

# TECHONOMY

SUMMER 2017



## The Convergence of Man and Machine

How business and society are being transformed

# We've never lived in a time so fraught with uncertainty. New innovations sprout from every corner, unexpected and unbidden. Connectedness has changed everything.

We're constantly distracted. Our lives, moment to moment, are interrupted with information, energized by entertainment, and enlivened but also complicated by the human realities that online community thrusts before our eyes and ears.



PAUL SAKUMA PHOTOGRAPHY

*David Kirkpatrick with Facebook's Mark Zuckerberg at Techonomy 2016.*

It's hard to make the right decisions in this time of tech-driven tumult, whether you're a citizen, a worker, or any kind of leader. An eruption of opinion changes the landscape in a second, whether from a dissatisfied customer or the president of the United States. Companies and entire countries are turned upside down.

Even more complicated is the fact that much of the change is wonderful. Objective measures of many sorts of economic and social welfare are up and to the right, despite our sense of precariousness and very real dangers like climate change and geopolitical conflict.

But our modern situation is better understood when you accept the scope of technology's impact. Techonomy exists to surface those discussions, acknowledge our collective uncertainty, and drive dialogue to help us make sense of it.

Soon the landscape will become even more confusing, and not just because virtual and augmented reality will deepen the verisimilitude of digital interactions. Very shortly,

like it or not, we will almost certainly enter an era of brain-to-brain digital communication. You think you are stimulated and confused now!

But herein we remain grounded, explaining new ways of working with customers and how big companies are accepting and embracing the potency of startups. We declare our confidence that the liberal arts still serve as a lodestar for society, despite automation and the frightening future of work. We devote a huge chunk of the magazine to the fascinating and promising landscape of technology in health. Genomics may change healthcare as much as connectedness has changed communication.

All this accompanies our conferences—Techonomy Health and Techonomy NYC and our flagship two-day Techonomy 2017 this November 5th through 7th in Half Moon Bay, California. This is where our efforts are most distilled.

So here's another sign of how little is fixed or certain in this age of technologized transformation. For all our own certitude about the importance of the digital, Techonomy's most central products are resolutely non-virtual: conferences and this magazine. Despite all the richness of our own website, we continually see our print effort having unique impact. We hope you find it useful.

**DAVID KIRKPATRICK, Chief Techonomist**

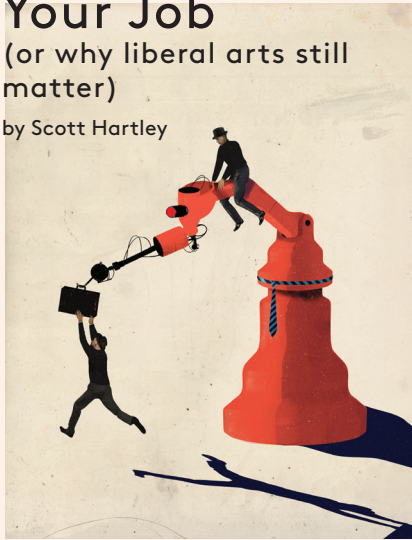


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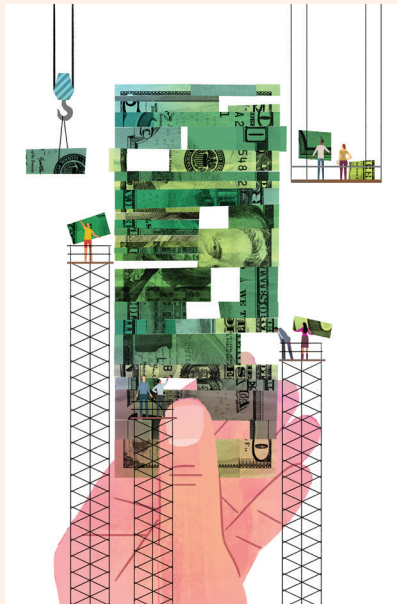
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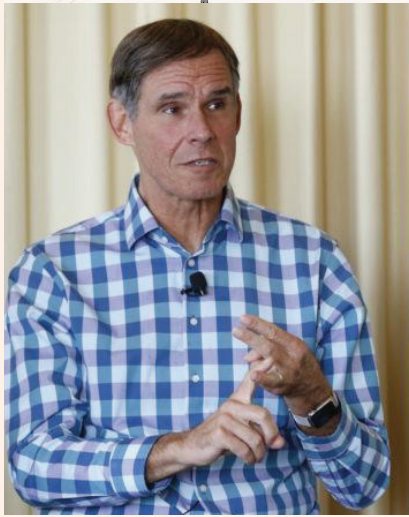
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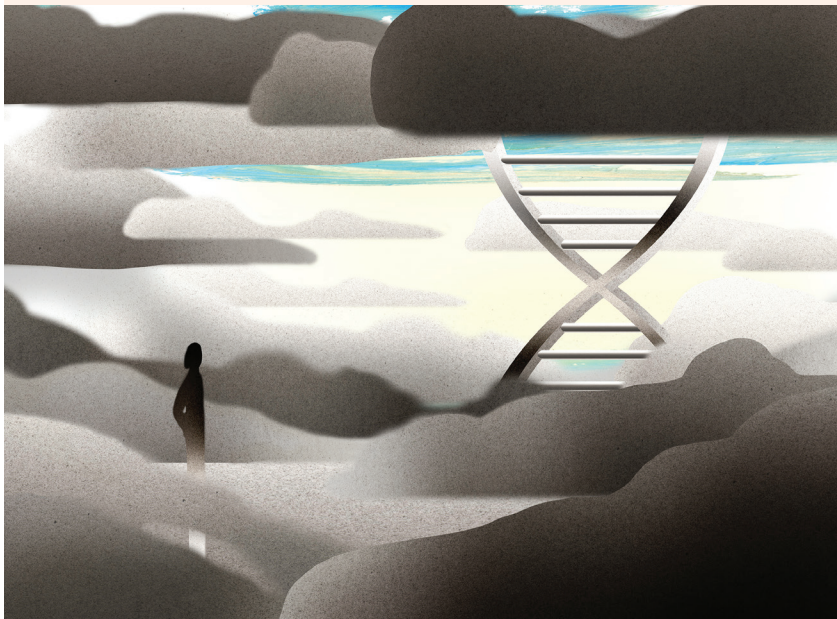
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"Nearly 15 years after the Human Genome Project, the world still hasn't seen a single fully-sequenced human genome."

ON THE COVER



We asked Keith Negley to illustrate the growing conflation of man and machine, and the strange world we're heading into.

Publication Design  
by Rob Hewitt  
curiousoutsider.com



# Techonomy in Your Hands

**As Techonomy approaches our eighth annual flagship retreat, our partnerships and our company are growing, our excitement remains high and the challenges of tech-driven transformation remain urgent.**

Our staff now occupies a brand-new WeWork office on Manhattan's West 43rd Street. You can see us all on the facing page.

President Josh Kampel works closely with our growing group of partners to help them refine their own messages. They don't just sponsor our conferences. Together we host dinners, craft content, and even create special events. We are honored by the commitment they have made to our mission.

It's a challenging mission, because the ways that tech is altering business and society is multi-faceted. Josh created a set of stickies to help explain the complex context, which you'll find when you turn the page. (He also wrote our article on how big companies are using crowdfunding.)

Program Director Simone Ross and Chief Technologist and Editor David Kirkpatrick spearheaded editing this magazine, even as Ross was fine-tuning the extraordinary lineup of speakers and topics for our Health and New York conferences. The way we put our events together is like a Rubik's Cube. Ideally we'd like to hint in our live program at all the interrelationships illustrated in Josh's stickies.

Our articles are a product of our community. Some authors, like Jennifer Schenker, Meredith Salisbury, and Ann Babe, have written for us before. Schenker has been with major business publications her entire career, and is now launching her own startup in Paris to help big companies deal with the topic she writes on here – working with startups. Salisbury is a longtime journalist specializing in genomics.

She's written about it for us several times before. Babe was an employee at Techonomy until she struck out as a full-time journalist specializing in tech-enabled social change. One of her articles examines how refugees benefit from tech innovation. The other is about how global healthcare will be advanced by tech.

Dan Munro recently wrote a book about healthcare reform called *Casino Healthcare*, and explains here why health startups aren't likely to have

Uber-like impact. Investor Scott Hartley became passionate about the misunderstood challenges of automation and work, so he wrote a book called *The Fuzzy and the Techie* about the importance of the liberal arts.

There is endless grist for the kind of in-depth conversation we curate. If you have ideas for topics we should pursue or people we should know about, let us know.

Thanks for being part of our community.



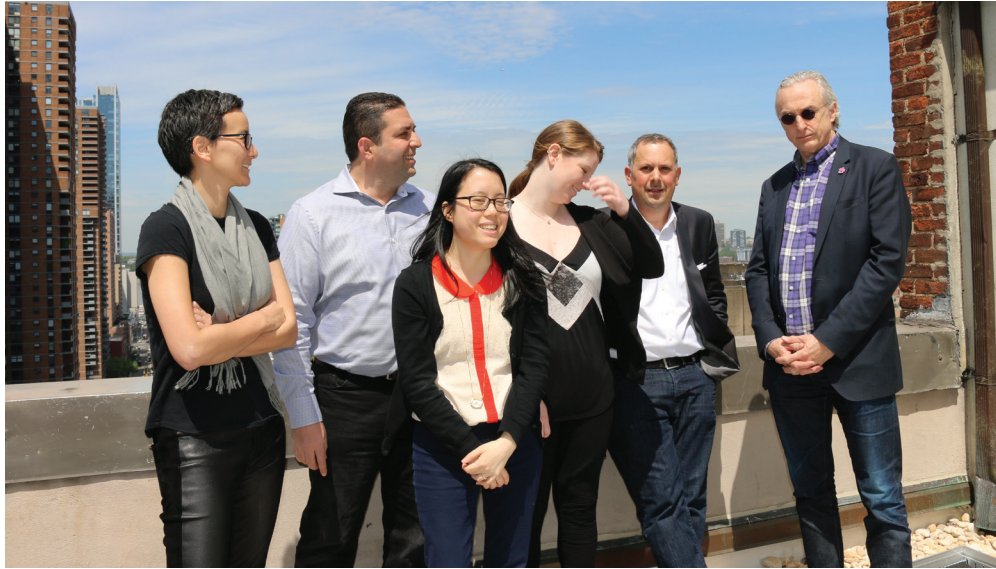
*In her younger days Cudaback was not really an armed revolutionary, but you get a sense in this shot of her adventurous spirit. In the inset, seen more recently.*

## *Glenda Cudaback Morrow*

*1945-2017*

Very few in our community got to meet or interact with the amazing Glenda Cudaback Morrow, but her intellect and creativity made key contributions to our programs from the beginning. She was an integral part of our brain trust, with a talent for being ahead of her time. We always found ourselves amazed at how even her most out-there ideas had an edgy logic which the audience could understand.

She was diagnosed long ago with cancer and given only a short time to live. As in so many other ways, Glenda defied the odds. She will be missed, but remains with us in spirit. Wherever you are, Glenda, may it be filled with elephants, corgis, perfect peonies, white wisteria and champagne. —SIMONE ROSS



Techonomy's energetic crew on the roof of our building in New York's Hell's Kitchen.

From left: Simone Ross, Lawrence Dvorchik, Mary Kan, Nora McNulty, Josh Kampel, and David Kirkpatrick.



How can content and technology change the game?

**Turner**

The Experience is Everything.





# Why Techonomy?

Our mission is to help organizations and leaders understand the transformative role technology plays in social and economic progress. Through highly-curated events, video and written content and executive workshops, we help executives, government officials, and other leaders develop strategies to deal with accelerating change. We engage with our community all year long. Our events are not "tech conferences." We don't focus on tech as an industry vertical. Rather, we explore its broader impact on business and society.

(The photo here shows part of our new office at WeWork on Manhattan's West 43rd Street.)

## BUILDING BLOCKS

CLOUD  
SOCIAL  
MOBILE  
BIG DATA

## TRENDS

BLOCKCHAIN  
AUGMENTED &  
VIRTUAL REALITY  
ARTIFICIAL INTELLIGENCE  
INTERNET OF THINGS  
AUTONOMOUS VEHICLES  
ROBOTICS & DRONES





ORGANIZATIONAL IMPACT

LEADERSHIP

INNOVATION MODELS

INFRASTRUCTURE & SECURITY

RECRUITING & TALENT

INDUSTRIES

AGRICULTURE

EDUCATION

ENERGY

FINANCE

HEALTHCARE

MANUFACTURING

MEDIA & ADVERTISING

RETAIL & COMMERCE

TELECOMMUNICATIONS

TRANSPORTATION

SOCIETAL IMPLICATIONS

INCOME INEQUALITY

REGULATION

FUTURE OF WORK

PRIVACY







# big

Companies are Learning  
to Work with

Small Ones  
(but it's not easy)

▼  
by Jennifer L. Schenker

▼  
Illustration by  
Emmanuel Polanco



**Dutch phone company KPN didn't see it coming. After startups began to make it easy for people to send text messages over the internet, eating into the SMS business of telcos worldwide, KPN's share price plummeted. In 2001 the company's chief executive announced massive layoffs and issued a profit warning. Three years later Facebook paid \$19 billion – more than the market cap of KPN– for just one of those upstarts, WhatsApp.**

Welcome to a new world, where the smartest people at the biggest companies are constantly being blindsided by seismic shifts.

Telecom operators are hardly alone. Moves by Silicon Valley upstarts are accelerating car manufacturers' moves to morph into mobility service companies. Insurance companies are seeking ways to compete with digital interlopers that process and pay claims in seconds. Growth for banks is elusive at a time of rapidly-accelerating disruption, so they are entering new markets like digital identity, while energy companies are expanding into everything from health monitoring services to food delivery.

That's not all. Businesses across the spectrum are wondering how to respond to artificial intelligence technology, which promises to impact everything from the way steel is produced to how farmers grow crops. "Every few months a new technology or approach or concept pops up," says Robert Wolcott, professor of innovation and entrepreneurship at the Kellogg School of Management at Northwestern University. "And there is a greater sense of urgency across most industries to do something about it."

That urgency is driving big corporations into the arms of startups.

It is no longer just about Silicon Valley tours where buttoned-up executives meet young entrepreneurs in hoodies, as if visits to "startup petting zoos" could somehow make companies more innovative. Corporates are acquiring, investing in, or partnering with startups around the globe in record numbers.

More than 1000 big companies

worldwide have opened corporate venture arms, spreading their bets by taking stakes in multiple startups. Some corporations are creating their own stand-alone "startups" and recruiting entrepreneurs to run them. Another strategy is opening stand-alone incubators and accelerators or joining ones backed by multiple players. Other models include hackathons and global startup competitions, or opening labs in universities and then taking stakes in the companies that get spun out. (The following article, on page 14, details another approach—using crowdfunding platforms to validate corporate ideas.)

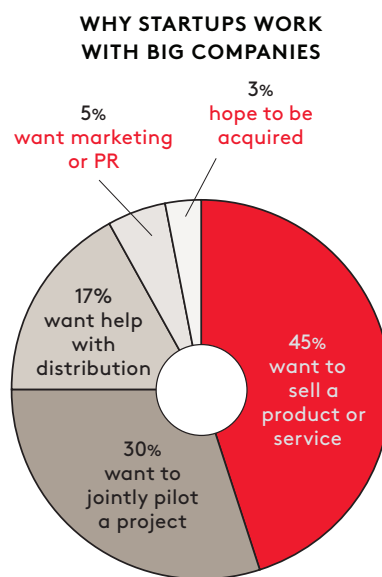
There is good reason to outsource R&D to young companies. They bring agility and fresh thinking to big corporations that are not only bogged down by bureaucracy but

are slaves to quarterly results. That makes it difficult, if not impossible, to willingly cannibalize cash cows. "Startups have a huge advantage: they don't have legacy systems or legacy thinking," says Harrie Vollaard, head of innovation at Rabobank, a forward-looking Dutch multinational financial services company.

But big corporates have something startups don't: market expertise and customer reach. On paper they make appealing partners and customers for startups, which seldom have the resources or experience to scale on their own. In a recent accelerator Startupbootcamp survey of global startups, 45% said they are looking to sell their products and services to corporates; 30% said they want to collaborate with corporates to pilot a project or for a proof of concept, and 17% said they want to partner for distribution or resale purposes. (See chart below.)

But there are downsides to working with behemoths. For starters, big corporates work on different time scales. Take the case of Hoana, a Honolulu-based medical device startup. It announced a partnership with a large automotive seating manufacturer in 2015 to introduce a vehicle seating system that can detect the physical and mental status of occupants. The product is still in the testing phase. "Anything you put in the car has to go through at least two to three years testing, so the time line on monetization is very different," says Edward Chen, Hoana's President and COO. "Our collaboration is going well, but if we were based entirely around the auto industry we would probably go out of business." The frustration for startups can be similar when working with companies in industrial manufacturing or highly regulated and conservative industries such as banking and insurance.

Institutions are burgeoning to help bridge the gap between the large and small. To say that there has been an explosion of incubators



Data: Startupbootcamp



and accelerators in the last few years is an understatement. Over 180 specialized accelerators worldwide are playing the role of coach, helping corporates understand internet time, even if they can't yet dance in step. The accelerators offer early-stage companies short, fixed-term programs that feature education, mentorship, financing and connection to big corporate customers. There has been so much demand that Startupbootcamp created specialty accelerators for banking, insurance, food, digital health, smart cities, and the Internet of Things.

Admiral Group, a large UK car insurer with a presence in seven countries, has joined both the Plug and Play Tech Center in Silicon Valley and Startupbootcamp InsurTech in London. "It gives us a lot of visibility on what is happening in the market and what the trends are," says Ori Hanani, head of operations for Admiral Group's French unit. "We try not to get distracted by shiny things that seem very cool and instead concentrate on whether this will generate value for our shareholders." Both Admiral Group and Rabobank say they are getting value from working with accelerators because their membership is linked with broader company-wide innovation programs.

But for too many big financial services companies, joining an accelerator "is just a box-ticking exercise," says Nektarios Liolios, cofounder and CEO at Startupbootcamp FinTech London, who has witnessed many failed efforts. "It is very rare anybody has put any serious time in trying to be strategic about this before embarking on the journey. Ask many of them how they measure the success of their initiatives and it is

interesting to hear the answers you get – mostly corporate blah blah and naïve assumptions." The banking sector has a particularly steep learning curve, he says, because "there is no R&D culture. They don't understand that you need to try multiple things at the same time and that not succeeding is an important part of the process, to find the one thing that will actually work."

And, adds Liolios, "none of this will have any success unless banks invest heavily in culture change internally." Regine Haschka-Helmer, a digital transformation and innovation specialist and CEO at Seedlab in Berlin, agrees. "A lot of corporations are turning to accelerators to solve all their problems and make them more innovative," she says. "It is never going to happen. Accelerators are like an island. They are good for learning and getting in touch with the startup scene, but

not for transforming the core of your company. Corporations need to first define what they want to change internally."

**SO HOW DOES A COMPANY CHANGE** internally and integrate innovation into the way it had traditionally operated? There is no off-the-shelf innovation operating system. Every large business is struggling, and there is general agreement that no one has found the magic formula. Banco Santander, a Spanish retail and commercial bank with operations in more than 10 countries worldwide, is experimenting. "There is a need for cultural change, to think differently and work in a different way. It means taking people out of their comfort zone," says Sigga Sigurdardottir, chief customer and innovation officer at Santander's UK unit. She is part of a 20-person innovation team focused just on that market. The team sets up partnerships with fintech startups to help the bank roll out new digital services (see box on next page).

The bank has created an alternate governance approach for innovation projects. Senior leaders meet



**Corporates are acquiring, investing in, or partnering with startups around the globe in record numbers.**



monthly to make decisions “incredibly quickly,” Sigurdardottir says. Sometimes that means approving projects that may cannibalize existing profitable businesses. “It is often not an easy conversation, especially when revenue models are in place, so we frame it around the opportunity and the customers,” says Sigurdardottir. The bank has little choice, she says. New European legislation will soon open the floodgates to new competitors. Banco Santander is shoring up its defenses by participating in accelerators such as FinTech Innovation Lab and also operating its own \$100 million venture fund, Santander InnoVentures.

Putting money into startups is another trendy way to absorb some of their DNA, or maybe more. In 2016 corporate venture funds invested \$24.9 billion in 1,352 deals globally, according to CB Insights. Not surprisingly, the most active funds were those of big tech companies long active with startups. Intel Capital and GV (formerly Google Ventures) were tied for first place, with 50 deals each. The venture arms of Salesforce, Comcast, Qualcomm and Cisco were also in the top 10, as were funds run by GE and Bloomberg.

But operating new corporate venture funds are companies that would not likely have dreamed about such an approach until recently, such as Campbell Soup, JetBlue, Kellogg’s, Volvo, and auto parts maker Robert Bosch as well as farming equipment maker John Deere. In the UK, the most active corporate venture firms include an arm of ad agency Saatchi & Saatchi called Saatchinvest, consumer goods company Unilever, pharma company Pfizer and Aviva, an insurance company, according to CB Insights.

**BUT NOT ALL COMPANIES THINK** a venture fund is a good idea. “We decided not to set up a corporate venture capital fund because it creates unhelpful incentives,” says Todd Roberts, senior vice president of Ca-

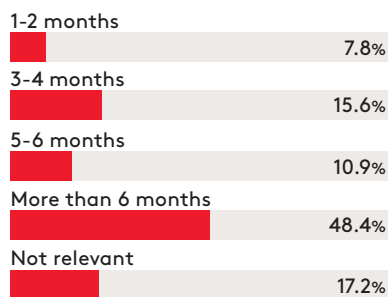
#### SANTANDER LEARNS FROM AMERICAN STARTUPS

**Banco Santander, a 160-year-old bank operating in more than 10 countries worldwide, is working with startups to roll out new digital services to its client base. Thanks to a collaboration with U.S. startup Ripple, Santander UK was able to introduce blockchain technology for international payments via a new app it tested with customers in May 2016. And the bank added an automated small business lending service in April 2016 with the help of Kabbage, another US startup. The bank’s venture arm is an investor in both companies. “Bringing fintechs into the bank really helps break down silos,” says Sigga Sigurdardottir, chief customer and innovation officer at Santander UK.**

nadian Imperial Bank of Commerce (CIBC), one of the five biggest banks in Canada. “You end up investing just because you have a fund, and then you have pressure to exit those companies. We think that to hold on to something for five or seven years and then get out runs counter to our objectives as a 150 year old company.”

But that doesn’t mean CIBC doesn’t ever fund startups. It is one of six banks that invested a total of 27 million Canadian dollars in a fintech company called SecureKey last October as part of an ambitious plan to roll out a national digital identity

#### STARTUPS SAY IT TAKES TOO LONG TO SIGN A DEAL WITH A BIG COMPANY



Data: Startupbootcamp

network in Canada to offer a secure way for consumers to exchange all types of personal data. The project—possibly the largest privacy-by-design consumer digital identity service initiative to date—is expected to be the first widespread commercial use of blockchain technology in financial services.

Striking a deal with a big corporate like a bank is 50% hard work, says SecureKey CEO Greg Wolfond. “The rest is timing, good luck and the ability to get to the right person inside the company. We were lucky enough to get through to the right people.” The banks are not just placing a bet on a new technology. They are hoping SecureKey’s digital identity and authentication technology will help them branch out into entirely new markets and put them at the nexus of the digital economy.

General Motors’ \$500 million investment in ride-sharing company Lyft was spurred by a similar motivation. GM, which has its own corporate venture arm, chose instead to invest in Lyft directly. Says Jochen Renz, managing partner at New Mobility Consulting: “Autonomous driving will almost certainly start with ride-hailing fleets rather than personal vehicles. Through the investment in Lyft, GM most probably wanted to...test autonomous vehicles in real world driving conditions and get access to future business models enabled by robotic cars.” Autonomous fleets enable the collection of vast amounts of data that help train the artificial intelligence required to manage driving. GM also made a direct investment of around \$1 billion in Cruise Automation, an autonomous vehicle startup.

Other traditional businesses are also making direct investments, aiming to leap into the digital age: Unilever spent \$1 billion to buy Dollar Shave Club, a startup that sells razors online; and Walmart spent \$3.3 billion on internet retailer Jet.com.



## Corporations can treat tech as strategic, move quickly with the help of startups and change processes and culture. Or they can make superficial moves and see business decline.

**CORPORATIONS CAN'T ALWAYS** find existing startups to buy or partner with. So they are turning to professional “company builders” such as Barcelona-based Heywood & Sons to create their own “startups” from scratch, often headed by experienced entrepreneurs (see box).

Another company builder is Founders Factory in London, backed by corporates in six sectors: easy-Jet (travel), L’Oreal (beauty products), Aviva (fintech), Holtzbrinck (education), Guardian Media Group (media) and CSC Group (artificial intelligence). Founders Factory has a 60-person staff and promises to build and scale over 200 early stage tech companies in those six sectors over the next five years.

A website for buying used cars online called Hellocar was created by Founders Factory and then spun out as a stand-alone company at the request of The Guardian. It was looking for new types of e-commerce sites to generate revenue for the newspaper. Founders Factory hired a serial entrepreneur to be the CEO. Hertz was brought in as a partner to increase the supply of used cars and Aviva, a global insurer, to provide insurance. “All of them helped in the go-to-market process,” says Founders Factory co-founder and CEO Henry Lane Fox. “Now we are getting interest from clients in energy, agriculture and consumer goods,” he continues. “All these companies realize that new technologies will impact their channels of distribution, their business models and their productivity. The race is on to get it right, and big companies are

just too distant from what this world of digital really looks like.”

**LIKE OTHER INSURANCE** companies, Dusseldorf-based Ergo Group, the primary insurance arm of Munich Re, finds itself under pressure to react to dramatic changes impacting its multi-trillion dollar industry. Ergo is in the midst of a \$1 billion spending

### GRUPE DANONE OUTSOURCED THE CREATION OF A NEW COMPANY

Global food company Danone turned to company builder Heywood & Sons to help it find a way to create a direct connection to Spanish consumers of its Font Vella bottled water. Heywood built a startup for Danone with the help of an experienced entrepreneur. The new entity quickly discovered that customers in Barcelona hated lugging water bottles home from neighborhood shops. So it set up a website that offered a delivery service via WhatsApp. Pep Viladomat, CEO and co-founder of Heywood & Sons, says using WhatsApp got five times more people to subscribe to the service than when they tried something similar with a conventional website.

Danone always intended to bring the project back in-house, but when it did it had to drop WhatsApp. “We cannot use a service for our customers that does not explicitly explain where the data is saved,” says Gemma Ferrer, Digital Business & Transformation Marketing Manager at Danone Waters. But she says Danone is pleased with what it learned about business models with the startup and its direct-to-consumer approach. Danone later created a site called [www.fontvellaencasa.es](http://www.fontvellaencasa.es) to make it easy to arrange recurrent delivery.

spree to transition into the digital age. The company is modernizing its IT and processes while separately launching a fully-autonomous digital insurance company called Nexible.

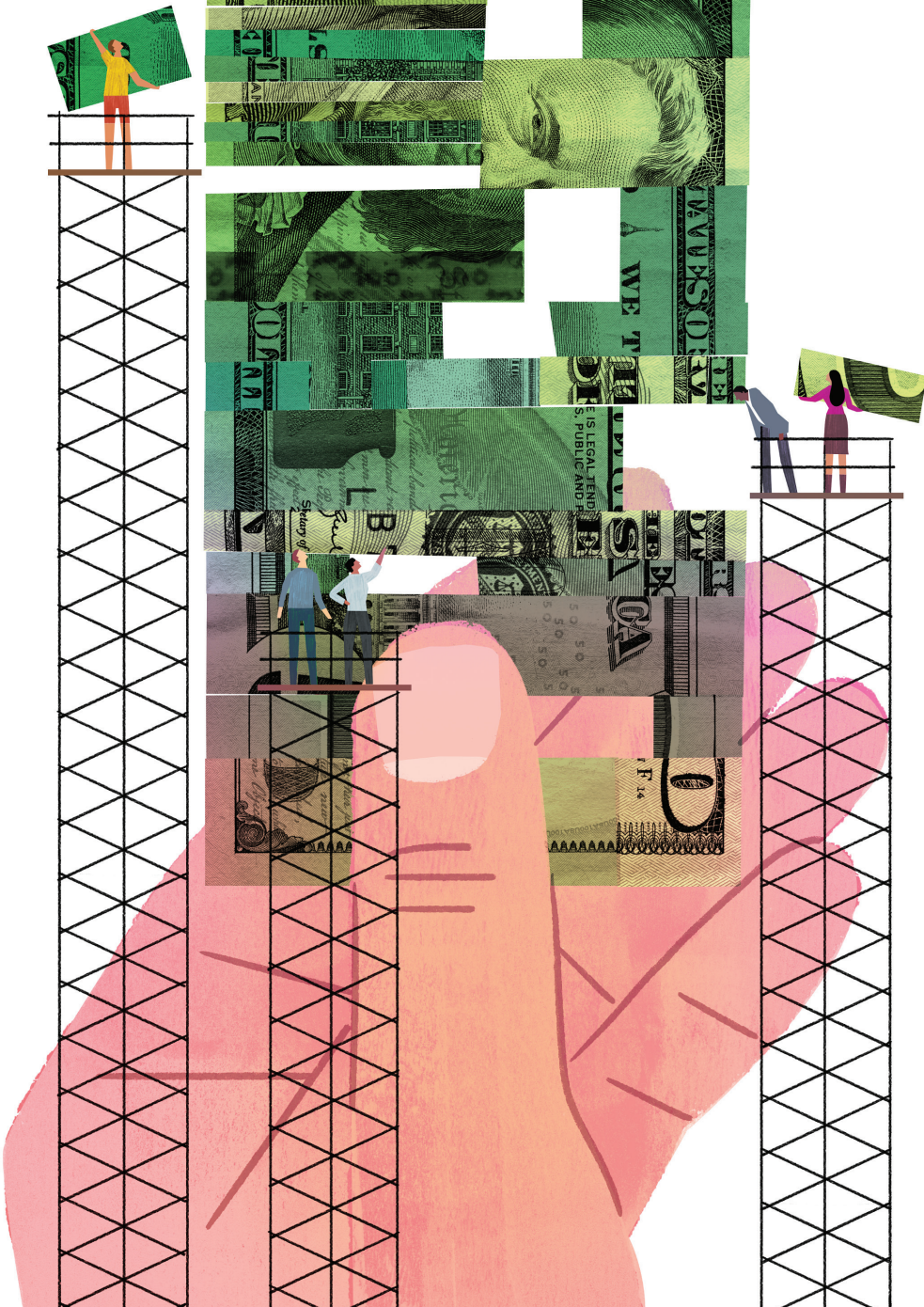
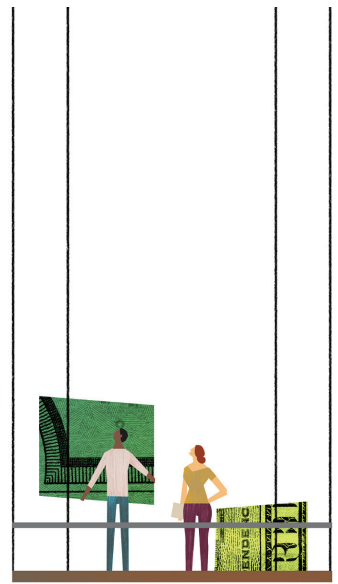
And it is deepening its relationship with startups. Ergo finds them in a variety of places: it is currently a member of Startupbootcamp InsurTech in London and has begun doing some investing. “The first step after we qualify them is to put them in touch with the relevant business unit,” says Ulrich Kleipass, Ergo’s head of innovation. “We can support the startup in our digital labs in Berlin for one month or three months. If we don’t get a commitment from the business unit we stop the project. We can’t force innovation on them. It is up to them.”

Ergo additionally has project managers for scaling successful projects, integrating them with the company’s IT and bringing them to market. “Currently we have eight projects running,” says Kleipass. “You qualify 600, talk to 200, introduce 50 to the business side, go in-depth with 15 and wind up with five projects.” When it comes to working with startups and going digital, “there is no silver bullet,” he says.

But the fate of companies and even entire industries hang in the balance. Corporations face a Kodak moment: They can treat tech as strategic, move quickly with the help of the right startups and change business processes and company culture. Or they can make superficial moves and be too slow in transitioning to digital and see their businesses decline. Film pioneer Eastman Kodak filed for bankruptcy in 2012.

**JENNIFER L. SCHENKER** has been on staff at *The Wall Street Journal*, *Time*, *International Herald Tribune*, *Red Herring* and *Businessweek*. She is launching a new print magazine called *The Innovator* aimed at big corporates to explain how tech impacts business and to help connect them to start-ups.







HOW CUSTOMERS  
ARE PAYING TO HELP  
BIG COMPANIES

# Indie over take

▼  
by Josh Kampel

▼  
Illustration  
by Keith Negley

Now even corporate giants  
are turning to crowdfunding to get  
innovation to market faster.



**When crowdfunding platforms like Kickstarter and Indiegogo emerged nearly 10 years ago, they helped entrepreneurs launch products by collecting preorders from anyone who was willing to support their idea. In many cases, the approach was a last resort for people who couldn't find investors on their own or didn't want to take on debt. It was generally understood that the product might not ever ship, but backers got the opportunity not only to support a fledgling concept they admired, and to get the resulting product at a fraction of the eventual retail price. Indiegogo has now served as a conduit for over \$1 billion in capital.**

But big companies, too, are turning to these platforms. Executives know their often-plodding behemoths can face significant internal challenges in bringing innovation quickly to market. So they need new ways to get products off the ground. And platforms like Indiegogo offer an additional advantage: they enable corporate R&D departments to engage with early adopters who want to help the company innovate.

Indiegogo is now working directly with corporate giants including GE, Motorola, and Whirlpool. They use the crowdfunding platform to gather ideas, validate hypotheses, and distribute new products.

Indiegogo's management watched Google, Philips North America, and other large companies launch campaigns on its platform. So in 2015, the company decided to launch a crowdfunding offering specifically for large enterprises. Since big companies are under great pressure both to innovate and grow profits, crowdfunding provides a way to validate interest and compress the time to market. "We provide a way for organizations to be profitable on products before they even ship," says Indiegogo Cofounder Slava Rubin, who until recently served as CEO. "We've helped brands like Hasbro bring their product research time down from 18 months to 6 months."

With these new systems, consumers are able "to vote with their dollars," says Noel Dolan, a category manager at W Labs, Whirlpool's innovation incubator. That makes the process very different from tradi-

tional means of gathering consumer feedback, like focus group or surveys, explains Dolan, who has also held various positions within Whirlpool. W Labs has successfully funded two new products that diverge from the rest of the core Whirlpool home appliance business—the Vessi Beer Fermenter and Dispenser and the Zera Food Recycler. The Vessi is targeted at home-brewing enthusiasts and had an initial goal on Indiegogo of selling 100 units. After shipping 200 orders, Whirlpool now is moving the fermenter into broader test markets using both e-commerce and brick and mortar distribution channels. If the product continues to succeed, it may get added to the core Whirlpool business.

"The first phase was to crowdfund," says Kelley Rich, a senior category manager at W Labs. "Then we test market through traditional retail. Then if that is successful, the product can move into one of the traditional businesses and scale." There was initial nervousness at Whirlpool about how consumers might react to a large company asking for preorders on a product that might never ship. Executives at W Labs were ready for potential backlash. "We had prepared in case we got beat up in the media or by consumers," says Dolan. In the end, the substantial savings Whirlpool offered its initial customers on Indiegogo seems to have overcome any issues. In fact the backers not only validated the product ideas, but the W Labs team says they have never seen a customer group more engaged and eager to provide

feedback. Indiegogo's Rubin says that sort of reaction is becoming common: "The backers love doing it and are excited. They want to influence what large companies are making."

The 125-year-old GE Appliances business was also painfully aware of the institutional barriers to bringing innovative new products to market, so it launched a new brand it calls FirstBuild around three years ago. There was no shortage of ideas. In fact, says GE Appliances veteran turned FirstBuild Product Evangelist Taylor Dawson, there was a "backlog of innovative new appliances" the company wanted to bring to market. GE CEO Jeff Immelt was urging the company's divisions to figure out how to act like startups, so FirstBuild was the idea of a group of longtime GE employees who knew they needed both a new culture and operating system for the business. "GE has very efficiently-running factories," says Dawson, "and introducing new products throws a wrench into that efficiency. So we started a micro factory to produce small quantities rather than millions of units. We opened a maker space to nurture creativity and talent, inviting entrepreneurs to create things potentially relevant to GE appliances. We wanted to create a new brand that speaks to early adopters."

FirstBuild plans to release 12 products a year and has even built its own cocreation platform so consumers can engage with it directly on challenges as well as post new product ideas. Its most successful product to date, the Opal Nugget Ice Maker,

had a goal of \$150,000 for a 30-day Indiegogo campaign. But it exceeded all expectations by bringing in \$450,000 on its first day, ending up with a total of roughly \$2.7 million in Indiegogo sales. “GE does not typically make small countertop devices,” explains Indiegogo’s Rubin. “The campaign was created to validate the



concept that consumers wanted this form of chewable ice. Now that idea is penetrating the entire GE refrigerator business.”

Not unlike W Labs, FirstBuild’s goal is to bring new products to market that can ultimately be commercialized by GE Appliances, which was sold to Haier Group in 2016. It will be interesting to see whether the new Chinese parent company maintains an appetite for such an innovative strategy. But both Whirlpool and GE Appliances are gaining valuable insights from these projects and learning ways to integrate some of the lessons into their core businesses.

Appliance manufacturers aren’t the only ones using crowdfunding to bring existing ideas to market. Other brands are tapping the energy



*Two home appliance makers turned to crowdfunding for ideas that seemed outside the usual box. Whirlpool launched the Vessi Beer Fermenter (above). And GE Appliances started an entire new brand, FirstBuild, to co-create products like the Opal Nugget Ice Maker (left).*

of the Indiegogo community to help them understand the next products they should consider making. Hasbro has launched what it is calling Hasbro Gaming Lab, to discover and develop new games. Motorola is leveraging the community to source ideas for modules, referred to by Motorola as ‘mods,’ that work with its state-of-the-art Moto Z phone. Already more than 30 crowdsourced mods are taking preorders on Indiegogo, from a biometric module that does iris- and fingerprint-scanning for secure transactions to a breathalyzer module that detects alcohol levels to combat drunk driving.

Working directly with consumers through Indiegogo enables companies to find ways around sometimes-recalcitrant finance depart-

ments that may not want to fund risky development projects. “We know we don’t have all the ideas,” says John Touvannas, senior director for product management at Motorola. “To continue to foster innovation, we need to provide tools that enable others’ ideas to be prototyped and brought to market. Too often great ideas never come to light due to lack of funding, and working with Indiegogo is a way to overcome that barrier to entry.”

The sophisticated and multi-layered infrastructure and personnel that once gave big companies a competitive advantage has in many ways become an impediment to innovation. The giants are struggling to innovate within the confines of their current operating models. Shareholders are pressuring them at the same time to continue growing profits, which makes it harder to act as nimble as the startups they are almost universally

## Indiegogo is now working directly with corporate giants including GE, Motorola, and Whirlpool.

trying to fend off. Crowdfunding harnesses the creativity of entrepreneurs and early adopters.

The challenge will be bringing this new way of thinking into the core organization, rather than just creating ‘skunkworks’ projects or spinning up new innovation labs that don’t alter a company’s core DNA. These new products and services, even when they are successful at a small scale, usually do not offer much help to the bottom line. But the process helps brands think differently about speedy innovation. That is the kind of change, over the long term, that will determine who succeeds and who fails.

**JOSH KAMPEL** is *Techonomy’s* president.





Goory Al Hamed teaches Arabic over Skype from a refugee camp in Qushtapa, Iraq. • The 27-year-old Syrian refugee lives in the crowded, muddy camp in the country's northern region. It offers only a shaky wi-fi connection, but Al Hamed says she teaches her six students—who are as close as Lebanon and as far away as the United States—as often as she can, because she needs the money. Before she got here after fleeing Syria, she moved from city to city in search of a place to live. • “This is a good job, especially for refugees, because it's very hard to find job opportunities here in Iraq,” she says. For her language-tutoring services, facilitated through a New York and Paris-based startup called NaTakallam, Al Hamed makes \$10 an hour. ▶



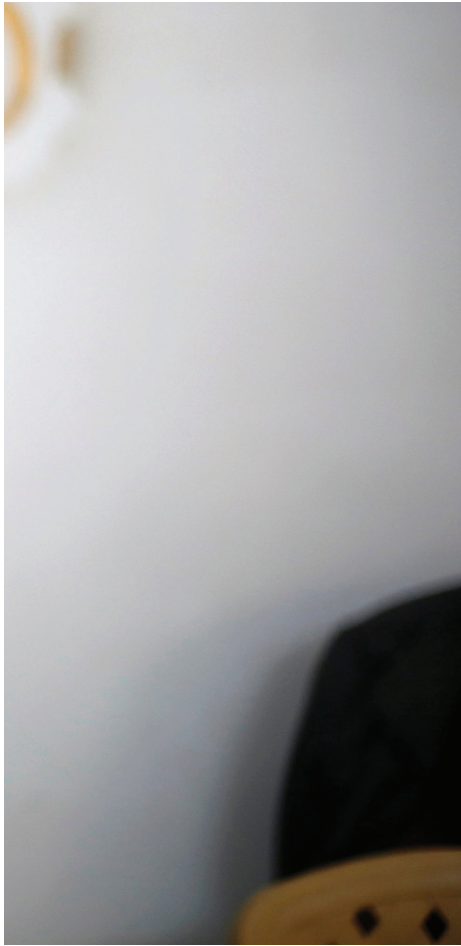
## How Connections Help Place the Displaced

Specially-developed technology tools are helping refugees find housing, work, language skills, and even turning them into technologists.

By Ann Babe



*Goory Al Hamed fled Syria and now teaches Arabic online to students around the world, from a refugee camp in Iraq.*



Al Hamed is one of the many displaced who are gaining various sorts of empowerment because of networking and technology.

NaTakallam, *we speak* in Arabic, is just one of a slew of startups, nonprofits, and tech-powered tools that have emerged in recent years, aiming to help asylum seekers and the displaced connect to opportunities.

“Tech is incredible,” says NaTakallam Founder and CEO Aline

Sara, a Lebanese-American based in New York who travels often to Lebanon, where roughly one in five people are displaced. “It’s been a lifeline for refugees.” The idea for NaTakallam emerged out of a Columbia University competition after Sara graduated from its School of International and Public Affairs.

There are more than roughly 60 million refugees worldwide—20 million forced across a border and about another 40 million displaced within countries. The lifeline of networked technology links those displaced people to everything from jobs, mentorship, and skills to a place to sleep at night. Aiming to make that lifeline even more robust, technologists and entrepreneurs across Europe, the U.S. and the Middle East are creating both for-profit and nonprofit organizations to launch smartphone apps, websites, crowdsourced databases, open-source spreadsheets, and plenty of other tools.

A bevy of Airbnb-style and other housing platforms match displaced guests with local hosts and vacant spaces for free. They include Netherlands-based Refugee Hero, the French *Comme à la Maison* (“At Home”) and *Réfugiés Bienvenue* (“Refugees Welcome”), the German *Flüchtlinge Willkommen* (also “Refugees Welcome”), and the UK’s *Refugees at Home*.

For language help, there is *Refugee Phrasebook*, a crowdsourced vocabulary aid of essential phrases, including medical and legal terms, in 28 languages. Begun in Berlin in 2015, it puts its phrases in spreadsheets that are open for anyone to access, use, customize, and print, says team member Markus Neuschäfer. While some other organizations don’t share translations or only share them in hard-to-reuse formats like PDF, he says, “we help refugees be more independent.”

And for tracking down job, mentorship, training, and learning opportunities, there’s the Jordanian

makerspace *Refugees Open Ware*, the Dutch co-design place *Makers Unite*, the German coding program *Refugees on Rails*, and the entrepreneurship center *Startup Refugees* and mobile-learning site *Funzi*, both based in Finland. *Funzi* is supported by Facebook’s *Internet.org* initiative.

There are a lot of tech tools for asylum seekers and the displaced. Whether they are actually using them is another matter.

Many refugees simply don’t know about all these tools, according to 30-year-old Syrian immigrant Maher Ismaail. A web developer, Ismaail left Damascus in 2014 and now lives in Berlin. He says that even when the displaced are aware of such tools, they often lack the language skills to identify and operate them. In addition, he notes other problems. For instance, on some housing platforms many more beds are being offered than sought, in part because entrepreneurs without a personal history of displacement don’t understand how refugees use technology or find information.

So Ismaail decided to tackle this problem by launching his own startup, *Dalili*, a database full of services and a search engine with which to find them. Arabic for *my guide*, *Dalili* aggregates jobs, internships, German-language courses, social events, and other opportunities to give the greatest possible number of Berlin newcomers “the chance to access these services,” Ismaail says.

“If you don’t know how to start your way as a newcomer, we will guide you step by step on how to integrate in the best and easiest way,” he says. Ismaail and his co-founder released a prototype of *Dalili* earlier this year, and plan a full version in both app and website form soon.

Ismaail hopes *Dalili*, built upon his own painfully-acquired personal knowledge of what it means to be a refugee, can offer fellow newcomers a user experience other ventures cannot. “I’m an immigrant. I know what





*Syrian refugees at a refugee settlement in Northern Lebanon attend an orientation session about teaching Arabic online. A teacher (inset) conducts a Skype session with a student in the U.S.*

we think and what we need,” he says. “I already suffered from the problems. I lost almost 10 months of my life here in Germany without doing anything connected to my profession.”

In launching Dalili, Ismaail can work within his industry as a web developer and, he hopes, make a living too. Unlike most efforts run by non-refugees, which are social entrepreneurship projects (though not always officially registered as non-profits), Dalili is a for-profit. While it will always be free for users, Ismaail says, it hopes to make revenue from companies through ads, recruitment fees, and the promotion of brands and events. “For-profit creates more job offers to newcomers,” he says. “We want to scale the business and let more people be involved with us.”

And, ultimately, Ismaail says, he wants to show other displaced people that it’s possible “to build a new life like me.”

Millions of immigrants leave their homes as well-trained and highly-qualified employees but are viewed as unemployable after they leave. A good example is Al Hamed, the teacher in Qushtapa. In 2013, she was about to complete the final year of a computer engineering degree, when she had to flee Syria with her parents, five sisters, and two brothers.

“I was in Damascus studying. Then the war started,” Al Hamed says. “Our journey was very hard. It was winter. We walked about two hours on foot. When we arrived we went to [Domiz] camp, and unfortunately we didn’t get a tent, it was so crowded.”

Al Hamed and her family left

**The lifeline of networked technology links displaced people to jobs, training, mentorship, and even a place to sleep at night.**



Domiz camp, going first to Duhok, then to Aqrah, and finally ending up in the governorate of Erbil, where she found Qushtapa camp and later NaTakallam. But she, of course, has bigger dreams.

When Al Hamed’s not teaching Arabic, she’s learning coding. Along with five others in Qushtapa, which houses more than 7,500 displaced people, Al Hamed is enrolled in Re:Coded, a rigorous 10-month programming bootcamp. Traveling to Kasnazan, at the outskirts of the city of Erbil, for in-person instruction, the coders study full-stack software development that’s been adapted from the curriculum at New York’s Flatiron School coding academy.

Re:Coded, incubated at New York University, partners with the United Nations Development Programme to offer the fellowship at no cost to selected refugees, internally displaced people, and vulnerable youth in Iraq. Forty percent of them live inside camps, like Al Hamed.

She puts in long, late hours of studying, in hopes of someday finding a job in the industry—and out of the camp. After graduating from Re:Coded at the end of April, she’s on her way: the program guarantees her a portfolio, certification, and, most importantly, full-time work within six months, in partnership with employers like Microsoft.

“I spend all day learning coding. I am so happy with it,” Al Hamed says. “For me, the most important thing is to work as a web developer one day because I love this field.” She has dreams of making it to England or Canada. “It can be anywhere,” she continues. “Just not here.”

*ANN BABE writes about community, identity, and tech-enabled social change around the world.*

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# ROBOTS ARE COMING FOR YOUR TASKS, NOT YOUR

In 2013, Oxford University economists Carl Frey and Michael Osborne published a study called *The Future of Employment: How Susceptible Are Jobs to Computerization?* The authors concluded that about 47 percent of U.S. jobs were at a high risk of machine automation over the next few decades. It was a sobering and fear-inducing thought. Various versions of this apocalyptic prediction are heard more and more; not only from professional prognosticators but from tech leaders and workers impressed with their own software and hardware yet fearful of the consequences for society. ▶

▼  
by **Scott Hartley**

▼  
Illustration by  
**Emmanuel Polanco**

(Or Why the Liberal Arts  
Will Always Matter)

-



THE FUTURE OF WORK





Such fears are understandable, but they may be misleading. It isn't that jobs are going away. Instead, jobs are inexorably changing as automation seeps ever deeper into society. We probably don't need to worry about the existence of jobs per se, but rather about those who do not cultivate their ability to think broadly and continue refining the soft skills that are unique to being human.

The argument that masses of human workers will permanently lose jobs to machines—what's called “technological unemployment”—has been made time and time again, notably at the dawn of the Industrial Revolution and during the Great Depression in the 1930s. Economist John Maynard Keynes contended that job losses during the Depression due to technological advances were leading to “means of economizing the use of labor outrunning the pace at which we can find new uses for labor.” In other words, many would be without anything at all to do.

Of course this didn't happen in such a stark way. In 1900, approximately 40 percent of all American workers were employed on farms; today that number is just 2 percent. What the Industrial Revolution did was move farmers into factories. But could this time be different?

Certainly we are seeing tremendous advances in artificial intelligence, robotics, and the routine automation of manual tasks. For example, many once flocked to high six-figure-salary jobs mining iron ore and gold in the Australian Outback, but today, giant self-driving Volvo and Caterpillar trucks weighing close to a million pounds are instead scraping the earth there in open-pit mines. “An autonomous truck doesn't need to stop for lunch breaks or shift changes,” Caterpillar's marketing crows. Scania, another vehicle company, has pioneered trucks that use GPS and LIDAR (light detection and arranging) sensors to operate with

optimal efficiency, minimizing fuel consumption. The trucks have improved efficiency by more than 15 percent. And of course we daily hear predictions that self-driving vehicles of all sorts are soon to replace human drivers, especially the millions who drive for a living.

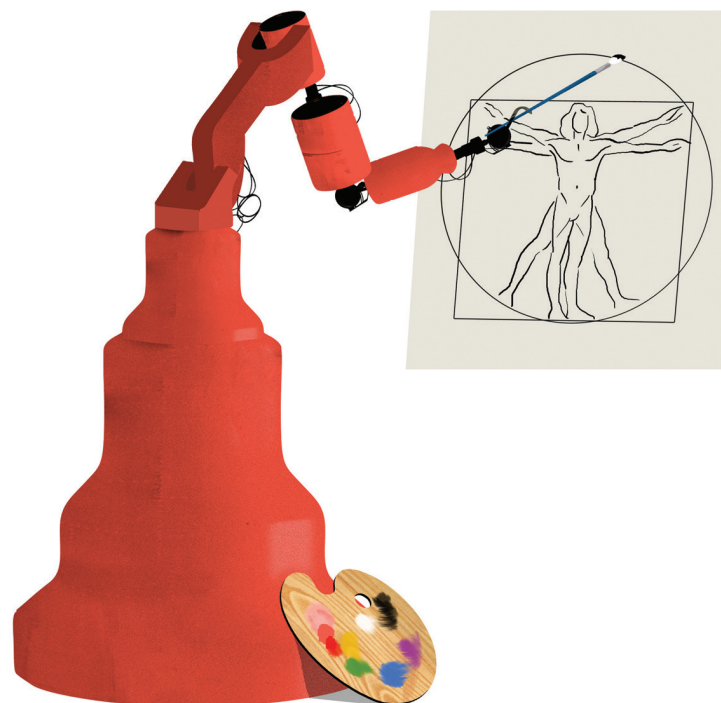
Machines often just seem to do things better. For example, vehicles like the CAT 797, a bright-yellow multi-million dollar, four-thousand-horsepower truck that carries four hundred tons, break less often when computers are operating them. Careless human drivers burn through lots more rubber on the truck's giant tires. That matters when each tire costs more than \$40,000.

Of course businesses cannot always just buy their way out of employing people. But in a highly controlled industry like mining, where worker safety and stamina is a major concern, and especially where work is highly routine, workers are moving from the pits into offices or

unemployment. Machine automation saves mining companies money, so over time they will add more and more such autonomous equipment.

Routine work will be done in whatever way is safest and most efficient. And this applies not just to manual work, but also increasingly to the cognitive work people do with their brains. But while routine tasks might go to machines, jobs are comprised of many elements. Only a small subset of what people do is likely routine enough to be scripted, programmed, and performed by a machine or computer. Many tasks within all jobs are subject to enough variation that employers will prefer human labor to machines for a long time. Machine precision is laudable, but so is human mutability. A machine might make a good burger, but is it also going to take out the trash?

The McKinsey Global Institute released a study in the summer of 2016 that analyzed the functions performed as part of 800 different occupations. Researchers looked at



over 2,000 tasks performed across all these jobs and concluded that “while automation will eliminate very few occupations entirely in the next decade, it will affect portions of almost all jobs to a greater or lesser degree.” McKinsey found that five percent of jobs could be fully automated (in stark contrast to the terrifying 47 percent figure in the Oxford study).

But the study concluded that we are likely to see a wholesale transformation of jobs, rather than their full replacement by machines and artificial intelligence. It found that roughly 30 percent of tasks within 60 percent of jobs would change. Researchers noted pointedly that this suggests that machines will augment our work environment rather than become our robot overlords anytime soon.

Those many tasks within a solid majority of jobs that will be immune to machine automation are those that cannot be sufficiently defined and programmed. Such tasks require creativity and original thought, intuition, coordination, communication, empathy and persuasion. In other words, humans might not perform rote tasks like guiding giant trucks to pick up piles of ore, or even elementary data collection. But they will ask questions of the data, help frame parameters, test hypotheses, collaborate with teammates across departments, and communicate results with compassion to clients.

In the hospital, nursing assistants today spend two-thirds of their time manually collecting health information. Over time, this job will certainly consist less of collecting patient vitals, because of course sensors do that quite well. But it’s presumptuous to believe seriously-ill patients would prefer an empathetic robot to a caring human. In other words, the job of the nursing assistant will become more, not less, human. In the office, data and analytics will inform assessments of employee performance, but a manager will still coach and mentor

his or her rising stars with care and hands-on attention. Humans will more and more interface with machines, but non-routine tasks will remain the purview of humans.

Because of the tremendous power of machines to supplement our abilities, the touch points between man and machine will continue to multiply. So we will definitely still need technical literacy, and in many cases solid STEM training. It’s of the utmost importance that these skills be nourished and prioritized across our communities. But it’s wrong to assume that basic technical training alone is sufficient to maintain relevance in tomorrow’s economy. For example, rote computer programming has already become a cheap commodity, purchased quickly and easily on the global market. And it is itself

will be OK when it comes to jobs to the extent that they continue to focus on integrated systems-thinking skills. What people will need are problem-solving skills, learning to learn, and learning to adapt.”

So the question becomes: How do we cultivate human skills of adaptation, empathy, consideration for another’s perspective, and the ability to work together and communicate across differences? How do we train for a highly dynamic world where, for a college graduate today, it’s impossible even to imagine the jobs of 2060? Success and continued successful employment will come to those with both the technical literacy to understand machines as well as the soft skills to help maintain the human-to-human interface atop our techie world.

## In this moment of technological inflection, we need to double down on the liberal arts. They give us the context with which to apply the new tools.

increasingly becoming automated.

At Harvard’s Graduate School of Education, David Deming is an economist who has looked at the change in relative employment for cognitive occupations over the past three decades. What he’s found is that the winners possess not pure math skills, or pure soft ones, but rather a blending of the two; what he calls “high math, high social.” Since 1980, jobs with a high requirement for social skills have grown significantly, whereas jobs with high math but low social abilities have actually declined. This is in part because in more complex work environments, worker specialization requires the trading and sharing of tasks, and soft skills reduce the so-called “transaction costs” of collaboration. Says James Manyika of the McKinsey Global Institute, who played a big role in its 2016 study: “People

The answer to this challenge might be our least intuitive yet: at the moment of technological inflection, we need to double down on the liberal arts. After all, this is where students are exposed to broad ideas and challenged to grapple with the arts, humanities, social, and natural sciences in settings designed to tug on our minds, question our assumptions, and refine our curiosity. The liberal arts are not at odds with technical literacy; they are what give us the context with which we apply the new tools, and our very human comparative advantage even in a world in which machines continue to get smarter and smarter.

**SCOTT HARTLEY** is a venture capitalist and startup advisor. He recently wrote “*The Fuzzy and the Techie: Why the Liberal Arts Will Rule the Digital World*” (Houghton Mifflin Harcourt).





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## Tech's Amazing Potential in Healthcare

In the following special section, created to accompany our Technomy Health conference in May 2017, we survey how technology mostly can, but sometimes can't, move healthcare forward. Since 2010, Technomy has delved across the economy, seeking ways that tech challenges and disrupts. And in recent years, we've honed in on genomics and healthcare because even more than in other industries, we sense that tech can change things quickly.

That's in part thanks to cloud tools, software analytics, and mobile tech. But it remains up to Congress to finally reform the American healthcare system (and we're not holding our breath).

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## WHY AMERICAN HEALTHCARE IS SO HARD TO HEAL

It's not broken. It's designed that way. And tech innovators alone can't fix it.

by Dan Munro

Illustration  
by Keith Negley

### BILL GURLEY OF BENCHMARK

was recently rated America's top venture capitalist by research firm CB Insights. But he does not invest in healthcare. Not long ago, Gurley spoke at Austin's South by Southwest festival and explained that it wasn't because he wouldn't like to. After all, the sheer size of the industry – about \$3.4

trillion in 2016, according to the federal Centers for Medicare & Medicaid Services—is about 18% of U.S. GDP. “But there’s an assumption of market forces when you do a startup,” Gurley said ruefully. “You expect customers to pay for value and to not pay for bad things...and the physics are just completely mucked up in the healthcare system.” • Through the years, other VC's have similarly thrown up their hands and declared the system “broken.” Sadly, it's really not. The American healthcare system is both complex and working exactly as designed. The complexity we all see—as patients, innovators, or investors—is actually a key feature, not a bug. • So don't expect to see an Uber of healthcare anytime soon. No less than four giant systemic flaws or complexities in American healthcare make it unlikely to produce the kind of giant paydays that startup investors seek. • The first one is simply a huge imbalance

between supply and demand. The United States has roughly one practicing doctor for every 400 people. So we don't have enough doctors, and the cost of the service they deliver is extremely high. To become one, it typically requires going deeply into debt—the average amount a doctor carries after medical school is \$183,000. ▶



In addition, our admirable system of rigorous training generally means doctors lose about 10 years of earning power by the time they are finished. After all that hardship and personal sacrifice, of course they expect to be well compensated.

The second complexity is that healthcare isn't a consumer product. Yes, a few small elements of healthcare, like basic primary care, can be delivered with a consumer business model (and companies like Walmart are starting to do that at scale). But the vast majority of acute and chronic healthcare is really expensive and unpredictable. Million-dollar medical bills are sadly not a rarity. This is further compounded by the fact that consumers cannot ever be expected to develop any real expertise around the nature of diagnosis and treatment for major illnesses. As patients, we rarely know what expensive healthcare we'll need, when we'll need it, or how much we'll need. In many cases we arrive to expensive procedures on a gurney—unconscious. In addition, the way the American healthcare system diagnoses and treats major illnesses is highly variable and doesn't produce uniform outcomes. No other consumer product or service brings with it such huge expense, variability, and personal risk.

As if these two challenges weren't bad enough, they are compounded by the two ways we finance the high cost of delivering healthcare: the first is known as "selective health coverage" and the second is the for-profit "fee-for-service" approach (FFS). Selective health coverage requires a definition because we're the only industrialized country that uses such a perverse method of health insurance. Every other industrialized country has a system that is essentially the polar opposite, and far more humane—universal health coverage. But in the United States, we sort (or select) health coverage using a complex mix of factors,

including the following ones:

- **Age** (those under 26 get family coverage and those over 65 get Medicare)
- **Income** (if you are poor enough to qualify for Medicaid, you pay virtually nothing)
- **Employer Sponsored Insurance (ESI)**
- **Heritage** (for example the special program called Indian Health Service)
- **Military Service** (with the VA covering military veterans)
- **Uninsured** (roughly 30 million Americans)

The largest single group (about 150 million) is employer-sponsored insurance, a method of healthcare insurance which is both an accident

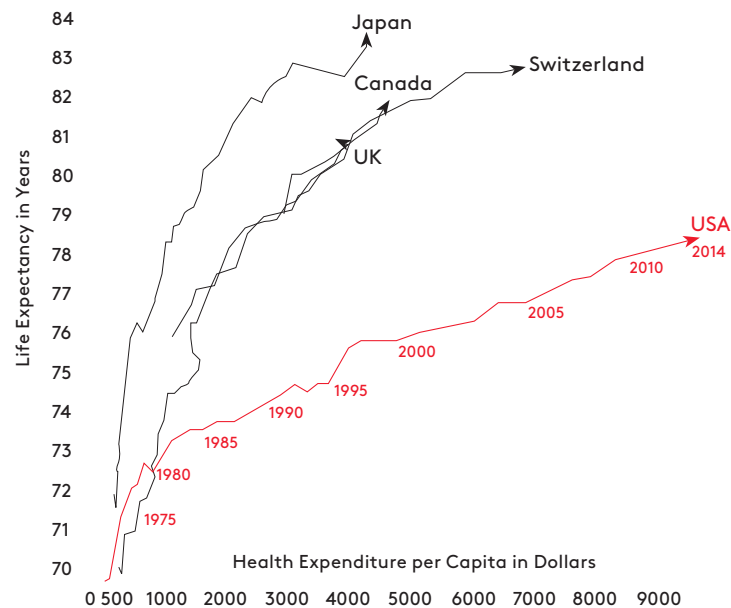
and a relic of World War II. Wages were frozen during the war and employers needed another way to compete for workers. The government allowed them to use benefits instead of wages, and employers were more than eager to take advantage of that.

So health insurance tied to employment emerged. Through the years, this system became expected and embedded, and tax incentives arose to support it. Today, federal, state and local governments forgo tax revenue of almost \$600 billion a year in order to subsidize employer-sponsored insurance. This tax exclusion is effectively our country's second largest entitlement after Medicare. We've come to assume that ESI works well simply because we're so used to it, but the U.S. is

## America's Healthcare Spending Scandal

The U.S. will spend more than \$3 trillion this year on healthcare, roughly 18% of GDP. By any measure, that is vastly more than any other developed country. Below we compare a few countries with the U.S., but any developed country would show similar data. We pay more, but live dramatically fewer years—a terrible combination.

LIFE EXPECTANCY VS. HEALTH EXPENDITURE OVER TIME (1970-2014)



Data: OECD and World Bank. Design courtesy Max Roser, via Creative Commons.

the only industrialized country that uses this antiquated and paternalistic way to provide health insurance.

The second uniquely American way that we finance healthcare, and our systems' final systemic flaw, is for-profit "fee-for-service" pricing that's tiered by coverage. The more you pay, the more coverage you get.

For many Americans this is a very painful flaw in our approach because it means that healthcare is rationed according to social class and wealth.

The complexity of this system is enormous. Fee-for-service as a model in itself doesn't mean our system is broken. In fact it is the primary mechanism of payment in every other industrialized country as well. But our version is uniquely tiered by the amount of coverage a person gets, as a way to maximize profits. That means that more services equal more fees—and more profits for providers.

Our "system" is purpose-built to do more stuff for more profit, so that's exactly what it does. It's like a car that only gets two miles per gallon. If we want to get better MPG in that car, we'd have to install a whole new engine.

To restate the four fundamental flaws in the system: there is an imbalance between supply and demand; high costs are a barrier to any large-scale direct consumer business model; we tier health coverage based on ability to pay; and we price healthcare by the service, aiming to produce profits for each segment of the healthcare industry. Individually, each flaw is daunting. But collectively they add up to something worse—a kind of iron-clad immunity to healthcare disruption.

**We have optimized the entire system for revenue and profits rather than safety, quality, or equality.** Of the four hurdles, by far the most problematic and entrenched is our unique adoption of tiered (or selective) health coverage. No other country uses this model and it really



**The entire American healthcare system is optimized for revenue and profits rather than safety, quality, or equality.**

only serves one purpose—to support tiered (or variable) pricing.

In political and policy discussion, many confuse universal coverage with "single-payer" healthcare, but that's neither accurate nor necessary because there are other ways to pay for universal coverage. In fact, the primary benefit of universal coverage is that it eliminates variable pricing. If everyone is in one big pool of insurance coverage, then we can have standardized uniform pricing for every healthcare procedure or service. The only real choice then is how that's paid for—either with a single-payer or multi-payer approach.

We desperately need and want new ventures that could help break down these barriers and influence our choices for systemic healthcare reform. Today, however, even if they get traction, they aren't likely to be able to fundamentally restructure this enormous industry or generate big shareholder value. Unless we make a major national policy shift

they won't be able to have an impact on elements like tiered coverage or variable pricing. In the end, we can certainly afford any healthcare system that's based on universal coverage. The only one we can't afford is the one we have.

Florida Governor Rick Scott once nicely summarized American healthcare's natural immunity to disruption: "How many businesses do you know that want to cut their revenue in half? That's why the healthcare industry won't reform the healthcare industry." Real change will require fundamental innovation in government policy. That will then likely unleash America's innovative spirit so we can figure out ways to more affordably and efficiently keep us all healthy.

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*DAN MUNRO writes about innovation, policy, and cybersecurity issues in healthcare. His book about the American system, *Casino Healthcare*, was published in 2016.*



# What does it mean to heal?

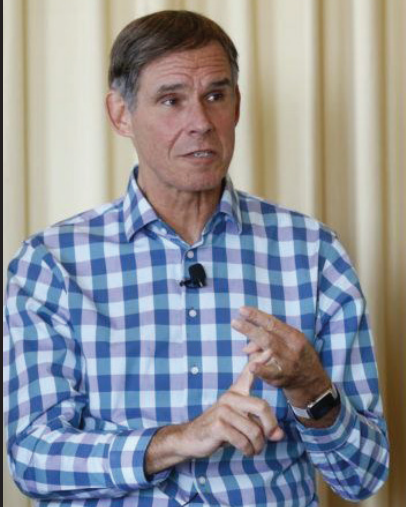
U.S. consumers are using the healthcare system more than ever - and yet we are still seeing increased rates of preventable diseases. So what happens when people face a health risk or issue, and need to manage or overcome it? And how can advanced technologies, AI, automation, and digital tools be designed to truly assist people as they work to maintain their overall health?

To answer these questions, ReD and Cognizant have engaged in an innovative study to understand how people heal. By visiting people in their homes, shadowing them at the doctor, taking part in their daily routines, and engaging in all the activities that people do to get better, researchers examined how Americans feel about

their health care, how they interact with the health care system and what else they do in their daily lives to support their health.

The study revealed that many of today's popular approaches to patient-centric care, including integrated care and patient empowerment, make it harder, not easier, for people to manage or overcome a health risk or issue. Instead, to drive improved outcomes, the health care industry needs to look to people's everyday lives for entry points, targeting the attitudes and behaviors that matter most to them when they need to heal.

To learn more, visit [Cognizant.com/healing](https://www.cognizant.com/healing)



PAUL SAKUMA PHOTOGRAPHY

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“Every day people are suffering unnecessarily and we’re wasting over \$1 trillion dollars a year in this country because we’re not adopting technologies that we know work.”

DR. ERIC TOPOL, AUTHOR, *THE PATIENT WILL SEE YOU NOW*

Just before Techonomy 2016 last fall, Techonomy convened its first-ever half-day health roundtable. It went so well that we expanded it to a full day in spring 2017. The discussion spanned the many ways tech can improve health and healthcare, including the role of genomics, behaviorally-informed health insurance, and how tech might help the United States achieve the healthcare reform it so desperately needs.

1. Dr. Eric Topol, author and chief academic officer, Scripps Translational Science Institute

2. Rachel Maguire, research director, Institute for the Future

3. From left: David Kirkpatrick, Proteus Digital Health CEO, Andy Thompson, athenahealth CTO, Prakash Khot, and Kaiser Permanente Chief Medical Information Officer John Mattison

4. Philips Chief Innovation and Strategy Officer Jeroen Tas

5. Sumbul Ahmad Desai, vice chair of strategy and innovation at Stanford Medicine with Rick Valencia, President, Qualcomm Life

“Artificial intelligence will play a big role in making sense of the trail—from diagnosis to treatment to the outcome of that treatment.”

JEROEN TAS, CHIEF INNOVATION AND STRATEGY OFFICER, PHILIPS

“How do we think about how the Internet of Things can enable us as providers to get people to engage in healthier behavior?”

DR. SUMBUL AHMAD DESAI, VICE CHAIR, STRATEGY AND INNOVATION, STANFORD MEDICINE

“It’s going to be very interesting over the next few years to watch companies like Apple and Google. How far are they willing to go in embracing the regulatory environment and the HIPAA laws? They are very, very big consumer companies that sell things to the masses and healthcare is a bit of a different animal.”

RICK VALENCIA, PRESIDENT, QUALCOMM LIFE



Genome-based medicine, a topic once confined to scientists in ivory towers, has reached the mainstream. In news reports and in conversations with their doctors, more and more people are hearing about the promise of using information gleaned from their own genes to deliver more targeted, customized healthcare. It's gotten to the point that standard recommendations for some types of cancer now include getting the tumor sequenced. But how close is genomic medicine to becoming a routine part of modern medicine?

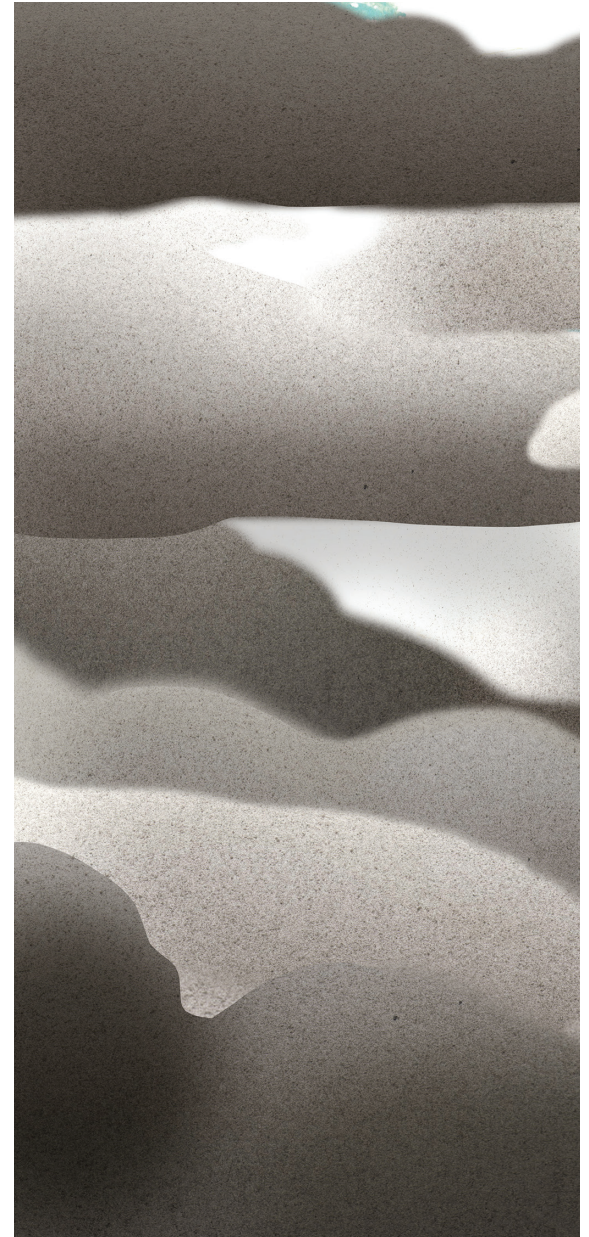
The answer is far more complicated than you might expect. Genetic testing is being used for more and more conditions. Scientists are making new discoveries all the time about natural genetic variations in people, and about the meaning of such variations when someone has a disease, especially cancer. So in that sense, the era of genomic medicine is all but upon us. However, we are still at the earliest stages of understanding what all this data actually means. As a result, we remain very far indeed from the day when incorporating genome information in healthcare is routine.

Success in genomic medicine will hinge on two things: accurately reading the genome, or at least the relevant portions of it; and interpreting how that information gets translated into well-being or disease. If you've heard about all the human genomes that have been sequenced so far, you probably think we've got the first problem licked.

In reality, 15 years after comple-

tion of the Human Genome Project, the world still has not seen a single fully-sequenced human genome. It turns out that the three billion letters that make up our genome are not uniformly easy to read—so while the vast majority of the human genome has been sequenced, sections remain indecipherable with the sequencing technologies of today. While we can make significant progress based on what we already know, we'll obviously need to be able to decode the whole thing to gain a complete picture of the exact DNA we possess.

Even when we know what's there, interpreting it remains the single greatest challenge for genomics in medicine today. Figuring out the biological function of each individual genetic variant is like solving a thousand Rubik's Cubes at the same time. Today's technologies of cloud services with giant data repositories and the growing capability of analytic tools make that possible, but still painstaking. But then scientists still have to figure out how all these ▶



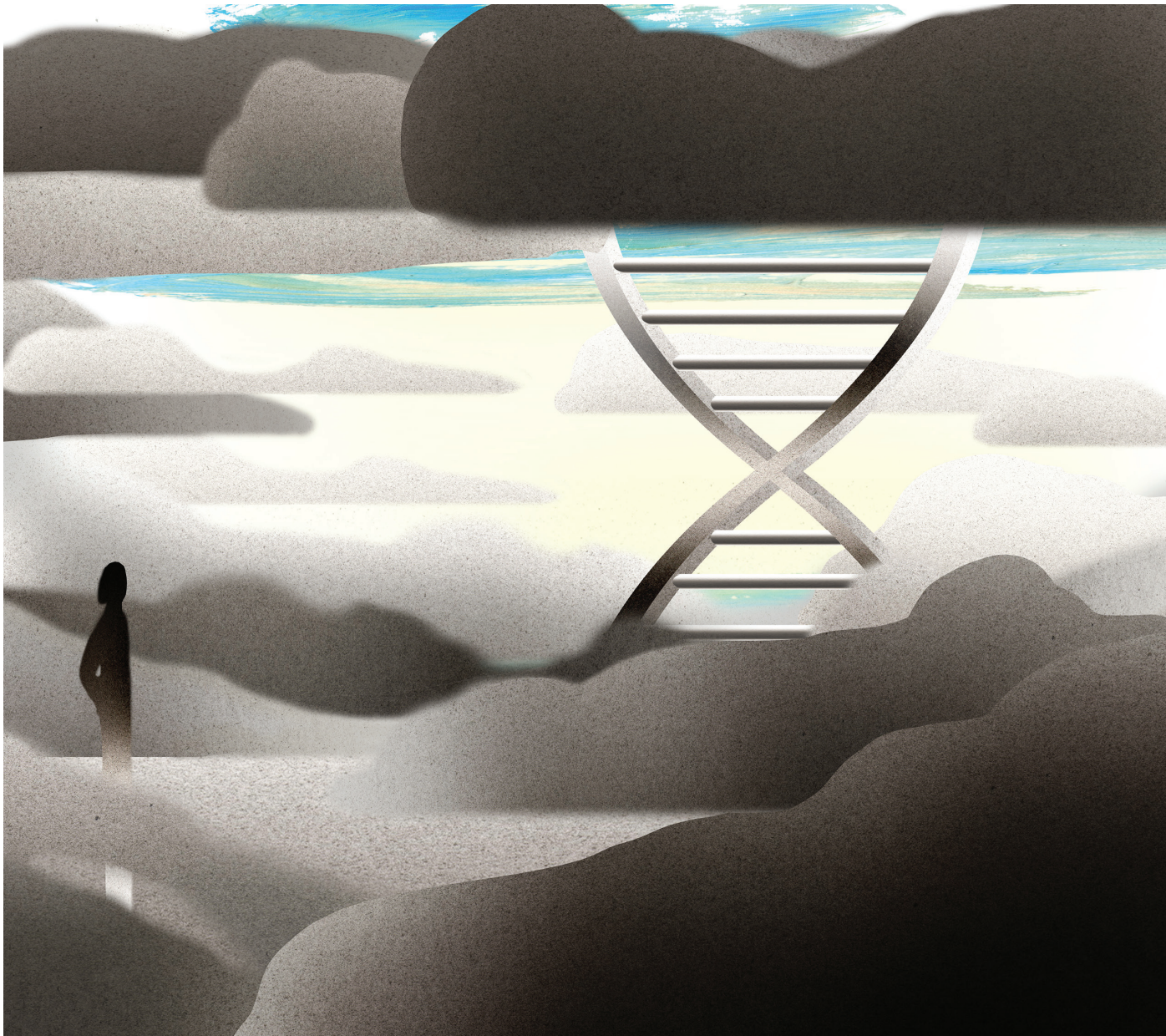
## Why We Still Can't Rely on Genomic Medicine

There's lots of progress, but we don't know nearly enough.

By Meredith Salisbury  
Illustration by Jon Han









variants work together, with any combination potentially affecting a person's health.

We are at the earliest stages of this transition to genomic medicine. Many of the discoveries made today will be refined or found to be incorrect later, so a lot of today's interpretations will ultimately be overturned. That may be hard for patients to accept. But regardless, it remains only a matter of time until a far more accurate and comprehensive version of genomic medicine becomes reality.

#### EARLY SUCCESSES

The low-hanging fruit in genome-based medicine was found in rare, often deadly, diseases. The genetic variants that cause such diseases are typically just as rare. So if you compare the genome of

of that size were inconceivable due to the then higher cost of DNA sequencing. Such research enabled a huge step forward in assigning biological functions to rare genetic variants—but scientists quickly found that they were generally not yielding unambiguous answers for common diseases, or for complex diseases that turn out to be caused by more than just one genetic variant.

#### ENCOUNTERING PROBLEMS

Though genomics has been a dedicated scientific field for decades now, researchers are still finding new genetic factors that influence disease. Every few years there's some unexpected discovery that not only explains a whole new set of genetic variants, but also reminds us how little we know about the inner workings of our code.

## Nearly 15 years after completion of the Human Genome Project, the world still has not seen a single fully-sequenced human genome.

an affected person to those of 100 unaffected people, the DNA culprit in these cases virtually jumps off the page. A number of rare diseases have been traced back to causative genetic variants, including Huntington's disease and Alport syndrome. For people with such diseases, a genetic test can provide a conclusive diagnosis and sometimes assist in finding a path for treatment.

These successes fueled the fire for genomic insights, and institutions around the world invested more resources to find the genetic causes of other diseases. This led to genome-wide association studies, in which correlations are sought between genetic variants and specific diseases by scanning the DNA of thousands or even tens of thousands of people. Only a decade ago, studies

To make useful advances, scientists have called for bigger studies. In some cases that means plumbing the depths of a far larger number of genomes. That's the rationale behind efforts like the Precision Medicine Initiative in the U.S., which has the goal of sequencing more than one million people. The concept is simply that if we compare enough genomes, otherwise hard-to-spot differences will eventually become obvious. A different approach is to study fewer people but get access to much more detailed data about both their genetic variants and their exact medical conditions. This idea gave rise to efforts like Health Nucleus, part of J. Craig Venter's Human Longevity, Inc. (see following story for an interview with him). For each participant, HLI conducts whole genome sequencing in

addition to many clinical tests, from brain scans to microbiome analysis and much more.

But most scientists agree that these approaches must be used together for maximum impact. At a conference, Venter told researchers, "We can't tell much more today about my genome than we could 15 years ago. We literally need millions of genomes."

Regardless of how much information such studies yield, though, correctly interpreting a set of variants in a given person's DNA will still not be straightforward. "There's a lot of subjectivity," says Heidi Rehm, director of the Laboratory for Molecular Medicine at Partners Healthcare Personalized Medicine in Cambridge Massachusetts. She has championed the development and implementation of better standards for clinical labs so analysts can generate more consistent interpretations. Nonetheless, she says, any time human judgment is a factor it's very difficult to control for variables.

#### WHERE WE ARE NOW

While the research community is quite familiar with the limitations on our ability to interpret genomes today, the same cannot be said for physicians or the public. And that is bound to cause problems.

Let's say, for example, that someone goes in for a genetic test to learn whether she is at increased risk of breast cancer. While the genetic analysis turns up hundreds of variants, none of them is known to be associated with breast cancer. The patient breathes a sign of relief and moves on with her life. But two years later, one of the variants picked up in her scan is found by scientists to be implicated in hereditary breast cancer. Now an at-risk woman is walking around thinking she's in the clear, while access to the revised scientific data might help save her life. How will the medical community handle this? With the crude medical record systems in use today, it is vir-

tually impossible to track the status of knowledge about all those variants over time and update patients when information changes. But this will be urgently needed during this time of great medical transition.

Then you have cases when scientists believe variants should be causing a certain disease, but they don't. No one knows this better than Rosalynn Gill, one of the first participants in the Personal Genome Project initiated by Harvard Medical School's George Church. Gill's genome scan in 2012 revealed a variant believed to be responsible for what's called Long QT syndrome, a rare and dangerous heart condition. She had no family history for it and so was skeptical of the finding, but PGP scientists urged her to get checked. A thorough exam concluded that she does not have the

syndrome. "We have a lot to learn," says Gill, a veteran in the genetic testing field who believes her experience will be repeated as more people get their genome sequenced. For a range of diseases, she adds, even when "the early reports of mutations [had] really strong associations—as more data rolls in, the associations [have] become less strong."

The technical explanation could be that the genetic variant is only somewhat associated with the disease, or that it is indeed causative but other protective variants can offset it. Or maybe the variant must work in conjunction with another variant to cause disease. There's also the possibility that the variant must accompany external factors, such as those from environment or diet, before disease onset occurs. We sim-

ply don't know. And this confusing set of possibilities could apply to the relationship between many genetic variants and medical conditions.

What we do know is this: when genomic medicine works, it works better than any other weapon in the arsenal. There are countless stories about last-resort patients with rare diseases or cancer whose lives have been saved or extended thanks to the use of genome-based information. But before we can get to the tantalizing future in which most patients see regular benefits, we need a lot more investment in research to gain sufficient scientific understanding of how the human genome works.

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

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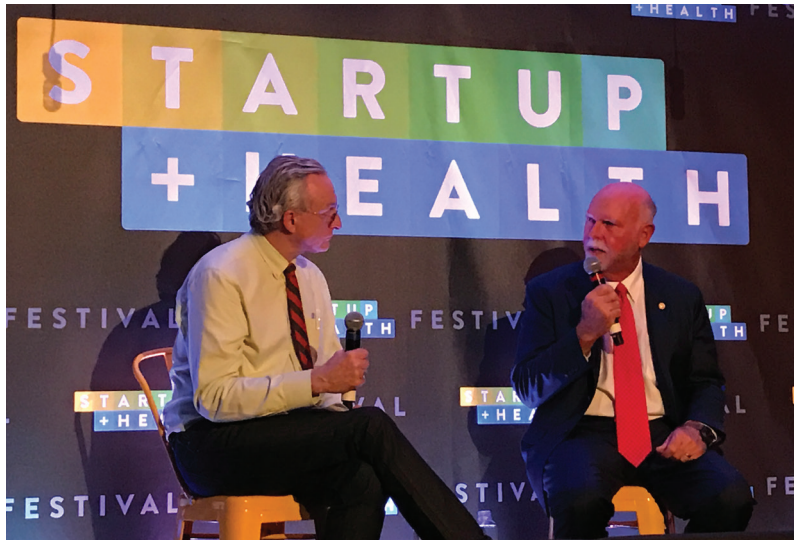
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# J. Craig Venter on Genomics, Cancer, and Longevity



*Techonomy's David Kirkpatrick (left) interviews Human Longevity Inc.'s J. Craig Venter at the StartUp Health Festival in San Francisco in January.*

J. Craig Venter is a key pioneer in genomics. In 1998 he founded Celera Genomics to sequence the human genome and to compete with the federally-funded Human Genome Project, which started in 1990. The two projects ended up announcing their results at about the same time, in 2001. Venter subsequently launched several for-profit and nonprofit efforts to continue advancing genomics research. In 2013 he cofounded Human Longevity Inc., based in San Diego, to help better interpret the proliferating genomic information. HLI aims to conduct the most thorough medical exams possible and then correlate that for each individual with a state-of-the-art genetic sequence. The aim, as more and more such exams accumulate, is to better understand what the genetic data means.

**Techonomy's David Kirkpatrick interviewed Venter on stage at the StartUp Health Festival in San Francisco in January 2017. Some excerpts:**

**Venter:** When we first sequenced the first human genome it cost \$100 million and took 9 months, using a \$15 million computer. And it wasn't replicable. The government spent about \$3 billion doing a shabbier version, and it was not replicable either. Not much has happened in the sub-

sequent 15 years, except incredible technology changes. Cloud and distributed computing changes what's possible. When the cost to sequence a human genome got below \$2,000, we started Human Longevity.

My genome has been on the internet for over 15 years. But there's not much understood about it or anybody else's, because we need really large numbers of genomes coupled with clinical and phenotype data [about a person's characteristics and their

interaction with their genes and the environment]. We set up our own phenotyping clinic called the Health Nucleus. It started somewhat naively, just wanting to measure everything we could. But it's turned into a radical change in medical discovery.

We're looking at the whole genome, the microbiome, 2,000 chemicals, complex MRI imaging of your brain, whole body measurements as well as cancer screening. We do CT scans of the heart, the intestine and

the lungs. All that in one eight-hour day. The data's really comprehensive.

The thing that surprised us is that about 40 percent of the healthy people that come in find out they're not healthy. They have cancer. Or they have major heart disease. They have brain aneurysms that they did not know about.

At the Health Nucleus, we've been discovering stage 0, stage 1, and some stage 2 cancer that is 100 percent treatable because we're discovering it at a stage where it hasn't metastasized yet. We discover a cancer and individuals know they have it for about a week. They have surgery and a week later they're cancer-free. Versus, you discover a cancer because it got big and it causes you pain. In the U.S. we get about 1.4 million new cases of cancer a year. Those people didn't get that cancer the day before. Some have had it for years, some for months.

**Kirkpatrick:** It must take a somewhat brave person to subject themselves to this if 40 percent turn out to have a major medical condition.

**Venter:** Knowledge is power. But it's interesting. Men come in two-to-one over women. I actually thought it would be the opposite, that more women would want to find something out early so they could do something about it.

Early screening is absolutely wonderful, and I'm a testament to it myself. With a new MRI technique we have in my own clinic, we diagnosed that I have late-stage prostate cancer, but it hadn't yet metastasized. I had surgery. And now two months later I'm cancer-free. It is disturbing when you learn you have something substantial wrong with you, so I understand that part of the fear. The counterpart of the fear is I'm now cancer-free.

We've also found several brain aneurysms. It's now an outpatient procedure to put a coil in and treat a brain aneurysm, but if you don't

know about it, you can't do anything about it.

**Kirkpatrick:** So you're trying to change the attitude of medicine towards prevention, and go radically early into the prevention business?

**Venter:** Exactly. Some physicians have been angry that we're screening healthy people. I say, "Well, how in the hell do you know they're healthy?" We have this primitive view of what health is. If you look OK and feel OK, you're deemed to be healthy. That's something out of the Middle Ages, but it's a view that's pervasive in the medical profession.

**Kirkpatrick:** You could have called it the Genetic Expression Institute or something. Why longevity?

**Venter:** Longevity's a catch-all, because we're looking at all diseases across the entire genome, and they're actually integrated. Our goal's not just to make people live longer, but to have a healthy life span. About 35 percent of males in the US and about 20 percent of females will not reach the age of 75. Two-thirds of the reason is cancer and heart disease. Both are detectable early. Both are predictable from the genome. Both are treatable early, so those are preventable deaths. That alone will significantly change peoples' longevity, by treating two-thirds of the reasons people die.

**Kirkpatrick:** How many people have gone through this thus far?

**Venter:** Well over 400.

**Kirkpatrick:** On the phone you said it didn't seem expensive to you, but 25,000 bucks for this exam is a lot of money, right?

**Venter:** We have two MRI machines, CT scanners, DEXA scanners. You have to have technical people that really know what they're doing. The interpretation of this data is really complex. We're doing it at a very thin margin.

**Kirkpatrick:** There are a number of other genetic-sequencing projects happening at more of a mass scale: for example 23andMe and the Precision Medicine Initiative, which aims to assemble genomic sequences of one million Americans. Do you see yourself competing with those?

**Venter:** It's like one-hand clapping. It's half the picture. Without the phenotype and the clinical data, the genome is useful for knowing what percent Neanderthal you are or for tracking populations. But if we're going to learn and go forward, we have to have all these new data. People pretend we can interpret the genome now. We're at the earliest stages of beginning to do that.

We're not trying to find a magic pill to make people live longer. We're looking at the reality of our physiology, the complexity of disease with every tool that's available, plus the human genome. We're trying to understand the genome and disease.

**Esther Dyson (from audience):** I'm curious about the non-medical data you're collecting—about the environment, behavior, and all the other stuff, because that contributes a lot to health risks as well.

**Venter:** We give people questionnaires. It's important to know whether somebody's a smoker or not. Environment plays a very key role, so we do try and record all those things.

We're not really measuring behavior. I know from my genome that I am very high risk for melanoma, but that doesn't include the trait of liking to be in the sun surfing and sailing all the time. That probably quadruples my risk.

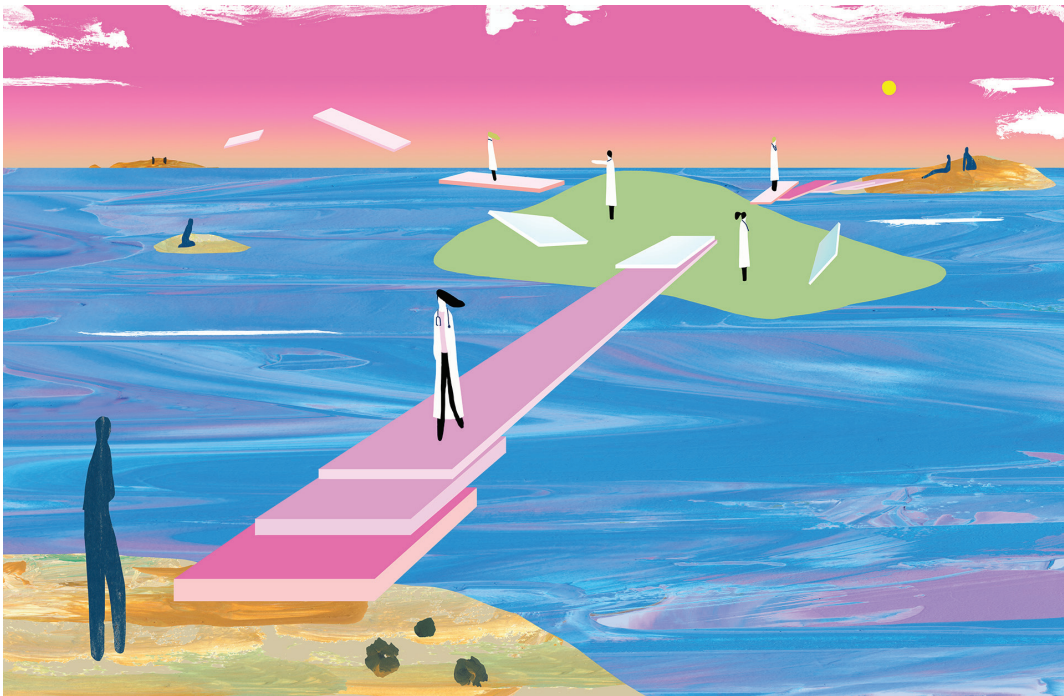
We can solve everything in the not-too-distant future that's nature. The genome will be predictable. Everything else is the environment. The environment is 12 orders of magnitude more complex. We're trying to start with the easy problem first.



Githurai in southern Kenya is known for its hot sun and high crime. About 11 miles away from the outskirts of Nairobi, much of Githurai is off the electrical grid. So residents typically don't have reliable access to lighting to help them feel safe at night, or clean water and energy to power healthcare systems round-the-clock.

In Githurai, if a pregnant woman needs to deliver her baby at night, she must travel to a medical facility with electricity more than 13 miles

away. Sometimes, the distance and the logistics are too great and minor complications turn serious—or fatal. So the community wanted to in-



## The Global Healthcare Revolution Will Be Technologized

By Ann Babe  
Illustration by  
Jon Han

Tech innovations are helping improve healthcare in places with few resources and immature health systems.



stall its own healthcare facility with 24-hour water and electricity. To do that, it turned to something Githurai already had: the sun.

Collaborating with Dutch healthcare innovator Philips, neighborhood residents and officials co-created a Community Life Center (CLC) that runs primarily on solar power. That energy supply is strong enough to refrigerate vaccines and medicines, run laboratory equipment, connect to the internet, and light the area.

As a result, the number of patients treated in Githurai has increased from 1000 per month before the CLC was installed in 2014 to around 4,000 per month—a 400 percent increase.

“If we want to strengthen the health system, then we need to start at the community level,” says Eddine Sarroukh, head of Philips Research in Africa, who adds that more than three-quarters of patient deaths occur in such local facilities. “We need to make sure that the access to primary care is in place, because that is the key for global development.”

The message is clear, then: globalized health care depends upon localized health care. So instead of endlessly shuttling patients, doctors, and supplies back and forth across long, sometimes unnavigable, and often dangerous distances, why aren't we doing more to apply exponential technologies to bypass them?

Besides solar-powered clinics, other technologies are also helping prove scalable change is possible in under-resourced facilities around the world. They include 3D printing, virtual reality, and new forms of telecommunications.

**To get to Gumdi**, Nepal from Kathmandu requires a long drive and can mean braving monsoon-induced mudslides and oftentimes impassable roadways. A disastrous 7.8-magnitude earthquake devastated the region in 2015, compounding the challenges of maintaining supplies and devices for the region's

basic health service, Health Post. Until recently, when Gumdi needed a replacement part to fix a medical suction pump, for example, it faced a three-week delay.

But then Chicago-based nonprofit Field Ready brought in a solar-powered 3D printer. Now it can model and print the part on-site in just one hour. Partnering with the World Vision International Innovation Lab and other humanitarian initiatives, Field Ready harnesses the maker movement to localize production in low-resource countries like Nepal, Syria, Kenya, Myanmar, and Haiti. It prints umbilical cord clips, IV hooks, tweezers, kidney trays, and replacement parts for broken medical and other equipment. It even can 3D print prosthetic hands.

“We're taking manufacturing and putting it where it's needed, rather than using a long supply chain that's expensive, cumbersome, and slow,” says Field Ready Director Eric James. “It's hyper-local manufacturing.”

According to James, supply-chain logistics eat up almost two-thirds of medical aid budgets. And manufacturing supplies locally saves costs not only in transportation, but also in actual production. In Nepal, for example, the device that doctors use to look inside people's ears, known as an otoscope, costs from \$35 to \$150. But the cost to 3D print one is only \$7, explains Field Ready innovation advisor Ben Britton.

“Humanitarian supplies made in the field build resilience in the system,” he says.

Another tool drastically shortening the supply chain is drone technology.

In Bhutan, Papua New Guinea, Malawi, and the Dominican Republic, Menlo Park-based startup Matternet is starting to use unmanned aerial vehicles to expedite the transport of diagnostics like pap smears and HIV and tuberculosis testing. Some of these countries have only a few testing facilities

nationwide, and it can sometimes take months to transport samples to and results from the lab. That delays urgent treatment and care.

Drones can bring that time down to less than a week, says Matternet cofounder and CEO Andreas Raptopoulos, and, in the not-too-distant future, as little as a day.

According to Raptopoulos, drones promise to be a “transformation technology for logistics,” because their efficiency creates a “leapfrog” effect, much as cell phones did in communications at the turn of the century. This translates into decreased cost and potentially widescale impact.

“The system is fully electric and the components are mechanically simple. Most of the complex things are in the software,” says Raptopoulos. “So you have systems that are much more cost-efficient than a slow truck on a bad road.”

Long distances inhibit not only supply-chain logistics, but also professional training and knowledge sharing. To remedy this, Médecins Sans Frontières (MSF) is tapping into telehealth and virtual reality technologies.

For its operations around the world, MSF uses VR to train logistics staff to build new modular hospitals, geeking out in state-of-the-art fashion by combining VR helmets and 360-degree visualization to create immersive experiences.

According to Elvina Motard, MSF's technical team leader, VR helps the organization “be operational faster,” by engaging staff with the hospital environment and teaching space-management skills before it's time to construct. And while VR speeds up construction, it doesn't compromise long-term sustainability: MSF's modular prefabricated hospitals take just three weeks to build, Motard says, but last at least 30 years.

“We want them to be deployed fast, we want them to be high quality, and





*Silicon Valley-based Matternet is testing its drones for medical deliveries in several countries, including here in Malawi.*

we want them to last long,” she continues. “Virtual reality technology is used on site to show the people how.”

After a successful pilot in the Philippines in 2016 with a 3D VR model, MSF is using similar technology for projects in South Sudan, Mauritania and Haiti.

MSF is also using telemedicine to connect more than 300 projects around the globe, however rural and remote, with the best specialized medical expertise at any time.

The organization’s remote platform, called Intersectional Telemedicine, fields about 200 clinical cases

a month, with the help of human coordinators like Daniel Martínez, a pediatric and vaccination advisor with MSF in Geneva. These coordinators analyze incoming medical questions, determine their urgency, and match them with a qualified expert (taking into consideration medical background, language skills, and understanding of the local context).

When an expert receives an alert, which Martínez says is “like a 911,” they then reply using the same platform within a specified timeframe.

This system not only saves the time and money of sending a physical team to each site, but MSF gets additional value from the data it aggregates. “We find out how to solve one case in one country, and it gives us a clue as to how to solve it in other places, too,” says Martínez. With this data, MSF can analyze which diseases are most in need of additional

expertise and can also improve guidelines for MSF support staff.

Field Ready, too, is working to build local knowledge and expertise. It’s focusing on increasing capacity in the many countries where it operates, by training community stakeholders how to use 3D printers in ways that make sense for them.

“We’re certainly not showing up with 3D printers and saying, ‘Look, isn’t this cool?’” says Director James. “Instead, we’re finding ways to help them sustainably maintain the projects they have.”

Rather than entering a community with preconceived notions of what it needs, James says, Field Ready partners with people on the ground to listen to their concerns and make an assessment, collaborating with them from the beginning.

“We believe there’s a huge human component to this. It’s about working with people,” James says. “We’re not just going out there to fix one thing; we’re training people in all of these different methodologies and technologies.”

Field Ready also hopes its solutions can help other communities around the world by ensuring any knowledge gathered is iterative.

**Technologies like artificial intelligence, remote robotic surgery, and microchips for on-site diagnostics will become central to health care in developing countries.**



*Nonprofit Field Ready is bringing 3D printers to resource-challenged regions to make medical supplies and repair*

*devices on demand. At top left, some of the parts and tools it can make, and printing underway in Haiti (left) and Sudan.*

To that end, Field Ready shares open-source electronic files of its 3D printing designs so that anyone can use, adapt, and benefit from them—and someday make a living. “We’re trying to support 3D printing to be a viable business here,” says Field Ready’s Britton from Nepal. “That’s the way it’s going to be sustainable.”

He says that when India shut down the India-Nepal border in 2015, it shut off Nepal’s lifeline. The blockade put millions at risk, leading to violent protests. “People were unable to get medical supplies just because of politics,” Britton says. “Imagine, though, if there had been 100 3D printers in Kathmandu.”

Back in Kenya, Philips agrees the “holistic” community-centered approach is paramount, says Sarroukh,

who is based in the company’s Nairobi research lab.

In addition to Githurai’s Community Life Center, Philips started to build one in Mandera, Kenya—a single county which accounts for 25 percent of the nation’s maternal mortalities. It also put one in Tadu, Democratic Republic of Congo. Philips plans to install others across Africa.

But before it does, it aims to talk with the people it’s trying to serve. Prior to building Githurai’s CLC, Philips assessed 17 different primary-care centers across the county to ask local community members what they wanted to see in their medical facilities.

Many said they needed more than just a healthcare center. They wanted a real “community hub,” says Sarroukh, that feels connected and safe.

So Philips designed the CLC with LED area lighting, an entertainment and media player, and space for social, sporting, and educational events.

In the future, other exponential technologies like artificial intelligence, remote robotic surgery, and advanced microchips for on-site diagnostics are likely to become central to health care in developing countries. But, with all of this exciting, sometimes dizzying, tech, it’s crucial not to lose sight of what matters most.

“It is about technology,” says Philips’ Sarroukh, “but it is also about community needs and making sure we are addressing the needs that matter.”

*ANN BABE writes about community, identity, and tech-enabled social change around the world.*



# How Private Data Can Reduce Public Uncertainty

By Diana Farrell

Statistics about consumer spending in response to health emergencies demonstrate how private sector resources can help inform public policy choices.

It's still early days for the new administration and, like its predecessors, staffers and the president are repeatedly facing new challenges and finding that they need to make quick yet thoughtful decisions. When I worked in the White House under President Barack Obama, we were in the midst of the recession and working tirelessly to find policy solutions that could right the ship.

Among the many challenges, perhaps the most frustrating was the lack of real-time, granular information to help us truly understand the difficult and varied financial decisions United States households were facing day to day. The information we had was outdated and often subject to significant revision, which made informed decision-making nearly impossible.

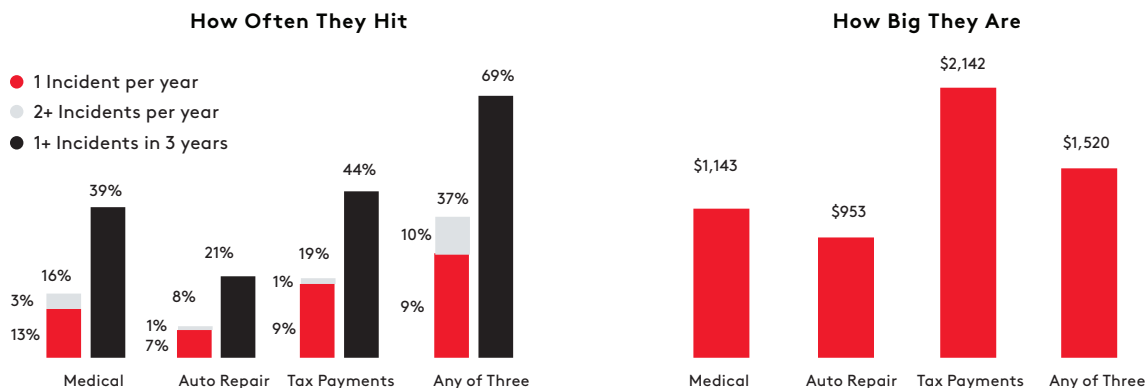
While the economy is in a better place now than it was in 2009, the need for on-the-ground intelligence about U.S. household finances has if anything only increased. And the private sector now is in a unique position to help, thanks in large part to the growing ease with which large amounts of data can be accumulated and analyzed with today's technology tools. Private institutions can thus

leverage their own resources and technology to help drive innovative financial solutions, better measure our country's economic pulse, and help guide effective policymaking.

Healthcare is an area where new insights are emerging. JPMorgan Chase Institute has consistently demonstrated the economic nuances that granular financial data can illuminate, and our research on the relationship between physical health and financial health is a telling example. While we might intuitively guess that major health challenges can have a significant impact on a household's bottom line, until recently we did not understand exactly how families manage the expenses associated with those challenges.

The Institute's recent report on

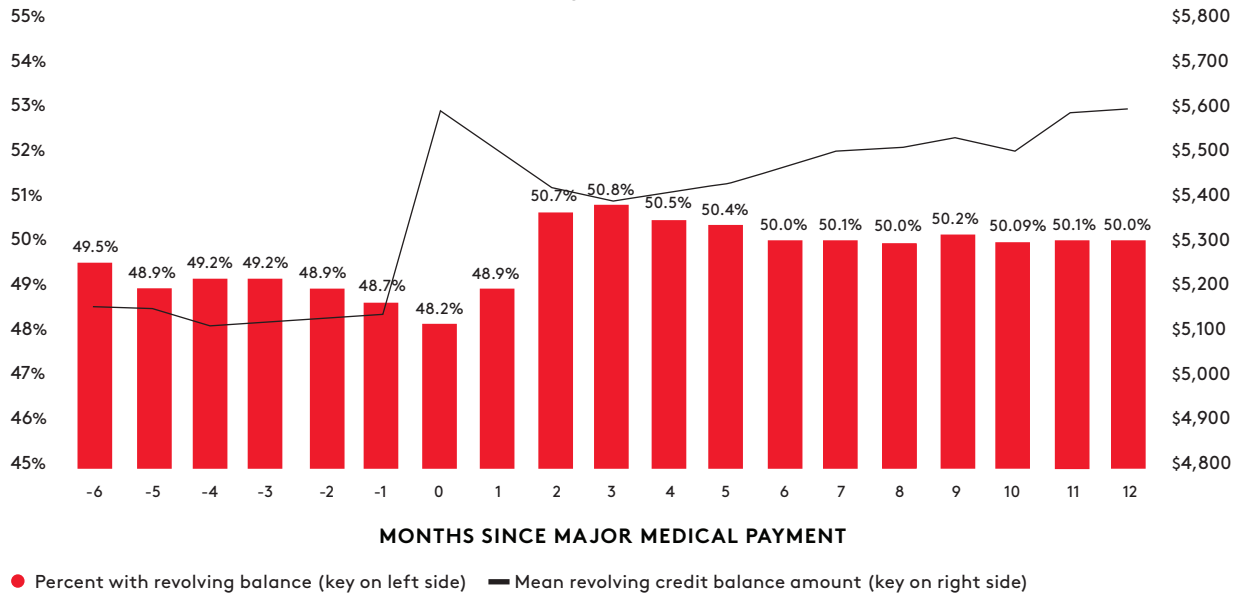
## EXTRAORDINARY PAYMENTS AND AMERICAN FAMILIES



Source: JPMorgan Chase Institute



WHAT HAPPENS TO DEBT AFTER FAMILIES GET HIT WITH A MAJOR MEDICAL PAYMENT



Source: JPMorgan Chase Institute

expense volatility revealed that almost four in ten people—particularly middle-income and older families—make an extraordinary payment of significant magnitude in any year. Healthcare payments stand out as one of the culprits (along with auto repairs and taxes), with families paying a median amount of \$1100 (see chart on facing page).

More surprising is the fact that extraordinary medical payments were more likely to occur in months with higher income. Total income was \$163, or 4 percent higher, in months with a major medical payment. The income increase stemmed mostly from tax refunds, rather than labor income, and represented a small percentage of the mean medical payment of \$2,089. These results indicate that people are either holding off on medical treatment until they have additional disposable income, or waiting to pay for the treatment. Making matters worse, 12 months after the medical payment, families still had not recovered financially, as the chart above on revolving credit

card balances indicates.

This level of detail on how U.S. households are managing against inevitable medical payments is critically important, as the nation's leaders evaluate policy changes that will impact how Americans access medical insurance. Separately, the American Bankruptcy Institute found that personal bankruptcies recently declined as healthcare coverage increased.

When responding to a physical ailment, Americans turn to their doctors for reliable and informed diagnoses. When responding to economic challenges or in developing policy, our leaders similarly should turn to data that provide a granular and timely view of the U.S. consumers' financial health to make the most informed decision.

For us at the JPMorgan Chase

Institute, gaining such insights is only the beginning. We are investing in our data assets to improve our understanding of the economy in many ways. We call upon other organizations to contribute their own unique data. By better understanding the actual world in which we live—and not the estimated, revised, or survey-based world—we can help our country's top decision-makers make more-informed choices for the health and wealth of the entire country.

*DIANA FARRELL is the founding president and CEO of the JPMorgan Chase Institute. Previously, she was Global Head of the McKinsey Center for Government and the McKinsey Global Institute. She served as Deputy Director of the National Economic Council and for President Barack Obama.*

Until recently we did not understand exactly how families manage the expenses associated with major health challenges.





Our days are soaked in data, and the virtual poses an ongoing challenge to the real. Imagery rushes at us incessantly from our screens, alongside the actual things we see when we look up. At many moments it's unclear which should most command our attention.

It's a fruitful context for art, if someone can grasp such slippery new realities. So discover the work of R. Luke DuBois—musician, visual artist, and data scientist. He reminds us, with alarm but also humor, that data is a blunt instrument, capable of telling lies as much as truths.

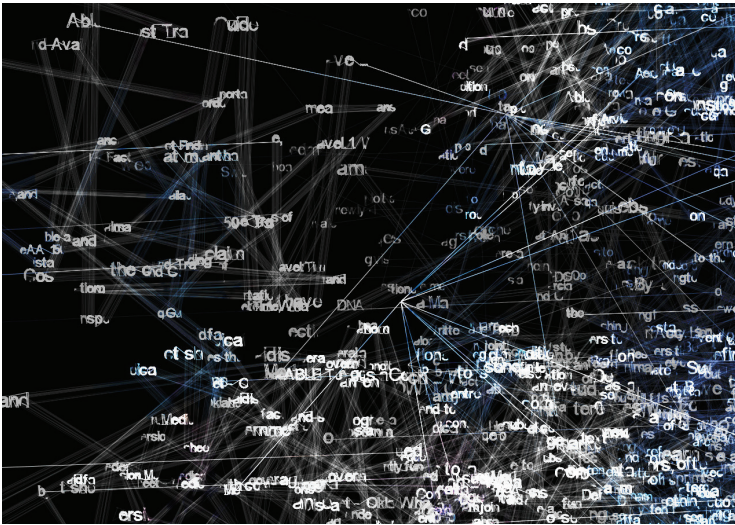
His one-person show in 2014 at The Ringling Museum of Art in Sarasota, Florida put him on our radar. It was a profusion of screens, singly and in multiples, along with prints and giant projected videos. Throughout it all was music. His work, in a dizzying profusion of forms, is comfortably immersed in our too-familiar digital world, yet frequently transcends it with visual grace and charm. (He exhibits his visual art at bitforms gallery on New York's Lower East Side.)



## R. Luke DuBois: An Artist Who Just Happens to Use Computation

This programmer/musician/visual artist makes work of unusual nuance.

By David Kirkpatrick



*The National Portrait Gallery commissioned DuBois to create this dual portrait, entitled **Sergey Brin and Larry Page**. These stills come from the two-screen video, composed entirely using Google's own tools after the company's cofounders refused to cooperate.*



For DuBois, data is like paint, something to be applied roughly or smoothly, deftly or clumsily, with exactitude or abandon. He aims not so much to tell essential truths as to point in the direction of subtle uncertainties that enrich us to ponder.

DuBois mapped the United States, labelling each town with the words most frequently used by people there to describe themselves on online dating services. He created a set of what looks like eye charts, based on the State of the Union addresses of American presidents. Each one's

most frequently-used words are in large type across the top, with their other words getting smaller down the page—a visual summary of each president and era. Another piece, about gun violence, puts an actual gun that was used in a New Orleans murder on a pedestal, connected to the network and programmed to loudly shoot a blank every time a murder is reported in whatever city it is being exhibited in.

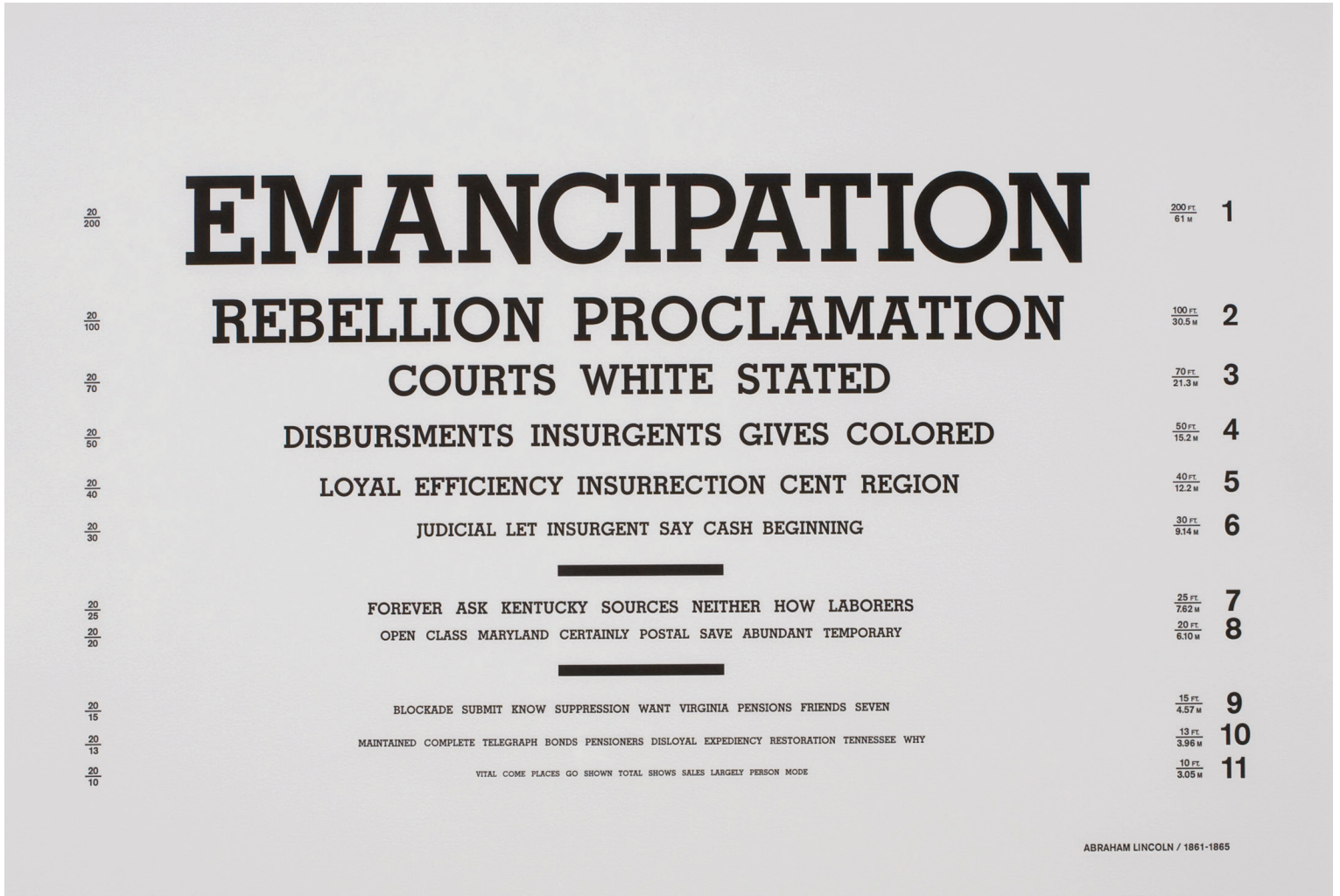
DuBois's videos and music undermine familiar notions of time. He worked with a performance artist

and shot a high-definition video piece in Manhattan's Union Square in 2007. The performer spent 72 hours in a set like a boudoir, beneath a canopy on a traffic island. She spent the entire performance going through the motions of getting ready to go out, but her movements were extremely slow. Then, in editing the resulting video, DuBois sped it up so her movements were compressed down to 72 minutes—about how long the actual process might take. The outcome has an ethereal unreality. Another piece shows us all the movies that won the first 75 years of Academy Awards for Best Picture, but speeds them up to only around one minute each.

How many artists can be found in engineering schools? Not enough. And yet that's where I visited DuBois not long ago. He teaches at NYU's Tandon School of Engineering in Brooklyn. It is unusual for its faculty of not just engineers, but artists, historians and sociologists. On the wide windowsill of DuBois's office sits a NeXT computer—the kind Steve Jobs created during his exile from the company he founded between his stints at Apple. The artist used it during his music composition Ph.D. at Columbia. He obligingly turns it on and plays some ambient music based on an old algorithm. The office also has a shelf filled with several hundred diverse and well-used LP records, and an old-fashioned turntable. DuBois is conversant in the languages of the present, but does not spurn what came before.

"I didn't study visual art or engineering, yet here I am," he says. "I'm a musician, but I've had a computer since I was nine. I asked my father for a bike and he was in an anti-bike mood. It was an IBM PC jr." He learned to program by sending away for magazines and holding them open on his lap while typing in code. His brother Doug, 15 years older and a successful art photographer since the 1980s, inspired him to go into





art. “A lot of my understanding of visual language—the idea that something is always more complex than it phenomenologically is—comes from my brother. A photo of two people sitting on a couch is never just two people sitting on a couch.”

That notion, combined with his easy familiarity with programming, enables DuBois to make art of unusual sophistication and nuance. He created a complex dual video portrait of Google cofounders Sergey Brin and Larry Page as the result of a prestigious commission from the National Portrait Gallery in Washington D.C. Each year, the museum it asks a major American artist to memorialize an important citizen

(or in this case, citizens). DuBois approached the two and said he wanted to video them while they read aloud a long poem about all the things a woman can lose—from keys, to her mind, to her virginity. Then he wanted them to answer questions about what it means to search for something. Finally, his software would conduct a live Google search based on their answers every time the resulting video was played.

The two executives balked. They said they had to have approval of the final cut, not something an artist would likely accept. “They freaked out,” says DuBois. “The National Portrait Gallery told me it was the first time this has ever happened. Even

Bill Gates sat for an oil portrait.”

As an alternative, he made a portrait using the subjects’ own tools. He downloaded videos of them from YouTube, owned by Google. He transcribed it using Google’s speech recognition technology, on an Android phone, its software made by Google. The final piece consists of two screens (see pages 50-51). One shows the two men speaking. Superimposed are images brought up by Googling the words they speak. On the other screen, a more abstract data visualization appears, created in part again from Googling their words.

“It is a critique of them, a little bit,” DuBois concedes. “But I did it that way in part because I think in the

COURTESY BITFORMS GALLERY, NEW YORK. PHOTO: JOHN BERENS

An image from a suite of prints entitled *Hindsight is Always 20/20*. They visualize, in the form of eye charts, a data analysis of the most-frequently-used words

in the State of the Union addresses of every president, here Abraham Lincoln. Words are sized based on the frequency of their use by each president.

This installation at New York's bitforms gallery in 2008 shows prints representing the words of, from top left, Presidents Calvin Coolidge, Herbert Hoover, Franklin D.

Roosevelt, Harry S. Truman, Dwight D. Eisenhower, John F. Kennedy, Lyndon B. Johnson, Richard M. Nixon, Gerald Ford, Jimmy Carter, Ronald Reagan, and George H.W. Bush.



U.S. we value wealth over invention. If the person on the street knows who Page and Brin are, they know that they founded Google and that they're rich. But they don't know they wrote a seminal research paper on how to categorize information on the web. We valorize the success, not the invention that led to it."

"We live in a big data, machine learning society, which is really a problem," DuBois expounds. "Large quantities of data and media assault us from all sides. We're swimming in it, so you might as well use it in your cultural stuff...I'm making art with the materials I'm commenting on."

Referring to his presidential eye charts, DuBois continues: "Imagine a

social studies class in 2025 where all they learn about a president is the top 20 words in their speeches, because that's all we have time for. You may say 'That's nuts, we'll never do that.' But that's where we're headed." Then, in a manner not unlike in his own art, he softens himself a tad: "And on the positive side it's an interesting way to look at the history of America through the rhetoric of its leadership."

He may be adept with digital tools, but he won't be defined by them. "I'm not really interested in working with the computer," he says. "I'm interested in a 30,000-foot view of things that people might not have noticed."

"I wish people would stop using the word technology incorrectly and

ghettoizing it," he continues. "Everything is technology. Music is technology, unless you're improvising a cappella in a fucking desert. My point is, you should be precise. Otherwise, it puts tech into a ghetto. It causes the community that does computer art to think of themselves as specialized vis-à-vis other fine artists. The code bros start thinking they're smarter. They're not. They just know how to type." It's the kind of thing we need artists to remind us about, amidst our sometimes oppressively connected world: tech is a critical tool, but hardly a virtue in itself.

DAVID KIRKPATRICK is *Technomy's* Editor-in-Chief.



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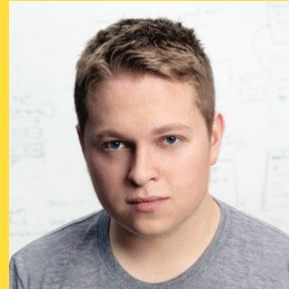
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