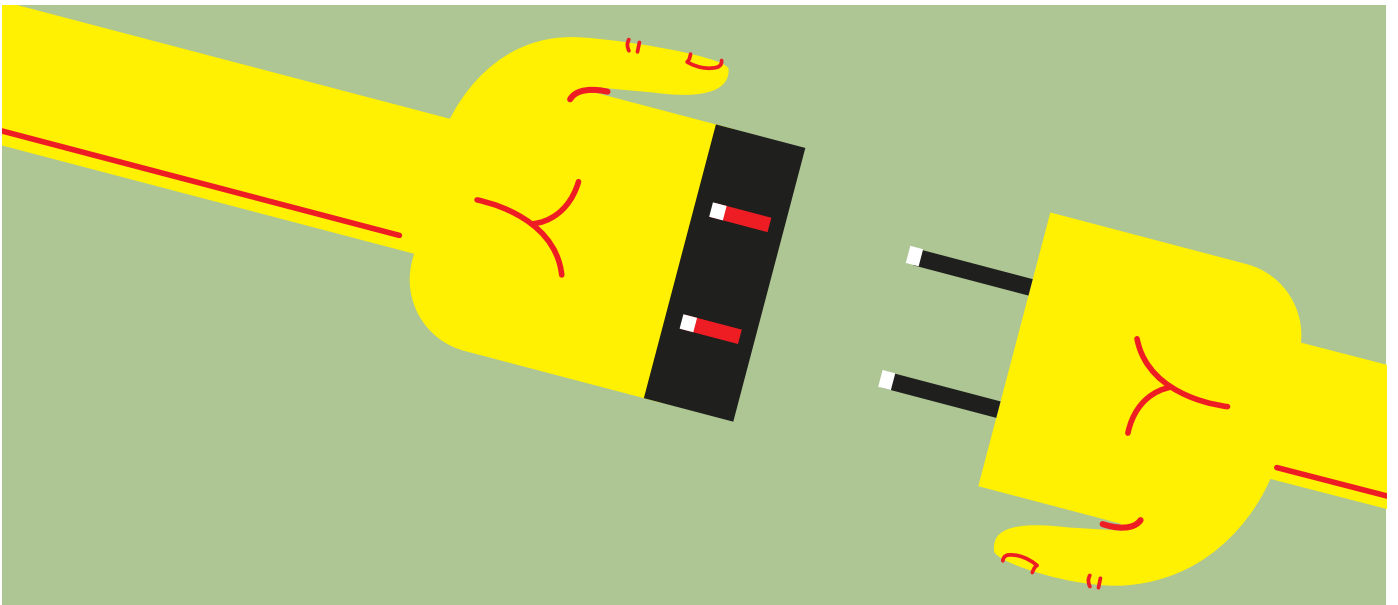
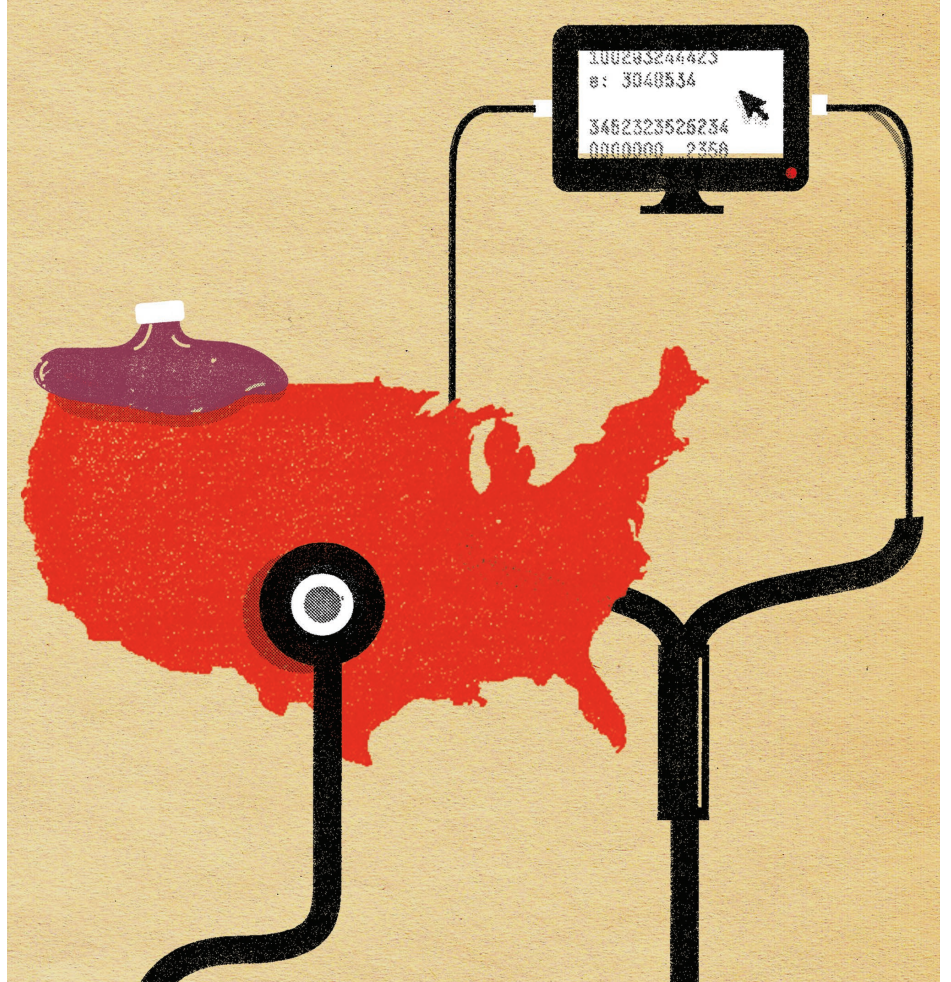
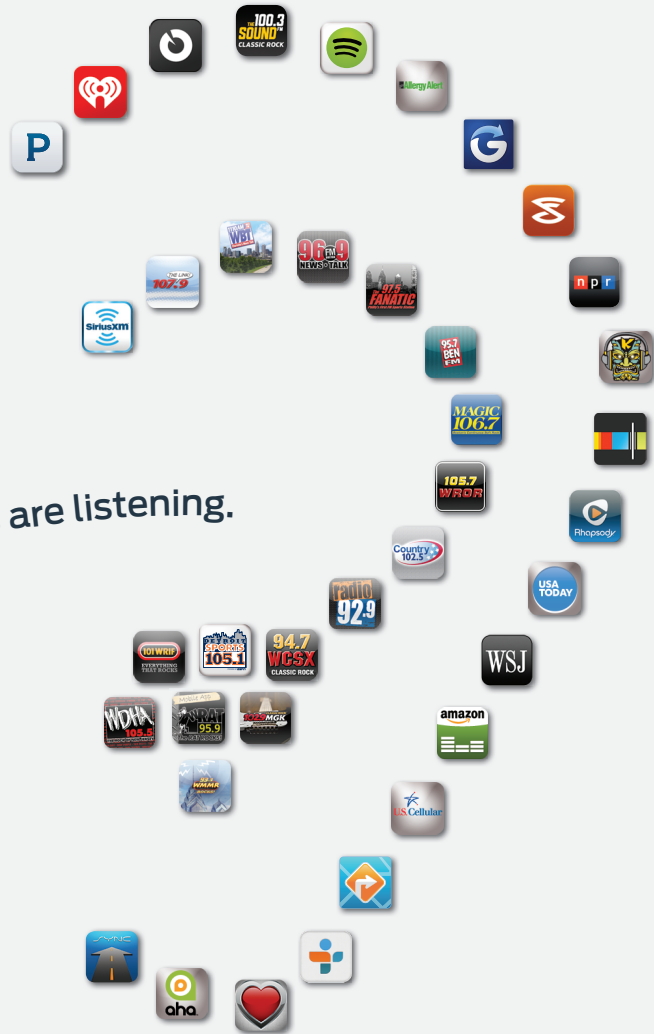


TECHONOMY

A REPORT FROM TECHONOMY MEDIA 2014





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Your apps are just a voice command away when you're in your **SYNC**® AppLink™* equipped Ford. You'll have hands-free, voice-activated control of a wide range of compatible apps. SYNC. Say the word. ford.com/sync

Driving while distracted can result in loss of vehicle control. Only use mobile phones and other devices, even with voice commands, when it is safe to do so. Not all features are compatible with all phones. SYNC® AppLink™ is available on select models and compatible with select smartphone platforms. SYNC AppLink is not compatible with MyFord Touch.® Commands may vary by phone and AppLink software.



Go Further



Techonomy Detroit resonated in the halls of Wayne State University.

Technology Is the Lever, a Better World the Goal

TECHONOMY AIMS to help leaders and citizens build a new society. The world has mammoth problems, but it also has an extraordinary resource in tech-driven innovation. We see technology as a potent lever to apply to our challenges—whether grand ones like the global economic divide, disease, illiteracy, building cross-cultural understanding, and climate change, or those close at hand like keeping our companies competitive and our communities cooperative.

Business is the engine of social progress. But those that abjure immersion in the tools of tech will struggle. Leaders must embrace the unsettling changes cascading tumultuously across society.

Photograph by Asa Mahat

Techonomy creates dialogue to help us all adapt. Our events bring together technologists and leaders from other sectors. The Techonomy 2014 retreat is at the Ritz-Carlton Half Moon Bay, California, on November 9-11, and our public Techonomy Detroit September 16. It homes in on U.S. economic growth, competitiveness, jobs, and urban revival. We host dinners and smaller events all year, as we seek ever to find new ways to convene and stimulate discussion that leads to insight and action. Our debut Techonomy Bio on June 17 at the Computer History Museum in Mountain View, California, explores how IT progress drives biological advances.

We publish articles and video at Techonomy.com, and as you can see, we still see a role for print. You'll find here highlights from our conferences as well as gems like Jack Dorsey's original drawings for Square. Aetna CEO Mark Bertolini gives his prescription for a renovation of health care; Zach Sims, the 23-year-old CEO of Codecademy, outlines the future of learning; Eri Gentry, a young bio-hacker and futurist, explains why she doesn't worry the Internet will draw us apart; and I look at Internet.org, the stunningly ambitious effort for global betterment spearheaded by Facebook.

We are entranced and energized by the opportunities before all of us. We hope you'll take away from this magazine a sense of optimism about the potential for progress in business and society, and new ideas for how to encourage it. Thanks to Ford for its support of this book.

David Kirkpatrick
Chief Techonomist



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Cover Illustrations by
Oliver Munday



FROM LEFT, David Kirkpatrick, Stewart Brand of The Long Now Foundation, Scanadu's Walter De Brouwer, and Ina Fried of AllThingsD (now at Re/code) talked after dinner about Silicon Valley cultures for innovation past and present at Techonomy 2013.



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Techonomy's staff pitched in as we moved to new offices on Manhattan's West 22d Street. FROM LEFT, Alex Cudaback, Josh Kampel, David Kirkpatrick, Tim Charters, Adam Ludwig, Simone Ross, and Ann Babe.





Trends, Triumphs, and Troubles

The Shareable, Connected, Measured City

■ Think of a city as an ecosystem of interconnected parts, itself part of a global ecosystem of cities and countries. Enhancing interaction among a city’s diverse economic participants becomes a critical factor for growth and improvement—government to citizens, buyers to sellers, students to teachers, financiers to innovators. Seoul, Korea, stands out for its efforts to create a culture of sharing, launching public awareness campaigns, business incubators, and sharing-friendly legislation. The tools to help citizens share a city’s resources are explod-

ing, as companies like Uber and Airbnb bring efficiencies to how we consume; new online educational and skill-sharing platforms change how we learn; the so-called maker movement democratizes who can produce things; and crowdfunding sites like Kickstarter and Indiegogo along with loan pioneers like Lending Club streamline how businesses and creative projects raise financing. Cities are also becoming measurable. We will increasingly monitor, map, and remediate pollution, water leaks, noise, traffic, and criminality. The “Internet of Things” distributes intelligence across the scope of modern life. Cities, and

all of society, become one big programmable, shareable system.

For My Data You Must Pay

■ With cameras and sensors increasingly ubiquitous, our own government routinely spying on us, and location-based apps growing in popularity, it may seem we simply have to forget about anonymity. Shouldn’t we get something in return for the information we reveal? Pundits like Jaron Lanier believe the data we agree to release could become a new form of currency. And consumers increasingly realize their data is worth a lot. The process has already

Tech is helping make our cities, like Seoul, shareable and programmable.

begun. Some auto insurance policyholders let their driving habits be monitored by in-car GPS in exchange for reduced rates. Many would likely also reveal personal behavior and dietary habits if it won them lower health insurance premiums.

Crowdsourcing as a Corporate Tool

■ “Most of the smartest people work for someone else,” Sun Microsystems co-founder Bill Joy famously said. Crowdsourcing allows them to work for you. The General Mills Worldwide Innovation Network (G-WIN) taps inventors outside the company’s ranks to solve product or packaging problems. A 24-year-old community college dropout won a G-WIN

GE teams with Quirky to solicit product ideas from “the crowd.” Their Spotter product monitors humidity, light, motion, sound, and temperature.





You can see where drones drop bombs with mobile social media app Instagram, courtesy of Dronestagram.

photos of drone missions on Instagram and Twitter. As far back as 2008 Israel texted Gazans during Operation Cast Lead, providing advance warning of aerial bombardments, and in 2012 the Israeli Defense Forces used Twitter, YouTube, and live-blogging to document an attack on Hamas guerillas in the Gaza Strip.

The Government Nuts Who Threaten the Net

■ The Internet bolsters growth and economic health, but many leaders seem to want to kill the goose that laid the golden egg. China, India, Iran, Russia, and others want the ITU to take Net regulation from nonprofit groups (most dominated by the U.S.) and hand it to governments. Turkish Prime Minister Erdogan blithely tries to turn off YouTube and Twitter. Putin attempts to seize sites where dissenters organize. EU legislators seek commerce-killing privacy rules. We all must work to insure the model remains openness, not a Great Firewall of Fear.

Contributors: Ann Babe, Adrienne Jane Burke, Alex Cudaback

open innovation challenge and \$18,000 by developing a “method of analyzing the texture of a chewy granola bar.” Collaboration between GE and crowdsourced consumer-products maker Quirky develops co-branded electronic products. And groups like Innocentive and Massolution issue public challenges to solve problems and develop products.

Tech Turns to Human Rights

■ Is Internet connectivity a human right? The tech industry thinks so, and innovators are focusing on providing other basic services as well. Initiatives like Internet.org, spearheaded by Facebook’s Mark Zuckerberg (see p. 34), aim to extend connectivity to literally everyone. World Wide Web inventor Tim Berners-Lee recently urged “every country to develop a digital bill of rights to advance a free and open Web for everyone.” Project Outernet, launched by a New

York-based nonprofit, seeks to give free quality content “to all of humanity.” Meanwhile, tech-centric startups are emerging to bring basic tools like eyeglasses, hearing aids, and financial services to all the world’s people. For example, Sana, based at MIT, is an open-source, cellphone-based platform that aims to democratize access to medical information and improve quality of care.

IT Makes Bio-Progress Go Exponential

■ In February, the British government announced it was seeking public comment on when (not if) patients should be allowed to create embryos with genetic information from three individuals, using in vitro fertilization. Why push a parental trio? Dr. Sally Davies, the UK’s chief medical officer, says people who have hereditary disorders like muscular dystrophy and epilepsy should still have the

right to have children. It’s an extreme example of the ethical and medical complexities emerging as progress in computing helps generate new knowledge about genetics and biology. There’s also serious talk about engineering glowing plants and cloning woolly mammoths. How many parents would it take to make a glowing mammoth?

Social Media Goes to War

■ Threatening our enemies may not have been what Facebook’s creators had in mind, but social media is now a tool of war. The Daily Beast reports that the CIA used Twitter, Facebook, email, Skype, and cellphone accounts to inform mid-level Syrian army officers that there would be consequences for using or transferring chemical weapons. In an effort to raise awareness about covert U.S. and British military strikes in Afghanistan and Yemen, a site called Dronestagram posts



CHONOMY



Techonomy's
David Kirkpatrick (l)
with Aetna CEO
Mark Bertolini



The Business of Revolution

At Techonomy's flagship retreat, we talked about how tech's progress is changing companies, countries, and individuals—for both good and ill.

THE SAGUAROS were vibrating outside the hall in Tucson during Techonomy 2013, such were the energy waves emanating from the stage. Or perhaps the foundation of business was shaking.

Giants of old industry are starting to think differently about how to conduct business, organize companies, and evolve products. This was evident when Techonomy's David Kirkpatrick sat down with Aetna CEO Mark Bertolini, who described his company's shift towards a tech platform for health, with tech subsidiaries separated from the traditional insurer. Bertolini's personal story is astonishing. He broke his neck in a skiing accident and almost died, and separately spent many months caring for his seriously ill son. This gave him a direct view into the system, which allows him now to bring a consumer's frustrations and insights to the table. (For his views in detail, see p. 30.)

Shortly after that session, we heard from Ford CMO Jim Farley, whose thinking about the role of social marketing, collaborating with customers, and turning the car into a platform for new experiences turned many heads in the audience. (For that conversation, see p. 16.)

One theme that emerged repeatedly was the pace of change



LEFT: Alex Ljung of SoundCloud

TOP RIGHT: From left, Gary Bolles of eParachute, Paperless Post's Alexa Hirschfeld, Ericsson's Vish Nandlall, Facebook's Cory Ondrejka, and Paul Zak of Claremont Graduate University **BOTTOM RIGHT:** From left, David Kirkpatrick, Tim O'Reilly of O'Reilly Media, Max Levchin of HVF LLC



in biotechnology, with progress in genomics accelerating even faster than Moore's law, according to several speakers. Stewart Brand, whose tech pedigree stretches back to the earliest days of the PC (and his *Whole Earth Catalog*), believes that the disruption coming from synthetic biology will perhaps supersede even that from the Internet. An astonishing late-night session brought Brand together with serial tech and medical entrepreneur Walter De Brouwer and veteran tech journalist Ina Fried to discuss the ethos of entrepreneurship and innovation and how it's changed over time. De Brouwer explained the key role, in his opinion, of disrespect and disobedience in creating new value in society. Fried noted that tools like Wikipedia support the notion that many non-experts collectively know more than a single expert.

Zappos CEO Tony Hsieh anchored an afternoon devoted to the changing role of cities. He explained the ways he is conceiving of Zappos' evolution in the context of its hometown Las Vegas. Hsieh says culture in a company is much like community in a city. He is placing one within the other so that benefits flow both ways. Zappos employees are now ensconced in the former Las Vegas City Hall in the once-neglected downtown district. He's investing in small businesses, tech startups, health care, and educational institutions with the aim of catalyzing a zone of creativity that benefits all the participants, including the company and its employees.



01



05

08 09





03

DEBATE IN THE DESERT

For two intense days outside Tucson, Technomists exchanged and debated ideas as we all educated one another about the scope of tech-driven change.

- 01 Cisco's Carlos Dominguez
- 02 RISD President John Maeda (now at Kleiner Perkins)
- 03 Cyriac Roeding of Shopkick (center) and author Andrew Keen
- 04 ZZ Ward performs with guitarist Matt Roberts
- 05 FROM LEFT, Stephen Messer of Collective[i], Felix Ortiz of Viridis Learning, Shell's Hans Haringa, and Angela Kapp of KappCorp.
- 06 Author Nadira Hira
- 07 Reputation.com's Michael Fertik (!) and Bloomberg Beta's James Cham
- 08 James Manyika of McKinsey
- 09 Quirky's Doreen Lorenzo
- 10 FROM LEFT, Globant's Guibert Englebienne, Louise Conroy-Callagy of Net Power & Light, and Todd Cochrane of Geek News Central



04



06



07



10

MIT's Tom Malone explained the results of new research at his Center for Collective Intelligence that finds that the most productive and creative groups are those where people speak roughly equally and where women play a big role. Even more unnerving to men, Malone's research suggests that the more women in a team, the more effective it is. Similarly, Rhode Island School of Design President John Maeda explained why artists need to work with STEM folk.

Our closing session with Tim O'Reilly and Max Levchin took on the biggest topics. Levchin said, matter-of-factly, that we would obtain immortality, probably by about 2050. What more eludes him is how innovation will progress in the interim, though he's got some extraordinary ideas, and has lost his former pessimism (shared with his PayPal co-founder Peter Thiel) about the scope and ambition of modern entrepreneurialism. He thinks we're getting better at targeting the biggest problems. O'Reilly was also extremely optimistic about the opportunities for tech to foster social progress, though he worries about disruptions from political and religious forces in the U.S. and worldwide that may slow things down.

This is just a taste of what 250 participants found in the desert outside Tucson. We resume November 9-11, 2014, at the Ritz-Carlton Half Moon Bay south of San Francisco. The issues get tougher, but as they do the value of convening together to understand the best way forward grows greater and greater.



What is really going on is a change in the nature of work that needs to be performed, and how people need to do the work.

—Jim Stikeleather, Dell



Cities and metropolitan areas are starting to understand themselves as actors and problem solvers.

—Jennifer Bradley,
The Brookings Institution



When you have a bunch of people that are happy, living in communities, being productive together, you have a different world than the world we are in today.

—Mark Bertolini, Aetna



In the Internet, things can happen so fast, at such high scale, that I believe no country has really prepared itself to be able to deal with a disruption that affects the entire country at once.

–Craig Mundie, Microsoft

What you really need for a group to be collectively intelligent is to have a bunch of people in the group who are socially perceptive.

–Thomas Malone, MIT



FROM THE STAGE AT TECHONOMY 2013

We chose the three Cs of collisions, commuting, and co-learning, because we wanted something that could be replicated to other communities and cities.

–Tony Hsieh, Zappos

I love the idea that I’m working on something that is a direct counterpoint to the irresponsibility, lack of transparency, density, and BS of the “too big to fail” universe.

–Max Levchin, HVF LLC



Genes have been swapped for 3.8 billion years. In your and my body at this moment, by the hour, genes are being swapped amongst all of our microbes. That’s what they do for a living.

–Stewart Brand,
The Long Now Foundation

Things are getting incredibly cheap, accessible, and people are more and more interested in being an active participant in their own health or even in manipulating cells.

**–Eri Gentry,
Institute for the Future**





Ford's Data-Driven CMO on Mobile, Newsrooms, Tesla, and More

Jim Farley of Ford joined David Kirkpatrick onstage at Techonomy 2013 in Tucson. Farley leads Ford's drive to connect more closely with customers, and serves not only as Ford's chief marketing officer, but also as chief of its Lincoln division. We've edited the conversation. For video and full transcript, go to www.techonomy.com/ford.

KIRKPATRICK: Data is a theme endlessly repeated in tech. How does it change what you do?

FARLEY: On one hand, data makes us better marketers—more targeting, looking at trends, and much better revenue managers. But there's a whole piece of consumer data we haven't figured out yet. Think about what privacy means for a car company, when I know where you go and how you drive. There's a responsibility to consumer data we have to think through.

KIRKPATRICK: If you can navigate that right, ultimately you might get to a co-creation point, where customers are helping you and you are helping them, not only day-to-day, but in terms of what you build next, and you build a community that includes you and them.

FARLEY: I remember meeting Steve Jobs many years ago, and he basically said, not as politely as this, "Why do I have to step back so far in time when I get inside a car?" If we figure out the connectivity issue and bring in applications from the cloud, we

can actually build an experience of operating a car that's connected to your social graph. It's informing you about how to operate the car efficiently and effectively. You can foresee a really different experience of owning and operating a car. And a dialogue with the company that's constant. The million-dollar question is, "Will we as an industry try to monetize that, or will we serve the customer?" The great companies, I believe, build apps just to help the customer. They figure out the monetization afterwards. But as a big company, our tendency is to figure out how to monetize that process immediately. That's the journey we are all going to figure out together.

KIRKPATRICK: By 2019 it's predicted there will be 5.6 billion smartphones in the world, meaning all your customers will have them.

FARLEY: The most fundamental thing for our industry is that most people's lives are on their mobile device, and when they get in a car they expect everything—all the data

and all their apps—to run perfectly. But it's not that simple, because some mobile ecosystems are closed, others are open. There's going to be a whole transition in our industry over the next several years. You spend a lot of time in a car, and most people want to be more efficient than they are today.

KIRKPATRICK: Talk about marketing. How good can targeting get?

FARLEY: We have to have different talent. We are going to a whole new level of targeting. The digital media companies—Google, Facebook, Twitter, Instagram, Pinterest, LinkedIn—are evolving their targeting mechanisms. The challenging thing for a marketer is that each of the platforms is different. So how do we, as a company, figure it all out? On Twitter the way to find out if someone is shopping for a car is different than it is on Facebook.

We need a publishing strategy. We can't have campaigns like we used to. We need a newsroom. If something happens in the Philipines, we have to tell what's relevant to Ford and how we're helping. It means a whole different rhythm. The digital advertising model is always on. It's very different than the campaign model we used with radio and TV.



Ford's Farley says mobile tech changes everything for the auto industry.

KIRKPATRICK: I want to throw out one word and see how you react to it: Tesla.

FARLEY: Way to go. There's a lot to appreciate. All of us in the car business want everyone to love the driving experience. The experimentation on the distribution model, how they sell and service the products—it's fantastic. For us as an industry, electrification of the powertrain is one of the most fundamental changes, along with the mobile economy. We're all experimenting. Last month we sold 3,500 plug-ins. Not battery-electrics or hybrids, but plug-ins. We're about 35 percent of the U.S. market.

That's exciting. But there's a fundamentally different relationship with the consumer when your car is electrified. You want to be smart about when you charge it, because electricity rates change during the day. So all of a sudden, apps become super-important.

AUDIENCE QUESTION (ARUN SUNDARAJAN OF NYU): What is the right level of engagement with your consumers, especially for brands that are used to being high-end or exclusive?

FARLEY: Luxury in the past has been kind of an elitist idea, but that's changed. Everyone should expect great design. The democratization of

technology should be an expectation. I look at engagement the same way. As a brand, there's nothing more important and exciting than a consumer who cares enough to share their ideas and interact with you. It's hard to believe, but someone who's satisfied isn't any more loyal than someone who is dissatisfied with your brand. But someone who is engaged with your brand is twice as loyal as someone who is not engaged. You want to make sure that engagement fits the brand. So a 24/7 concierge fits the Lincoln brand. We want a one-to-one relationship, like a tailor. It's a very old idea of retailing. It's going to take us a long time to get there.



David Kirkpatrick looks on from the auditorium at Wayne State University.

OUR MOTOR CITY MEETING

FOR THE
SECOND YEAR,
A SPIRITED
PUBLIC
DISCUSSION
ABOUT U.S.
COMPETITIVENESS,
JOBS,
GROWTH &
URBAN
REVIVAL
IN A CITY
THAT
COULD USE
ALL OF
THE ABOVE





TECHONOMISTS gathered in Detroit to discuss how technology and innovation can bolster the American economy and its cities, especially hard-hit ones like Detroit. The 650 participants spent a day at Wayne State University in plenary and breakout sessions focusing on competitiveness, jobs, economic growth, and urban revival. We see Detroit as a testbed for change. How we do there will be a litmus test for our entire economy's transition to a digital age.

The city's crumbling factories and burnt-out neighborhoods attest to the challenges. But onstage at Techonomy Detroit, we only saw energy and determination. Michigan Governor Rick Snyder, recently returned from a trip to China, said that country may prove a key partner in reviving Detroit.

Dan Gilbert told participants that in Detroit, demolition must come before building. He considers ridding the sprawling city of rampant architectural decay to be the crucial next step towards saving it. Gilbert's companies, alongside others, have turned downtown into a vibrant hub for tech entrepreneurship.

Numerous speakers noted that technology in the hands of individuals can go a long way toward reviving our cities and growing our economy. Twitter co-founder Jack Dorsey talked passionately about the

TOP: From left, David Kirkpatrick, Jack Dorsey of Twitter and Square, Scott Moloney of Treat Dreams, Michigan Citizen's Catherine Kelly, and Grow Detroit's Alex Southern.

BOTTOM LEFT: Wayne State University's Jocelyn Benson (l) and Josh Linkner of Detroit Venture Partners

BOTTOM MIDDLE: From left, Susan Lund of McKinsey, University of Michigan's Joel Tauber, Dow's Carol Williams, and Felix Ortiz of Viridis Learning

BOTTOM RIGHT: From left, Edward Luce of The Financial Times, Dan Gilbert of Quicken Loans, The Brookings Institution's Bruce Katz



power of entrepreneurship, on a panel with local business owners. His company Square simplifies the process of accepting payment on a smartphone or tablet, and has enabled \$174 million in transactions for 5,500 Detroit businesses. (See p. 28.) Another easy-to-use technology is Baxter the robot, which costs \$22,000 and helps small manufacturing companies. As Baxter's inventor Rodney Brooks of Rethink Robotics explained, it's a tangible symbol of both opportunity and challenge in the new economy. "We need to get more smart people building things," said Venture for America CEO Andrew Yang, summarizing the conference's theme.

One plenary session addressed the "maker movement." "Tools for innovation have been rapidly democratized," said Ford's open innovation guru Venkatesh Prasad. "Somebody can walk into a space, think of something, get on the Internet, and get all the tools they need to take an idea to a pretty good working prototype." Etsy CEO Chad Dickerson said the movement "is about man taking over the machines again and being empowered." He foresees makers altering the shape of more and more industries.

Techonomy returns to Detroit this September 16. We've found a warm welcome from the business and technology communities there, especially from the growing network of local entrepreneurs. And we sense a growing passion to help Detroit and a deepening national sense of urgency about how to better craft policies to generate growth and employment in a rapidly changing world.



With 3-D printing, you actually enable people to become product entrepreneurs and create products all over the world for direct global access. So anybody can be an entrepreneur.

—Marleen Vogelaar, Shapeways



When I think about the maker movement, it is about man taking over the machines again and being empowered. In Etsy's case, being able to reach a global marketplace with your goods.

—Chad Dickerson, Etsy



I like to challenge the thought of the CEO being the person that's the catalyst for the change. Where are the radical people? Where are the people who are going to CEOs and changing *them*?

—Marlin Page, Sisters Code



There are 7.9 billion people on Earth. That means 90 percent of the consumers are outside the U.S. If we think about growing businesses with just a U.S. focus, we are really missing the people who are there to buy our products.

**–Nilmini Rubin, U.S. House of Representatives
Committee on Foreign Affairs**

**It's a global economy.
Let's embrace investment
from other parts of the world,
whether it be China
or someplace else.**

–Rick Snyder, Governor, State of Michigan



**FROM THE STAGE AT
TECHONOMY DETROIT**

Any time we see progress and innovation, we're going to see a road littered with tries that maybe didn't work out so well. So failure has to be an option. Embrace that and move forward boldly anyway. Be fearless.

**–Jean Case,
The Case Foundation**



**A lot of our conviction
and our practices around
entrepreneurship come from the city.
You see it in the people walking the
streets and working at these
businesses. It's just collecting
that energy together and doing
something with it.**

–Jack Dorsey, Twitter & Square

**We cannot let the
city's fiscal challenges obscure the
fact that it has tremendous
assets and that there are plenty
of opportunities for
worthwhile investment.**

–Bruce Katz, The Brookings Institution





TECHONOMY LAB 2013



TECHONOMY GOES TO SILICON VALLEY

The Internet of Everything



SKIN-LIKE
electronics

FROM LEFT,
O'Reilly Media's
Jon Bruner, Frank
Chen of Andreessen
Horowitz, IBM's
Kerrie Holley,
MCI0's Dave Icke,
and Trae Vassallo
of Kleiner Perkins
Caufield & Byers

at Techonomy's First Lab

TECHONOMY DOESN'T just do big honking conferences. We are also starting to convene more focused, shorter conversations. Our first such event, presented in partnership with Cisco, Ericsson, and Ford, was on the Internet of Everything, aka the Internet of Things. It was held on a brisk afternoon last May at SRI in Menlo Park, California. In talks and panels, we explored how intelligent connected devices, often including sensors, are moving into literally every sector

of life and society. Such sensors are going on our wrists, in our kitchens, and into everything from cars to chemical plants.

Many speakers waxed rhapsodic about smartphones as a key tool for the coming era. "What can you do if you have an on-body mainframe and an on-body network?" asked Gordon Bell of Microsoft, one of tech's great innovators. "The on-body platform is turning out to be the smartphone. Smartphone is a mainframe

for everything now, and people are putting other devices around that, like for health monitoring." Added Alex Hawkinson, CEO of consumer connected device company SmartThings: "People expect to be able to remotely control everything in their life from this device."

Kerrie Holley of IBM Research talked about the Internet of Everything as the logical next stage of a half-century long cycle in computing. It started with tabulating machines, then

OUR LAB SPEAKERS ON THE INTERNET OF EVERYTHING



The opportunity is to bring the power of the Internet and the connected world to bear in the smallest and simplest of connected objects.

—Alex Hawkinson, SmartThings



These connections are going to be very, very fast, so a dumb device plus connection equals a very intelligent device. We're in for a wild ride for sure.

—Dave Evans, Cisco

It's the whole ecosystem together—hardware, network, and a cloud storage solution that analyzes data and takes action on it. You need all of those pieces together.

—Frank Chen, Andreessen Horowitz



led to programmable computers, and now is moving to cognitive, sensing computers. “We see three worlds coming together,” he said—the physical world of things, human beings, and the digital universe. Rob Chandhok of Qualcomm put it similarly: “The next level is going to be a blend of the cloud, big data intelligence, and smarter and smarter things, near you, that talk to each other.” At the other end of the spectrum, one speaker explained how such technology

will even enable putting inexpensive sensor satellites in space, transforming weather prediction and numerous other activities.

Industries will become radically different and in some cases converge as the diverse new sources of data mature along with the tools to analyze them. “You can reinvent standard business practices very quickly,” explained Geoff Hollingworth of Ericsson. “The most obvious case is insurance and risk manage-

ment... you’re measuring risk, right? Now you can actually have units in the car. I can charge a lower premium for people, because I know they are safer.” Vijay Sankaran of Ford said the automobile industry is another one where such changes will be profound: “We’re just at the beginning of moving from an automotive company to an automotive technology company. The key disciplines going forward are going to be software, data sciences, and connectivity.”



We want to get rid of friction. Where is friction? People. People do not want to be disrupted. That’s really the thing that’s going to limit us.

—Gordon Bell, Microsoft



How do you think about where information goes and who you want to share it with and when?

—Cory Ondrejka, Facebook



I studied mechanical engineering and I finally feel like my day has come, because building connected devices kind of seems like the latest and greatest new thing.

—Trae Vassallo,

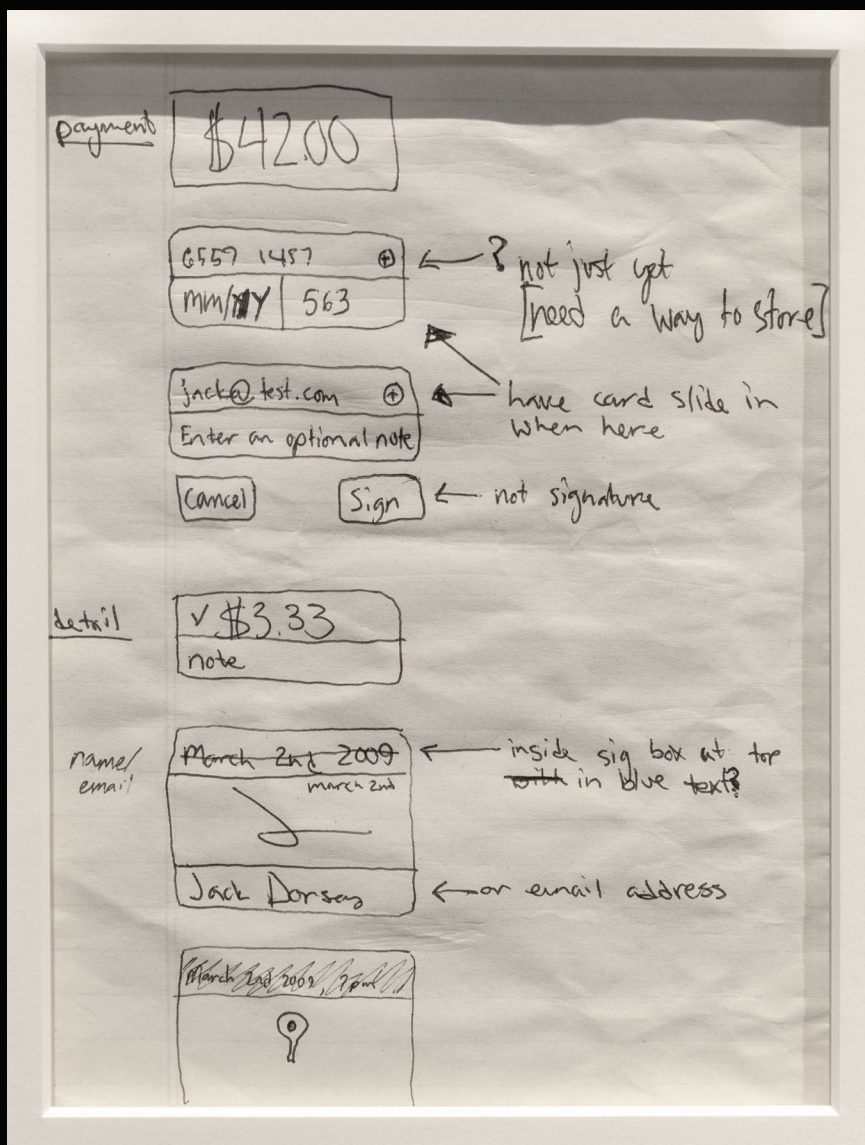
Kleiner Perkins Caufield & Byers



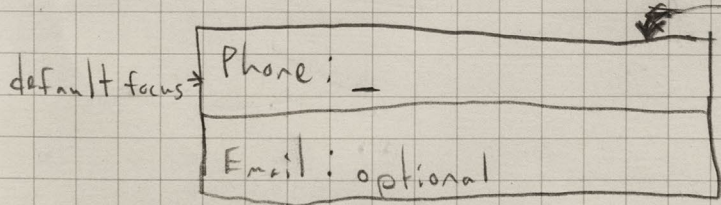
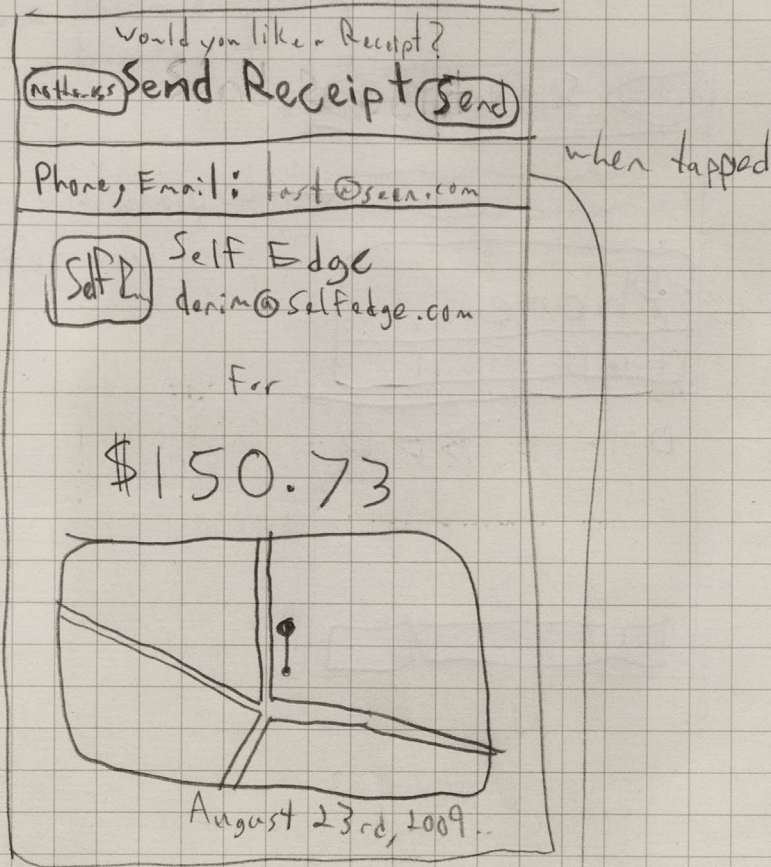
Dorsey's First Square Scribbles

IN FEBRUARY 2009, Jack Dorsey had recently departed from Twitter, which he co-founded. But he was already getting excited about his next idea. When his longtime friend Jim McKelvey, a glass blower from St. Louis, lost out on the sale of a \$2,000 piece of glass art because he was unable to accept credit cards, together they realized that their powerful smartphone devices should be able to process credit cards.

So Jack sat down in his apartment with engineer Tristan O'Tierney and drew a series of rough sketches to show how a smartphone credit card app might work. Over that year, he continued elaborating his vision with more drawings. These are the earliest written blueprints for what became Square—a mobile payment system that would enable everybody with something to sell to accept credit cards, whether a mega-company like Starbucks (which now uses Square) or a kid selling lemonade on the sidewalk. Like Twitter, it was a tool for empowerment, or as one of Dorsey's friends says "a democratization machine, like all of Jack's ideas." In addition to the software, Square created a special credit card reader that is inserted into the headphone jack of a smartphone or iPad. The service first became publicly available in October 2010. These drawings are now displayed in Square's San Francisco offices.



This Dorsey drawing from February 2009 illustrates how the smartphone interface might reflect a payment, as a user swipes a card, confirms a purchase, and signs.

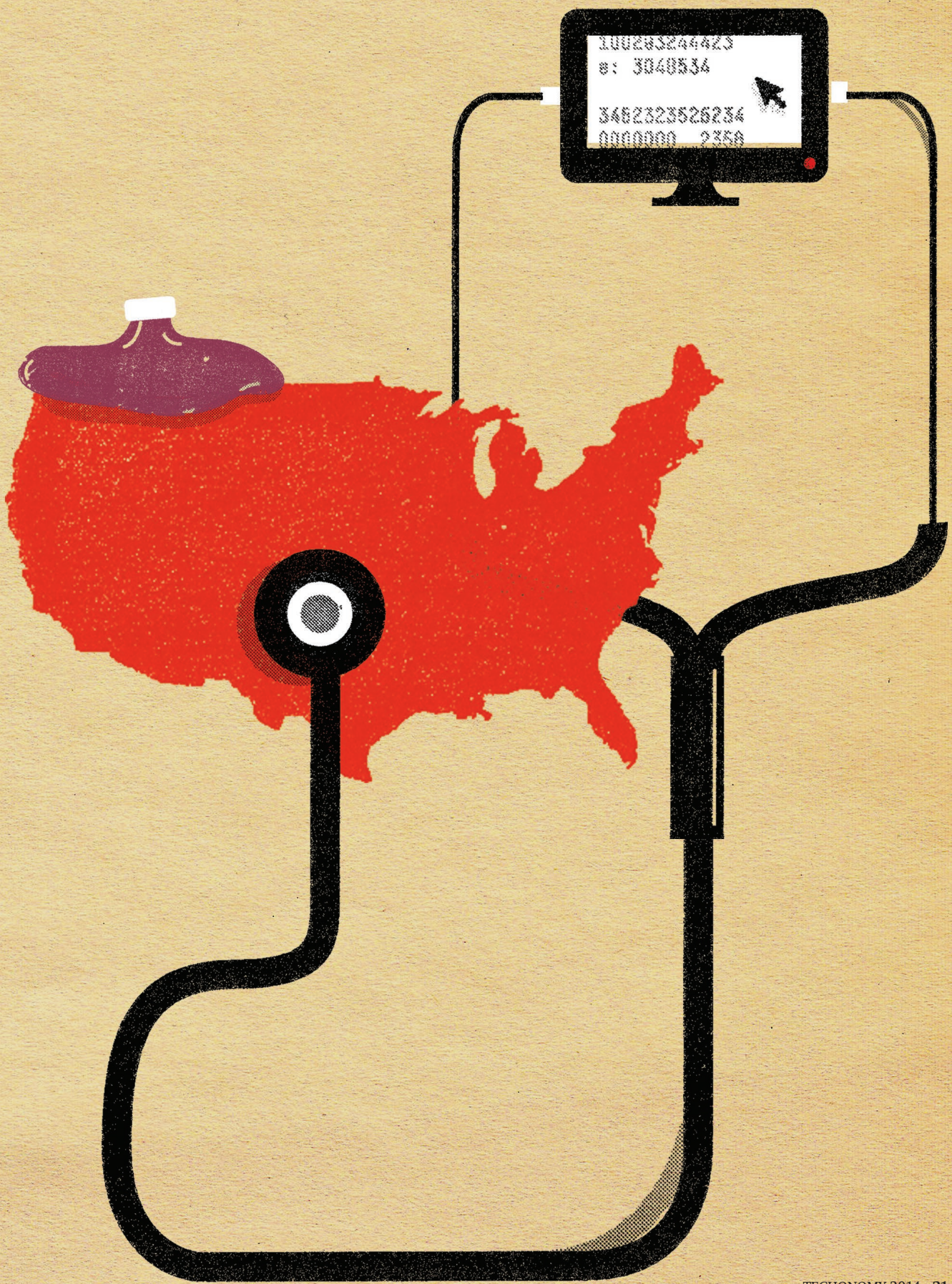


In August 2009, Dorsey imagines an on-screen receipt after a hypothetical purchase, geo-located, date-stamped, and offering the option to send via email.

TRANSFORMING INDUSTRY

**HOW
TECHNOLOGY
CAN
Transform
OUR
HEALTH
CARE
LABYRINTH**

By Mark Bertolini
CEO, Aetna



IN 2012, more than 95 million passengers passed through Hartsfield-Jackson Atlanta International Airport, the busiest in the world. On a clear day, 120 airplanes fly in and out every hour. The airport handled 930,000 takeoffs and landings in 2012. Can you imagine if each airline, pilot, and airport department had its own unique communication platform? The system simply couldn't function and we as consumers wouldn't tolerate the chaos and risk to safety.

But that's not very different from how our supposedly modern U.S. health care system operates. Why has our rat-maze approach to coordinating care continued largely unchanged for more than 60 years? For all but the simplest of health care needs, we all find ourselves at

some point trying to navigate a maze of health care facilities, doctors, pharmacies, insurance companies, and government programs, with all the associated conversations, paperwork, forms, bills, and files they all require.

According to the Institute of Medicine, the U.S. health care system wastes more than \$765 billion each year—about 30 percent of our health care spending. If we eliminated this waste, over 10 years we could reduce nearly 50 percent of our national debt. The waste is that bad. It's a huge handicap not only for the lives of every American, but for our overall economy.

What It Will Take to Transform the System

But there's good news. We can tackle

this stunning waste in health care by implementing technology solutions to reduce inefficiencies, redundancies, and administrative costs. As part of an integrated model, technology can transform health care. If we get this right, we can create a system that keeps costs flat even as we dramatically improve the health and wellness of the American people. We can also break down the walls that make up the labyrinth we call the U.S. health care system.

I've seen the health care system from every possible angle—I was an EMT early in my career, a patient after breaking my neck in a skiing accident, an advocate for my son who survived a rare and deadly form of cancer, and I am a health care executive. These experiences have taught me that we need to move from a

AETNA'S OWN INNOVATIONS

Aetna has been investing in innovative technology solutions that can fuel significant change in how people consume, pay for, and access health care.

ActiveHealth's CareEngine collects and analyzes massive volumes of data on a daily basis—including medical claims, pharmacy, and lab data. This data is matched with the latest and most advanced clinical standards to identify gaps in care at an individual level. Once these gaps are identified, clinical alerts—known as “Care Considerations”—are sent to the individual and/or their physician. In 2012 alone, more than 21 million Care Considerations were delivered, reducing medical errors and improving the quality of care.

The iTriage app helps people take charge of their health by answering the two most common medical questions —“What could be wrong?” and “Where should I go for care?” iTriage enables users to check their symptoms, learn about possible causes, research medications, locate and compare

nearby care options, choose a doctor, and make an appointment. This free app has been downloaded more than 10 million times.


Medicity technology makes it possible for physicians and hospitals using different electronic medical records and health IT systems to share patient information and collaborate on their care in a timely manner. Medicity helps physicians avoid delays in obtaining patient records and can reduce duplicate testing done when records are not easily retrievable.

The Aetna mobile app puts features like searching for a provider, reviewing claims, coverage, and personal health records, accessing an ID card, and checking drug prices, right at members' fingertips.


medical system designed around isolated health events to an integrated health care system that is focused on patient-centered care over the course of a lifetime. My focus and passion—both short- and long-term—is doing everything I can to help transform the system. Aetna has been working on aligning economic incentives between payers and providers, creating a simpler, more transparent consumer experience, and advancing technologies that seamlessly connect our health care system. This work also includes the many conversations I have on and off stage at venues like Techonomy and the World Economic Forum, where we are making the connections that will lead to a more convenient, user-oriented health care experience.

Make no mistake, though. Consumers have to take the driver's seat for this transformation, even as companies like Aetna and others help drive meaningful change. Years ago, most people simply followed their doctor's orders even if it meant repeating tests or agreeing to treatments they hardly understood. Now people are playing a much more active role in their own care, partly because they have access to so much more information via the Web. This information has fueled patient empowerment, making most of us a lot less passive about accepting "the doctor's orders" at face value. Yet an even greater driver of change is on the horizon: money. As more people have more of their own money at stake, I guarantee we will see greater demand for efficiency, lower costs, and better results.

How does this translate to the exam room? Imagine someone has



If we get this right, we can create a system that keeps costs flat even as we dramatically improve the health and wellness of the American people.



a chronic condition that requires treatment from different kinds of doctors. People are starting to ask if their doctors are sharing information and question why they have to fill out reams of paperwork at every doctor's office. What happens when one doctor contradicts what another one said? Does everyone know what the others are prescribing? Why can't the results of one test be shared seamlessly across a health team since we sign a paper every time that says it's OK to share it with designated doctors? Why are we running around repeating tests because no one is talking to each other? Health care may be the only place left in our lives where we tolerate such inefficiency.

**Coming Soon:
A Technology-Fueled
Consumer-Driven
Health System**

Finally, technology is beginning to accelerate a radical transformation. From motion-sensitive wristbands that track steps and sleep patterns to apps that allow you to schedule a flu shot at a walk-in clinic, the integrated digital experience is arriving. Consumers are responding to the availability of convenience and control that allows them to manage their personal health care. Over time, we believe that consumers, actively involved in managing their own health, will lead to healthier communities, a healthier nation, and even a healthier world.

Mark T. Bertolini is chairman and CEO of Aetna. Earlier, he worked at Cigna, NYLCare Health Plans, and SelectCare. He serves on the board of The Hole in the Wall Gang Camp, for children with cancer and serious illnesses.



Techonomy's David Kirkpatrick (l) interviewing Facebook CEO Mark Zuckerberg onstage in February at the Mobile World Congress in Barcelona

HOW BIG CAN ZUCKERBERG MAKE THE NET?

He wants to get everybody online, and Facebook is taking extraordinary steps to make it happen quickly. **BY DAVID KIRKPATRICK**

HOW MUCH difference can one company make? Mark Zuckerberg appears to be setting out to test that question with his immodest goal of connecting everyone on the planet to the Internet. While many companies talk about “doing well by doing good,” Facebook’s Internet.org initiative makes most other corporate projects for social betterment look banal.

But such extreme ambition is not illogical. A unique combination of circumstances confers on Facebook a position—and perhaps a responsibility—unlike any other company. Facebook’s site is the most popular on the global Internet. Over one billion people now use it on phones, making it the most popular mobile app as well. The Internet itself, in turn, is an unprecedented tool for social value and growth, transforming business and individual opportunity around the world.

Given its popularity, Facebook is likely to grow as Internet usage grows. “Over the very long term,” says Zuckerberg in an interview in his office, “if we can connect everybody in the world—will that be good for Facebook? Of course. But that doesn’t mean it isn’t also good for other people.” While 2.7 billion are currently on the Net, the 9 percent annual growth rate in that figure is, for him, unacceptable.

He wants to increase it by getting more people connected on their phones. Facebook launched Internet.org as a collaborative initiative with a group of other major mobile-oriented companies. All would also likely benefit as global Internet use grows. They include Ericsson, the leader in mobile system infrastructure; wireless chipmaker MediaTek; cellphone company Nokia; Web browsing software provider Opera; leading smartphone chipmaker Qualcomm; and Samsung,

which dominates Android phones. Some initiative projects will be conducted jointly with these and additional partners. Others Facebook will undertake alone.

The central idea of Internet.org is that the best way to grow the Internet is to give those without it a free taste of its life-altering resources. That should create more demand and ultimately lead to greater service availability. Facebook and Internet.org have announced several efforts so far to give that taste to unconnected people. The now globally famous social network itself is a significant lure. Explains Javier Oliván, vice president for growth: “In much of the emerging world, if you ask people if they want the Internet they may ask ‘What is that?’ But ask them if they want Facebook, and they say ‘Yes.’”

Said Zuckerberg at the recent Mobile World Congress in Barcelona: “The goal we have in Internet.

org is to create a sort of onramp to the Internet.” But he added, “It’s not that connectivity is an end in itself. It’s the things that connectivity brings.” Then he listed some he hoped would, in turn, become more available to everyone globally: “Basic financial services, ...credit to start a business or get a home, or access to basic health information.”

While he is highly analytical and methodical, Zuckerberg is not afraid to take enormous, even risky, steps to achieve his goals. Otherwise he could not have created a service of nearly 1.3 billion users in the 10 years since he founded it in his Harvard dorm room. His determination to move quickly towards ubiquitous global connectivity helps explain the jaw-sockingly unexpected \$16 billion February purchase of Whatsapp. In his view, owning it helps him proceed with Internet.org’s first big project—offering mobile users in developing countries a limited suite of essential digital services for free. Internet mobile messaging, which Whatsapp dominates in much of the world, is a critical element in such a suite.

To illustrate what he means, Zuckerberg talks about how anyone can pick up their phone and get certain things for free—like the ubiquitous “dial tone,” or the ability to dial 911 for emergency assistance. “It occurred to me there

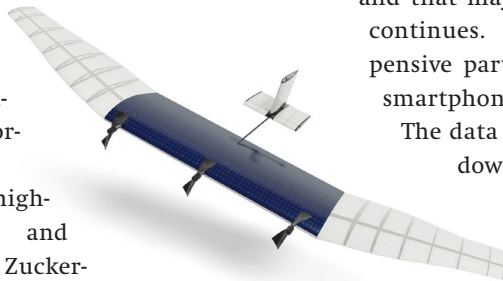
should be an equivalent of those basic services for the Internet,” Zuckerberg explains in his office. Since the Internet does a lot more than the phone network, such services can be richer than simply emergency response. “Pretty soon everyone will have a smartphone, they say, and that may be true,” he continues. “But the expensive part of owning a smartphone is the data.

The data is not coming down that quickly in cost.

Even if you can’t afford a data plan, everyone in the world should be able to pick up their cheap smartphone and get access

to weather information, and basic messaging, or maybe food or other commodity prices, Wikipedia, basic social network communication, and basic search.”

At Mobile World Congress he was promoting this idea to mobile phone carriers that operate in emerging markets. He wants to work with them to provide access to a digital onramp that is already in place. All but about a billion of the world’s unconnected people live in areas where wireless networks are actually available. Facebook aims to convince carriers to give the free services to cellphone customers, and offers in turn to help them capitalize on those customers’ newfound access to data. If, say, a user looking at basic Facebook or Wikipedia wants to view a video, a simple onscreen dialogue could sell a data upgrade on the spot. Facebook’s ex-



Facebook aims to use solar-powered drones for Net access in remote areas.



perts on interface and user-dialogue design are developing such tools and giving them to carriers. The Philippines’ Globe Telecom doubled its paying data users in one test that offered a basic version of Facebook for free. Of those, 25 percent were entirely new customers. Explains Dan Rose, who heads Facebook’s partnership efforts: “We’re trying to remove barriers to people getting online in a way that is net positive for the business of the operators.” Adds growth boss Olivan: “We can help operators prevent churn, acquire new users, and understand more about their user base.”

Internet.org’s partner companies



Mobile carrier Globe Telecom partnered with Facebook in Manila and elsewhere in the Philippines. Giving users free basic services led to more paid usage.

are undertaking other projects that could make all this work even better. There are many ways to increase the efficiency and reduce the cost of wireless Internet data. The companies aim to find ways to improve infrastructure, slim down data-hogging apps, and invent more effective business models for carriers. Ericsson is creating a facility on Facebook's campus in Menlo Park, California, so developers of apps can test them in conditions that simulate what a user would find in various developing countries. Signals in such places can be weak, bandwidth low, and simultaneous network users many. Qualcomm is helping stream-

line how apps run on inexpensive phones. Facebook has radically improved its own Android app to require dramatically less data than a year ago, without altering what the user experiences. Explains Facebook infrastructure boss Jay Parikh, who oversees the technical side of Internet.org: "What good is it to connect everybody if they can't use the applications? Or if they constantly go over their pre-paid limits?"

Parikh also manages an even more radical set of efforts to provide free Internet to that last billion people who lack any wireless coverage. Facebook plans to deploy a combination of satellites for areas of low

population density, unmanned solar-powered drones that stay aloft for months at a time for broadcast from closer to Earth to medium density areas (see illustration), and ground-based, so-called "mesh" wireless networks for unserved urban areas. Meanwhile, Google is separately experimenting with ways to provide Internet service in unwired areas. It's developing high-altitude balloons, and in April purchased New Mexico's Titan Aerospace, which makes solar-powered drones. Facebook, for its part, in March purchased British drone developer Ascenta. The social network is hiring as many as 50 experts in satellites, drones, and special data-carrying laser systems from places like NASA's Jet Propulsion Lab and Ames Research Center.

This may not sound like a company that exists just to help you share a selfie. It isn't. Facebook at 10 is worth \$150 billion, has steadily growing profits, and marshals vast resources. And Zuckerberg is a man of his generation who believes that a business has little real value if it isn't also doing good. "I cannot put together a model that shows how this is going to be profitable for us any time in the near future," he says calmly, sitting on the couch in his glass-walled conference room as employees stream past outside. "I have this philosophy that you can't always connect the dots on why something is going to be good for you going forward. But generally, if you do good things you end up benefiting down the line."

David Kirkpatrick wrote The Facebook Effect: The Inside Story of the Company That Is Connecting the World, about the company's early history and its CEO.



**EDUCATION
NEEDS
TO CHANGE
AS FAST AS
TECHNOLOGY**



BY ZACH SIMS

MORE AMERICANS go to college than ever. But how many think about the return they will get from tuition payments that can easily reach \$200,000? Up to half are unemployed or underemployed a year after graduation. And two-thirds say they need further training and instruction to enter the workforce, reports Accenture.

As student debt balloons, it's time for society to re-evaluate post-secondary education—and our entire system. We need to create new and innovative systems that help individuals achieve their potential.

The Web is changing many important functions of modern society—how

we transfer money, communicate, purchase products, and more—but has been slow to transform the critical task of educating the next generation of citizens and leaders.

American education remains basically modeled on an approach hundreds of years old. Students with varying levels of ability sit in classes organized by grade level before a “sage on the stage” who teaches reading, writing, arithmetic, and a bit of science. That system, at least in the U.S., doesn't seem to work well enough. Among developed countries ranked by the Organization for Economic Cooperation and Development, the U.S. is 31st in math achievement, 24th in science, and 21st in reading.

It's time for education to catch up with our technologically-enhanced society. Students deserve a relevant, modern, customized education that helps them acquire 21st century skills. So does American society.

Take computer science, for instance. Employers nationwide lament a massive skills gap, and the Bureau of Labor Statistics says there will be a million more job openings than trained workers to fill them by 2020. Yet, according to Code.org, an

organization that encourages more students to learn programming and coding skills, only 1 in 10 American high schools even offer a computer science class, let alone Advanced Placement in the subject. And fewer than 3 percent of college students earned a C.S. degree in 2012, according to the National Center for Education Statistics.

Curriculum is not the only part of the system ripe for change, of course. The delivery mechanism has also remained unchanged for generations. Teachers run classes as extended lectures and send students home to complete homework assignments, often alone and confused. It's a practice that's particularly disadvantageous for students who lack a conducive home environment.

We need pioneering innovations to make their way into more of our schools, like the “flipped classroom” model made possible by, for example, the extraordinary Khan Academy video lectures. In this model, educational material like lectures and other video is consumed by a student alone outside of the classroom, while “homework” and other practical learning-oriented exercises are

done in school, where students have access to resources and assistance.

My company, Codecademy, offers instruction in computer programming and other skills online. While millions of people have used Codecademy outside the classroom to learn digital skills essential to the 21st century, schools have begun to extensively use our educational material in the “flipped” model. Codecademy provides curriculum and lesson plans through an After School Programming component of our website. Teachers are able to function as facilitators of student progress instead of instructors, which eases the massive shortage of C.S. teachers in the U.S. More than 8,000 schools use this approach.

For decades, change to the staid American K-12 system and the “ivory tower” of higher education has come too slowly. Though charter schools, teachers unions, school boards, local activists, and others have worked to reform the system, it has often seemed impermeable. Technology may be the silver bullet to enhance the material and the way we teach. Our students already live in a tech-saturated culture, so they will certainly welcome such change. Technology can help America's students better prepare for the future, and keep preparing—since learning will increasingly need to be continuous as the stunning pace of technology change further accelerates.

Zach Sims, 23, is co-founder and CEO of Codecademy, which teaches programming online. The company was named a Technology Pioneer by the World Economic Forum and Sims was one of Time Magazine's 100 Most Influential People of 2013.

AS FITBITS FOR FEELINGS EMERGE, WHITHER EMPATHY?

BY ERI GENTRY

S EARCH GOOGLE for “empathy + technology” and you’ll read that “Studies have shown that increased dependence on technology has resulted in the diminishing of empathy” and “The Internet desensitizes us to shocking images, diminishing our empathy.” Meanwhile, narcissism (think selfies) and cyberbullying appear to be at all-time highs. And reality television is thriving on voyeuristic depictions of human weakness, competition, and cruelty.

A definition of empathy:

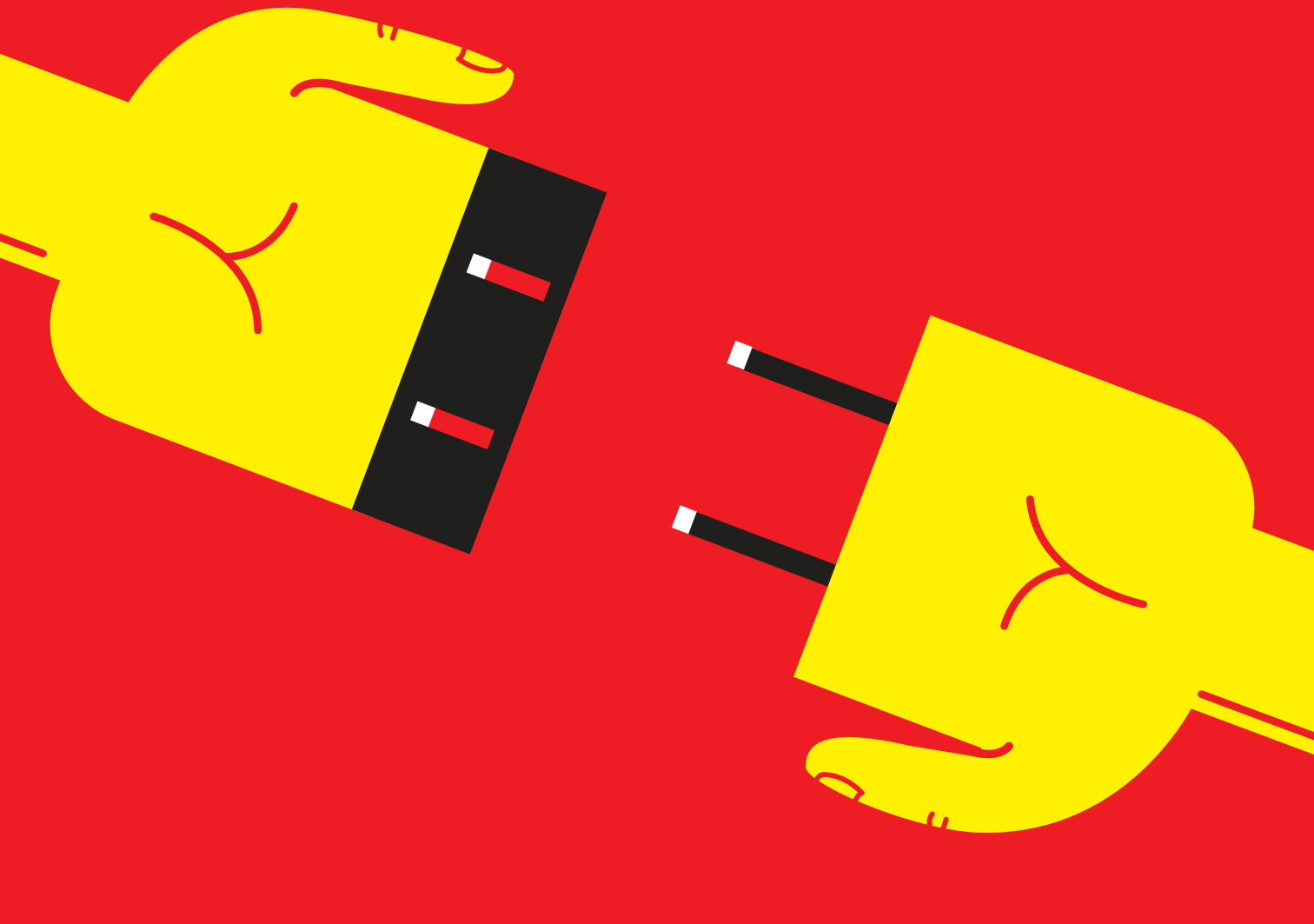
The feeling that you understand and share another person’s experiences and emotions (Merriam-Webster).

Are we losing touch with one another? Are we sinking towards something like Roman civilization, when bloodthirsty spectators eagerly watched men fight to the death in the name of entertainment, now just on high-def screens?

Or could empathy in society actually be enhanced by the capabilities of technology? Could ma-

chines sense our emotions better than our friends and family can and broadcast that data to them? It’s not a crazy idea. In fact, wearable technologies are starting to emerge that are specifically designed to give viewers a sense of what’s going on inside another person. They may be crude now, but they will get better.

Take a look at the Necomimi product from Tokyo’s Neurowear. It’s a set of brainwave-reading cat ears that perk up when the



user is alert or excited and lay flat when the user is calm. In its concept video, a boy-meets-girl-with-cat-ears story plays out: Boy approaches; girl's prosthetic EEG-enabled cat ears stand up; girl blushes; boy gets closer.

It is simultaneously ridiculous, cute, and relatable. Holding in feelings of affection is so utterly human. Necomimi takes reservation out of the equation. The wearer implicitly creates a new social contract when putting on the headset:

anything that excites or bores the wearer will be plainly obvious to observers, be it an advertisement or a married man. It may not be for you, but some people in Japan and elsewhere are using it.

The GER Mood Sweater from the American company Sensoree relies on galvanic skin response and LED-laden fabric to change color with the wearer's mood. And Heart Spark, a DIY heart-rate monitor necklace made by San Francisco-based Sensebridge, reveals to the

world with flashing lights when the wearer's heart races.

Generating emotion in a viewer is a goal of other new technology. Sensory Fiction, an interactive and wearable book-vest combo created as a prototype by four MIT students, will swell, squeeze, or vibrate against the user as he or she flips pages. Readers can literally feel the plot thicken, joining the protagonist on ups and downs throughout the story.

Empathy changes our brains,

hence our behavior. Although empathy-enabling technology can provoke solidarity, it may also contribute to manipulating us, or stimulating irrational decision-making. Politicians and advertising agencies have understood this for a long time. Behavioral studies tell us that we are more likely to donate to orphans identified with photos than with silhouettes. We are also far more likely to opt in to organ donation when asked in person by a DMV clerk than on a mail-in form. Images, smells, sounds—which can now be conveyed by various wearable technologies—may subtly guide us toward actions that seem to defy logic. When a would-be elected official rouses audiences with stories of “Mary, the retired grandmother of five, who can’t afford her heart medication,” he is playing on voters’ empathy to win votes for a new health care policy, regardless of whether Mary is accurately representative of senior citizens.

The “identifiable victim effect” leads us to become more saddened and outraged by news of the kidnapping and torture of a local girl than we would be by news of thousands dead in a far-off land. Neurally, images of victims activate the nucleus accumbens, an area central to the brain’s reward and pleasure circuit. When we understand the gravity and tragedy of a loss of thousands, it is through reason, not generally because of the effects of images, empathy, and nucleus accumbens activation. Brain-imaging technology combined with data analytics is giving researchers



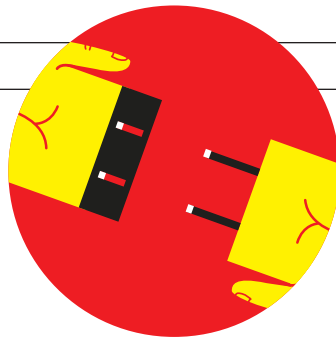
TOP: Believe it or not, people really wear Necomimi ears to reflect metabolic excitement in a way they cannot consciously control. (Photo courtesy Neurowear)

BOTTOM: The Sensory Fiction book-vest takes quite literally the notion that you should “feel” what you are reading. (Photo courtesy MIT Media Lab)

more understanding of the neurological and physiological effects of images and stories intended to produce empathy.

Simultaneously, innovation is exploding in several ways that may add further complexity to the empathy/technology nexus. Advances in wearables as well as smaller and cheaper sensors allow weekend tech-warriors to build their own devices that alter our senses, such as Mitch Altman’s “Brain Machine” glasses that use sound and light to stimulate certain brain activity, or the poking machine armband that delivers a physical poke each time your Facebook friends poke you. These are products made mostly for personal use or demonstration, but they show how easy it is to create devices that shape our experience of the world.

The growth of the Quantified Self movement has made it acceptable (in some circles) to wear your digital heart on your sleeve and, soon, products like the Scanadu Scout and Apple’s rumored iWatch, will



“Although empathy-enabling technology can provoke solidarity, it may also contribute to manipulating us, or stimulating irrational decision-making.”



be able to monitor enthusiasts’ biometrics. It’s not a great leap beyond that to interpreting your emotional state, as the Mood Sweater and Heart Spark are already doing.

The implications of detailed emotional data in business could be far-reaching and extreme. For example, health information coupled with emotional analysis could enable pharmaceutical companies to market drugs in a highly personalized and effective way. Personalized medicine may be beneficial, but imagine ads that can interpret emotions and respond on the fly with targeted messaging. For that matter, any industry with access to such data could fine-tune their advertising accordingly. In mobile gaming, crude emotional targeting is already being attempted, creating personalized and socially networked reward systems. Some argue that games like Candy Crush—today’s top mobile game—are contributing to the demise of gaming by causing millions to spend money on primarily luck-based activities that addict users with the promise of elementary rewards like stars on the screen and social recognition in the game and in social networks. Where will such businesses go as emotional sensing becomes more sophisticated?

The new millennial generation of digital natives frequently shows a greater sense of social responsibility and desire to be connected to one other than previous generations. Many of us want environments, jobs, and products that provide a sense of empathy and

fulfillment. Meanwhile, neuroscience, consumer medical devices, and numerous other tools are giving us a deeper understanding of the roots of human sensibility. We may better understand what it means to be human, but the consequences of using these insights are not yet understood. This generation will determine whether we use or abuse empathy.

In the 1987 book, *Amusing Ourselves to Death*, author Neil Postman posited that Aldous Huxley’s *Brave New World* got it right, not George Orwell’s 1984. “Orwell feared we would become a captive culture. Huxley feared we would become a trivial culture, preoccupied with some equivalent of the feelies, the orgy porgy, and the centrifugal bumblepuppy. Huxley feared that what we love will ruin us.” More recently, Dave Eggers’s novel *The Circle*, in a sort of homage to *Brave New World*, makes a similar point about the potential dangers of services like Facebook and Google.

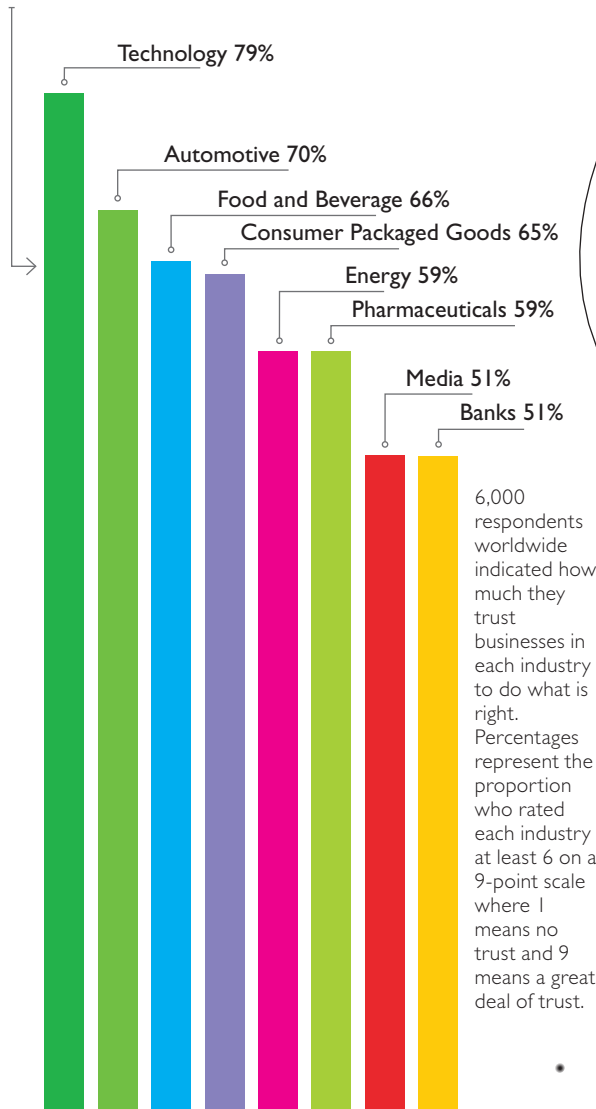
Technology and society now intersect at empathy in ways the world has never seen before. To prevent ourselves from fulfilling Huxley’s prophecy, we must be aware of empathy’s side effects. Once technologies that can affect empathy become commonplace, we may need more technology to protect ourselves. If we manipulate empathy, we cannot forget how it works in society—to bring people together.

Eri Gentry is an economist turned biotech entrepreneur and an advocate for science literacy. She is a science and technology research manager at the Institute for the Future, an independent research organization, and a co-founder of BioCurious, the first hackerspace for biotech.



The Uncertain Future of Our Data-Driven Society

POLLING SHOWS TECHNOLOGY IS BY FAR THE MOST TRUSTED INDUSTRY...



SOURCE: 2014 EDELMAN TRUST BAROMETER



...OUR 'DIGITAL SHADOW' GETS BIGGER AND BIGGER...

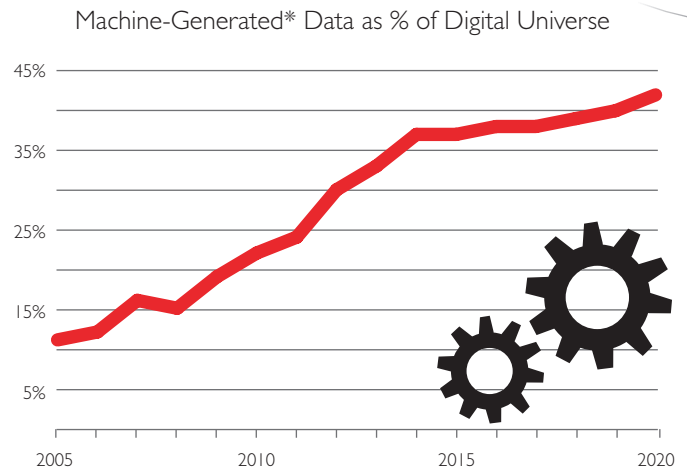
1.8 Million Gigabytes Information You Create Annually

4.1 Million Gigabytes Total Ambient Information About You* in the Digital Universe

SOURCE: EMC

*Adult age 45-59

...MACHINES CAPTURE AND SHARE MORE AND MORE DATA...

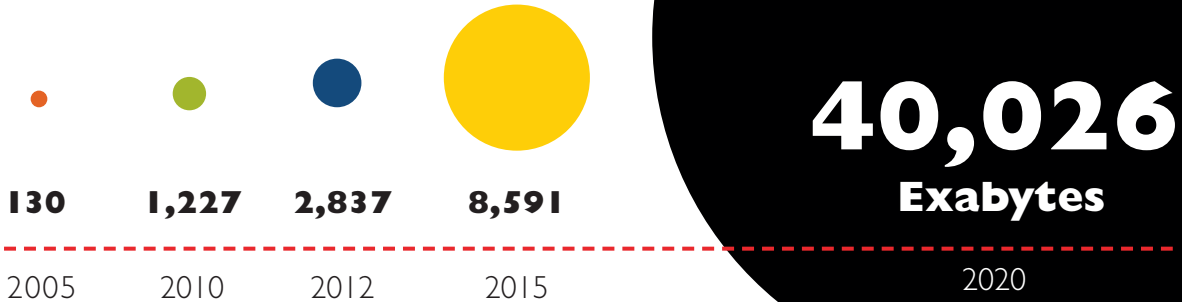


*Industrial Machines, Vehicles, Medical Devices, Embedded Systems, Security Cameras, Toys, etc.

SOURCE: EMC

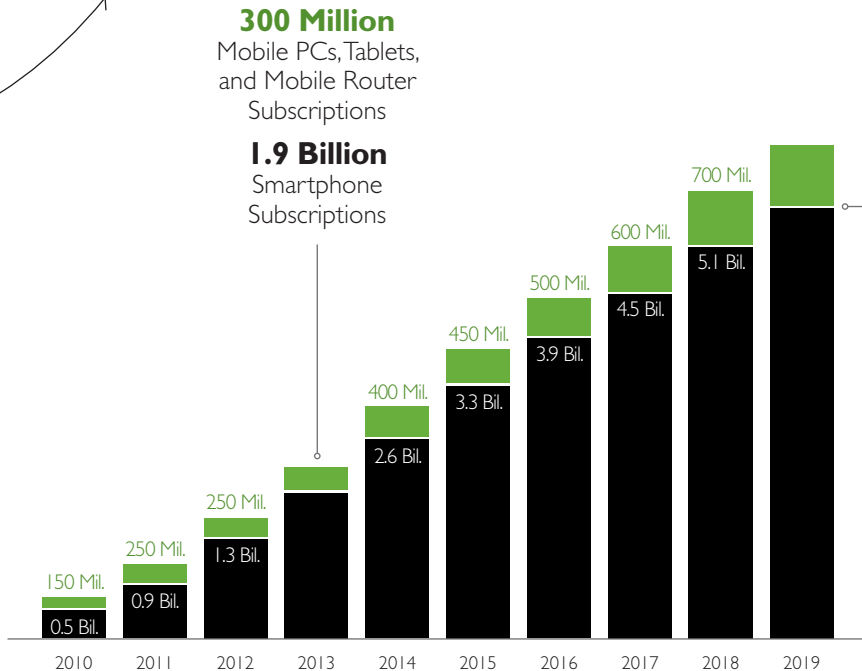
**...BUT AS THE
DIGITAL UNIVERSE
GROWS...**

Digital Universe in Exabytes
(Billions of Gigabytes)



SOURCE: EMC

**...AND ALMOST EVERYONE
IN THE WORLD HAS A SMARTPHONE AND
A DATA PLAN, WILL OUR TRUST
IN TECHNOLOGY ENDURE?**



800 Million
Mobile PCs, Tablets,
and Mobile Router
Subscriptions

5.6 Billion
Smartphone
Subscriptions
by the End
of 2019

SOURCE: ERICSSON MOBILITY REPORT



Making Art with Brainscans and 3-D Printers

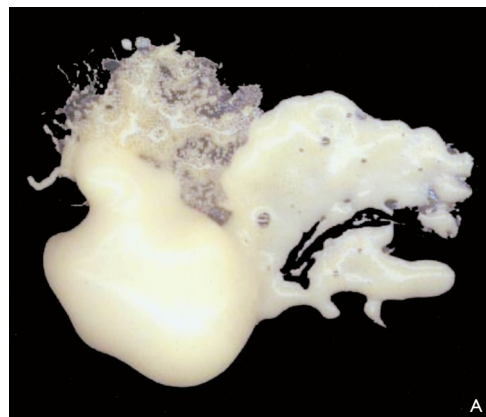
SUZANNE ANKER finds beauty and meaning at the borderlines of science. This visual artist and sculptor talks about “the way in which visual art and the biological sciences intersect because of technology.” She is conversant in the languages of all of them.

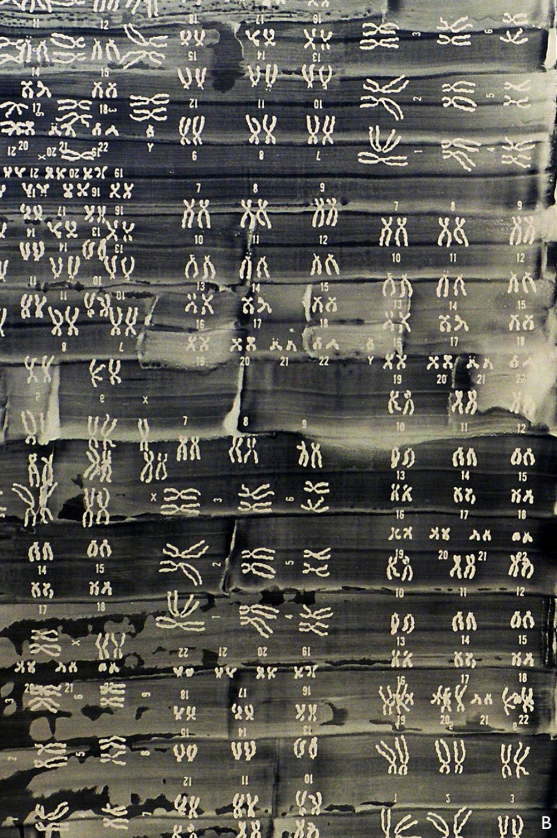
Anker often takes inspiration from the ways biological information is depicted. The silkscreen in figure B at right, for example, enlarges microscopic images of chromosomes into something resembling calligraphy. She tends to find and highlight intriguing symmetrical forms in natural images. In figure D she superimposes a butterfly’s wings on a brain scan.

Her tools may also come from technological realms. She’s been making sculpture with 3-D printers for twelve years, since long before the technology became trendy. It wasn’t easy to get started, she says: “It took me about a year to figure out how to make something, because you don’t want it to look like a reflection of technology.” Her first successful pieces used soft-

ware to uncover a third dimension in Rorschach tests. Then she printed them and finally cast some of the mysterious shapes in bronze. Figure C shows two views of one. For the colorful piece in figure E, she processed a two-dimensional photograph with Photoshop to obtain a 3-D “displacement map,” which she then “printed” with plaster, resin, and pigment and set in glass.

Anker is also a longtime teacher and chairman of the fine art department at New York’s School of Visual Arts. Six years ago she added a 3-D printing lab. More recently the department opened a “BioArt Lab,” complete with resident PhDs doing real research alongside students making art. “We’ve done tissue engineering, and grown cellulose cloth. We have 15 microscopes,” Anker says proudly. She wants students from both sides of the divide to see relationships between STEM disciplines and art. “If we want to make math and science more appealing to students, narratives involved in the imaginary world can help.”





CLOCKWISE FROM TOP LEFT:

- A.** *Stem Cells (4)*, 2004
Inkjet print
13" x 19"
- B.** Detail from *Codex: Genome (Primer)*, 2000
Silkscreen and pigment on wooden panels
3' x 4' (Photo by Henry Sanchez)
- C.** *Rorschach series (Bear)*, 2004-05
Cast bronze (front and back views)
4.5" x 4.5" x 2" (Photo by Henry Sanchez)
- D.** *MRI Butterfly (1)*, 2008
Inkjet print on watercolor paper
13" x 19"
- E.** *Remote Sensing (05)*, 2013
Plaster, pigment, and resin
4" x 4" x 1.75" (Photo by Raul Valverde)



The intense conversations of Techonomy 2014 take place this year at the beautiful Ritz-Carlton, Half Moon Bay, California.

It Gets Better (or Weirder?)

JUST WHEN YOU THINK you have a handle on how tech is changing the world, some outlier event makes you step back in wonder. Facebook buying Oculus VR? What? Turkish Prime Minister Erdogan shut down YouTube? Really? The cashier at an independent bookstore takes your money and says, "Thank you for supporting us." Was buying that book a charitable act? Well, on Amazon it would have been \$4 less, so maybe so.

At Techonomy we are watching one major new development with alarm. A counter-reaction to the Internet is gathering steam across the planet. More and more undemocratic governments recognize that the freedom of speech and broadcast power bequeathed to ordinary citizens by the social Web poses a profound threat. Revelations that the government of the U.S., where freedom is constitutionally enshrined, apparently views the Net as a ready way to suck up personal and national data make it sadly easier for governments elsewhere to justify crackdowns. All of us have to work to insure the Net remains a platform of openness and freedom.

One session we're planning for Techonomy 2014 we call (with due hyperbole) "The End of Industries," because borders are blurring as software-fueled companies of all sorts increasingly cross formerly firm borderlines. What "industry" will Uber enter next? Is Airbnb a hotel company or something new altogether? Meanwhile, the pace of innovation accelerates. More insurgent startups emerge from more places. As new services for startups themselves emerge, that further accelerates company formation and innovation. It will just get harder to keep up. That's why we believe so much in collaborative conversation. We hope you'll stay part of our community.

Techonomy Bio

June 17, 2014

Computer History Museum

Mountain View, California

www.techonomy.com/bio

Techonomy Detroit

September 16, 2014

Wayne State University

Detroit, Michigan

www.techonomy.com/detroit

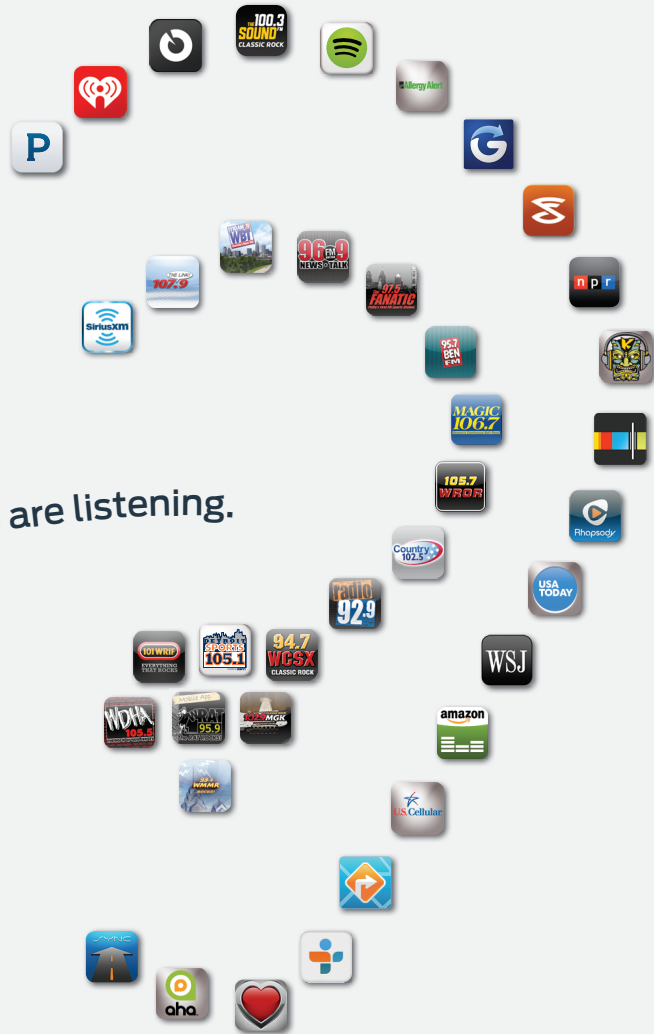
Techonomy 2014

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