised over $900 million.*
PETERSON: They think they can detect cancers before you ever see malignant cells. Grail uses massive computational power and visual image processing and machine learning. It's a moonshot. We don't know if it's going to work. But if it does, it will change the trajectory of cancer.

KIRKPATRICK: *I just picked up a book on ethical business the other day. The first company it mentions is Johnson & Johnson, because of your credo.*
PETERSON: The Credo is about 75 years old, it was written by the former head of the company—one of the Johnson brothers—before the company went public. It was written before anybody talked about social responsibility or having a mission or a purpose. It's really our behavior code. It is not a piece of paper on the wall. It says our first responsibility is to the mothers, the fathers, the children, the doctors, and the nurses to do the right thing. It talks about our responsibility for our workers, the communities in which we operate in, and the environment. It talks about how we treat our partners, our suppliers, our vendors.

And oh, by the way, if we do all of those things and improve people's health, the shareholder will get an appropriate return. ■

We would not be able to get breakthroughs without computational power, visual image processing, and machine learning.

PHOTO: COURTESY OF JOHNSON & JOHNSON

Welcome to Precision Medicine (If You're White)

Genomics helps tailor treatment for growing numbers of patients. But it works best for white people, who often already populate databases. How can it become valuable for everyone?

By **Meredith Salisbury** Illustration by **David Plunkert**

Since the start of the Human Genome Project in 1990, we've been hearing that genome-fueled discoveries would make it possible to tailor medical treatment to each person, delivering more clinical benefit with fewer side effects. What we haven't heard is that, at least for now, those benefits are going disproportionately to people of European descent.

Some scientists have worried for years that the genome databases underlying precision medicine are primarily populated with data from white folks, with people of other ethnicities seriously underrepresented. This imbalance, they feared, could lead to serious disparities in healthcare, which might compound inequalities already contributing to societal tensions now. But the problem has been little noted by the public and press.

Doctors say those disparities are already here. From genetic testing to genome sequencing, people whose ancestors came from places other than northern or western Europe are getting less accurate results, more incorrect calls, and generally less useful information than their white counterparts. The problem is not dissimilar to how bias has developed in various forms of predictive databases. Those used in facial recognition, for example, often don't work well for people with dark skin.

"I find it frustrating to have to tell patients that because of their race or ethnicity they have a higher chance of getting results that may be confusing," says Allison Kurian, a doctor at Stanford University Medical Center. In a recent study of 1,500 patients who got genetic testing to learn their hereditary risk of cancer, she found that non-white patients were more likely to get inconclusive results.

This is, of course, not the first time that medicine has favored white people. Robert Winn, director of the University of Illinois Cancer Center, remembers when Lipitor was introduced to treat high cholesterol. "It was a good drug, except if you happened to be Asian," he says. It turned out the dose was too high for that particular population, giving patients of Asian descent all the side effects without any of the clinical benefit. Just like Lipitor, precision medicine will work for all populations only when we have a much deeper understanding of what makes each group unique.

Ethnicity-specific data is important for many facets of healthcare; a simple example comes from those growth charts pediatricians use to determine how a child's height and weight compare with other kids that age. For a kid from Central America, where heights are typically shorter, "you might get overly worried if you plot the height...onto a standard North American growth chart," says Isaac Kohane, a pediatrics professor at Harvard University.

The precision medicine predicament is similar. "If you study genomics and are trying to determine what's normal and what's not normal based on how often you see a genetic variant in the population, that works well except in the cases where the individuals you're assessing come from different populations than the original studies were done on," Kohane adds.

Genetic variants aren't equally distributed around the world. Their patterns reflect the complexities of human evolution and migration. When a group of humans first left Africa tens of thousands of years ago, they took with them only a tiny slice of the genetic variation found in our species at the time. A much broader range of genetic variation remained in Africa.

Today, people of African descent have far more genetic diversity than the descendants of the small groups that migrated to Europe or Asia. As distinct populations settled in different places, they developed more variants specific to those groups. That's why scientists are pushing to sequence genomes from as many ethnicities as possible. Any individual's results need to be compared to the relevant collection of genomic data.

The imbalance we face today was an unintended byproduct of the structure of science. Funding for large genome-sequencing studies has been highest in countries where white people make up the majority. Even in a more diverse country like the United States, minority populations often lack access to top academic medical centers, which attract the bulk of research funding.

Then there's the challenge of matching cases and controls, the gold standard for a well-designed scientific study. If your standard recruitment protocols already include more Caucasian patients, researchers have to match them with even more Caucasian controls. Sometimes despite the best intentions, it's common to wind up with studies filled with white people—and results that are most relevant to other white people.

Now that the negative impact of this situation is showing up in doctors' offices around the world, scientists are working to level the playing field. At the University of Illinois, Winn is a key recruiter for the All of Us Research Program, an NIH-funded effort promoted by former President Barack Obama to sequence 1 million Americans. The program aims to build up genomic data to reflect the country's great diversity. Winn's group has just started, but already more than half of patients enrolled in the program are African-American.

Other countries, particularly in Asia, have launched similar projects to capture their own genetic diversity. The projects range from one called GenomeAsia 100K, an effort to sequence 100,000 people of Asian descent, to more targeted initiatives seeking to generate data on very specific populations around the world. The information produced will allow scientists and doctors to more accurately interpret genetic results from people in these ethnic groups.

Kohane at Harvard is hopeful that such efforts will avert major healthcare disparities. "I think it's literally only a matter of a year or two" before there are enough genomes sequenced to at least lay the groundwork for precision medicine that works for other ethnicities, he says. In the meantime, though, he urges patients not of European descent to question genetic test results by asking their doctors whether the information was gleaned from a relevant population.

Other experts are outright ashamed that the situation could have come to this. Says Nancy Cox, a professor of genetic medicine at Vanderbilt University Medical Center, "Creating health disparities because we have not adequately even surveyed [the relevant population] is not something that scientists should countenance."

MEREDITH SALISBURY *is a longtime genomics journalist and a communications consultant in life sciences.*

"I've gotten more benefit from attending Techonomy than from any other conference in recent years." JOHN CHAMBERS, *Former CEO and Chairman, Cisco*

The mood at the Techonomy retreat is relaxed, and last year the ideas and networking flowed freely indoors and out (above and left). The hotel (top) may be the best situated in America.

Next Stop: Half Moon Bay (November 11-13)

IF YOU FOUND THIS ISSUE OF TECHONOMY MAGAZINE PROVOCATIVE, you should join us at our 8th annual Techonomy retreat this November 11-13, at The Ritz-Carlton in Half Moon Bay, CA. The conversations are intense on and off the stage. Our unparalleled community of business executives, tech entrepreneurs, investors, journalists, and policy leaders comes together for a two-day idea fest on the coast of California, about 45 minutes from both San Francisco's Market Street and University Avenue in Palo Alto. If you have ideas for topics we should address, people we should invite, or just want additional information, please be in touch. Tech-driven change waits for no one!

PHOTOS: COURTESY OF THE RITZ-CARLTON, HALF MOON BAY AND PAUL SAKUMA PHOTOGRAPHY

PHILIPS

Healthcare

No silos. No limits.

At Philips, we help create seamless solutions that connect data, technology and people. Because today health knows no bounds, and neither should healthcare.

There's always a way to make life better.

See how we're removing the limits of care at **philips.com/nobounds**

innovation + you

TECHONOMY 2018
PARTNERS INCLUDE:

ERICSSON

Johnson & Johnson

PHILIPS

TECHONOMY.COM