i3

IT IS INNOVATION

THE 2018 CT HALL OF FAME
CES 2019 PREVIEW

NOVEMBER/DECEMBER 2018

BLOCKCHAIN
NEW WAYS
TO TRANSACT

SMART CARS
MONITORING
DRIVERS

TECH
CONNECTING
DOCTORS
WITH PATIENTS

SENIOR VP,
INTELLIGENT
SOLUTIONS GROUP

John Stone

Creating Intelligent
Machines at Deere & Co.

Consumer
Technology
Association™

CES

MEET THE MOST IRRESISTIBLE NEW POWER COUPLE

EVERYBODY'S TALKING

Sharp's all-new, modern and elegant, built-in wall oven features an edge-to-edge black glass and stainless steel design. The SWA3052DS pairs beautifully with our new SMD2480CS Microwave Drawer™, the new power couple of style and performance.

This 5.0 cu. ft. 240V. built-in wall oven uses True European Convection to cook evenly and heat efficiently. The 8 pass upper-element provides edge-to-edge performance.

Sharp's top-of-the-line Microwave Drawer™ features Easy Wave Open for touchless operation. Hands full? Simply wave up-and-down near the motion sensor and the SMD2480CS glides open.

It's just the kind of elegant engineering, smart functionality and cutting-edge performance you'd expect from Sharp.

NEW TOUCH GLASS CONTROL PANEL
EDGE-TO-EDGE, BLACK GLASS & STAINLESS STEEL
OPTIONAL 30" EXTENSION KIT SHOWN

SHARP | Simply Better Living

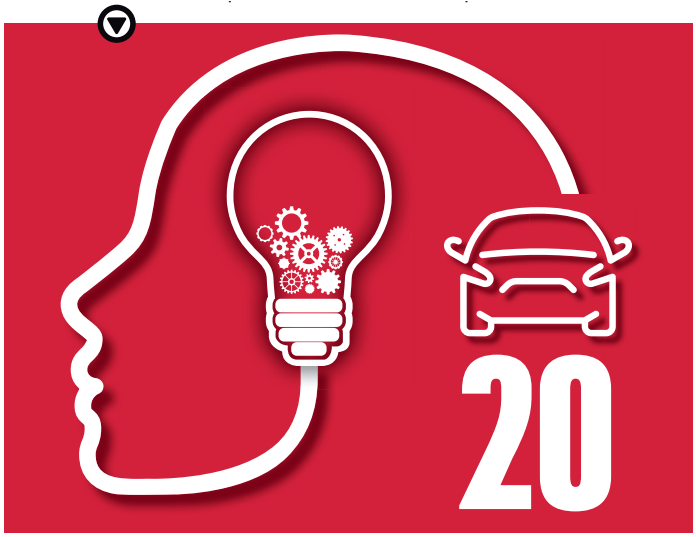
Be Original.

www.SharpUSA.com

Contents

16

24



20

ON THE COVER
John Stone
Photographed by Seth Lowe

Consumer Technology Association™

CES

The Increasingly Dangerous Trade War with China

> **Our industry, economy and consumer standard of living all benefited because of trade.**

By almost every measure, China and the U.S. are the world's two global economic superpowers. Yet we are in a dangerous game of "chicken" with China with no clear winnable end game for either nation. Each passing day of new tariffs, trade barriers, harsh words and lack of meaningful negotiations gives little hope for a resolution.

President Trump and President Xi are two strong leaders and neither are likely to back down. More, President Trump has been consistent in his view that unbalanced trade with China is not in the interest of the U.S.

The U.S. technology industry is being hurt by escalating tariffs. They affect the supply chain of components and increasingly finished products from China. But the auto, footwear, chemical, clothing, equipment and several other industries will also be affected.

The trade war will hurt our economy. Companies will be hurt. Jobs will be lost. Consumer prices will rise as these tariffs/taxes are imposed. Inflation will increase. Our overheated economy will cool and soon other nations will feel the impact.

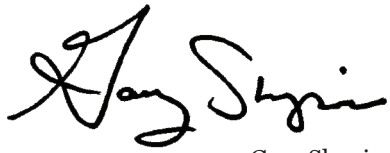
We saw all this with the Smoot-Hawley tariffs Congress passed in 1930, which helped cause the Great Depression. At that time, trade was less significant to our nation.

We are vulnerable. We elected the first anti-trade president in generations. We put too many of our eggs in the China basket — something I have cautioned against in the past. We let China get away with unfair practices for too long.

But we can only look forward. We have fought successfully for free trade for decades. Our industry, economy and consumer standard of living all benefited because of trade. Yet now we are seeing a 180-degree reversal on trade with China.

We can advocate. We can lobby. We can even sue — as Congress never gave the president authority to start retaliatory trade wars. But we must be honest: we face an administration hostile to China, focused illogically and simplistically on equality in inflow and outflow of products.

Now we must hunker down, plan for tough times and continue to innovate. We must make sure our voices are heard and reason prevails.



Gary Shapiro,
President and CEO

Pengpeng/Getty Images

STEADICAM®
POWERED BY YUNEEC
VOLT™

HOLLYWOOD STABILIZATION IN THE PALM OF YOUR HANDS

Visit us at CES®
Booth #14036

- Smartphone Stabilizer (Android & iOS Compatible)
- Smooth, Shake-Free Video Footage
- Lightweight & Collapsible
- GoPro® Compatible
- 8 Hours of Battery Life
- Sport Mode & Movie Mode

LEARN MORE AT
TIFFEN.COM/STEADICAMVOLT

Tiffen Company LLC.
90 Oser Avenue
Hauppauge, NY 11788

Merging Worlds

I have had the privilege of working with some of the best and brightest leaders in our industry with CTA's CT Hall of Fame program. This year we have a phenomenal class of visionaries that will be honored at the annual dinner held on November 7 at Capitale in New York City.

The 2018 class includes **John Briesch**, the Sony executive who led the CD launch; **Dr. John Cioffi**, the father of DSL (Digital Subscriber Line), **Robert Cole** founded World Wide Stereo; **Richard Doherty** an influential analyst; **Peter Lesser** founded X-10 USA Ltd., ushering in the smart home era; **Mike Romagnolo** created high-tech DOW Stereo/Video; and **Edgar Villchur** invented the acoustic suspension speaker. Teams include: **Jim Thiel** founder and chief designer of Thiel Audio's innovative speakers and former CTA Chair and President of Thiel, **Kathy Gornik** who grew the company into a prestigious brand; and the **Skype Team** who developed the person-to-person video phone platform in 2003. These leaders helped to shape the world. See bios on page 31.

Our cover story profiles John Stone, SVP, Intelligent Solutions Group at Deere & Company who is leading a digital transformation at the nexus of tech and farming. At CES, Deere will show how sensors and AI are equipping farmers with smart machines that will improve all our lives. Look for the Deere tractor in the self-driving lot and the combine called the "interconnected factory on wheels" on the show floor.

This pre-CES issue also looks at the enormous changes in automotive intelligence, 5G tech, blockchain, computing and digital health enhancing doctor patient relationships along with some energized startups. To see the latest innovations, join us at CES 2019, January 8-11. Please send comments to cstevens@CTA.tech.

Cindy Loffler Stevens,
Editor-in-Chief

Statement of Ownership, Management and Circulation
It Is Innovation* (*i3*)** (USPS 022897) is published (bi-monthly) six times a year by the Consumer Technology Association. The mailing address of both the publication and the publisher is 1919 South Eads Street, Arlington, VA 22202. The publisher and editor is Cindy Stevens. The managing editor is Mark Chisholm. The owner of the publication is the Consumer Technology Association. There were 25,643 copies of ***It Is Innovation (i3) published for the September/October 2018 issue; the average for the preceding 12 months was 27,776. The paid/requested outside county mail subscriptions for the September/October 2018 issue was 20,628; the average for the preceding 12 months was 20,280. The other classes mailed through USPS for the September/October 2018 issue were 3,108; the average for the preceding 12 months was 2,262. The Non-requested Copies Distributed outside of USPS (Pick-up Stands, Trade Shows, Showrooms and Other Sources) for the September/October 2018 issue was 1,487; the average for the preceding 12 months was 4,817. Total distribution for the September/October 2018 issue was 25,223; the average for the preceding 12 months was 27,359. 420 copies of ***It Is Innovation (i3)*** were not distributed during the September/October 2018 issue (office use, leftovers, spoiled and all other copies not distributed) and the average number of copies not distributed during the preceding 12 months (office use, leftovers, spoiled and all other copies not distributed) was 417. The percent paid/requested circulation in the September/October 2018 issue was 93%; the average for the preceding 12 months was 81%.

i3

IT IS INNOVATION

PRESIDENT AND CEO
Gary Shapiro

SENIOR VICE PRESIDENT
Jean Foster

EDITOR-IN-CHIEF
Cindy Loffler Stevens

MANAGING EDITOR
Mark Chisholm

EDITORIAL ASSISTANT
Jeremy Snow

SENIOR CREATIVE MANAGER
John Lindsey

GRAPHIC DESIGNER
Ian Shields

MANAGER, CREATIVE DIRECTION
Matt Patchett

ADVERTISING MANAGEMENT
Eric Schwartz
Oleg Burdo

CIRCULATION MANAGER
Gretchen Mitchler

EDITORIAL CONTRIBUTORS
Gary Arlen, Alan Breznick, Robert Calem, Jack Cutts, John Gaudiosi, Steve Koenig, Natalie Hope McDonald, Allan Richter, Ron Schneiderman, Steve Smith, Susan Schreiner, Murray Slovick

EDITORIAL ADVISORY BOARD
Kari Aakre, Intel; Dave Arland, Arland Communications; Sally Washlow, Cedar Electronics; Peter Brinkman, Casio; Gabriele Collier, HDMI; Kristen Cook, The Marketing Shack; Danielle Deabler,NPR Labs; John Dunstan, Netgear; Sean Durkin, Tencent; Bill Kircos, Intel; Bill Leebens, LM&M; Chris Loncto, Sharp Electronics Corp.; Daniel Pidgeon, Starpower; David Steel, Samsung; John Taylor, LG Electronics

DESIGN, PRODUCTION AND PUBLISHING MANAGEMENT
MANIFEST
228 E 45TH ST., SUITE 701, NEW YORK, NY 10017

SENIOR ART DIRECTOR
Carolyn Miller

PHOTO EDITOR
Leah Rudolfo

PRODUCTION TECHNOLOGY
Cheryl Beaver,
Andy Gulczynski

OPERATIONS MANAGER
Gabby Tan

It Is Innovation (i3) is published as a service to the members of the Consumer Technology Association (CTA) and to key players in the consumer technology industry. CTA represents more than 2,200 U.S. manufacturers of audio, video, digital imaging, accessories, mobile electronics, home networking, wireless communication, information technology and multimedia products that are sold through consumer channels.

The opinions expressed in articles are those of the authors and not necessarily those of CTA. Comments, questions and letters to the editor are welcome. Address responses to: *It Is Innovation (i3),* Consumer Technology Association, 1919 South Eads St., Arlington, VA 22202, tel: 703 907 7600.

It Is Innovation (i3) (USPS 022897 Vol. 6, No. 6) is published bi-monthly by the Consumer Technology Association, 1919 South Eads St., Arlington, VA 22202. Periodicals Postage Paid at Arlington, VA and at additional mailing offices. POSTMASTER:Send address changes to *It Is Innovation,* CTA, 1919 South Eads St., Arlington, VA 22202. Canadian Publications Agreement No. 41502062.
U.S. & Canada—$24.99 a year; $5 for a single issue
Mexico—$39.99 a year; $7.50 for a single issue
Elsewhere—$49.99 a year; $9.00 for a single issue
ISSN 23257350

Consumer Technology Association | CES

BPA WORLDWIDE BUSINESS

Pioneer

Control your smart home on the go. Hands free. Worry free.

Hey Google, is the garage door open?

Okay, checking. The garage door is open.

Hey Google, close the garage door.

You got it, closing the garage door.

CAR-TO-HOME SMART HOME INTEGRATION READY

You don't need to leave your connected world at home.

Have a connected smart home?

Google Assistant™ is now a part of Android Auto™, meaning that Google Assistant compatible devices can now report their status and be controlled directly from your car.

SMART THERMOSTAT[1]

SMART GARAGE[2]

SMART LOCK[3]

SMART LIGHT[4]

Google Assistant

androidauto

Available now on all Android Auto compatible Pioneer in-dash receivers, including the flagship AVIC-W8400NEX.

PIONEERELECTRONICS.COM/**CAR** FACEBOOK.COM/**PIONEERNORTHAMERICA** INSTAGRAM.COM/**PIONEERCARAUDIO** YOUTUBE.COM/**PIONEERELECTRONICS**

[1]Compatible smart thermostat required. [2]Compatible smart garage door opener required. [3]Compatible smart locks required. [4]Compatible smart lights or smart switches required.

A LOOK AT NEXT-GEN TECH

Disruptive innovation is central to America's entrepreneurial culture

Seth Lowe Photography

8
Innovator
John Stone
Leading Digital Farming at Deere


AFTERSHOKZ
TUNE IN
WITHOUT
TUNING OUT
BONE CONDUCTION HEADPHONES
open
Open-ear design keeps you connected
Titanium frame offers weightless fit
Skip tracks, take calls + adjust volume on-the-go
#BeOpen
aftershokz.com

INNOVATOR

John Stone
Driving Digital Farming at Deere

John Stone is senior vice president at Deere and Company's Intelligent Solutions Group

He is leading a digital renaissance for farming. Since his appointment to the position in 2016, he has been leading the company's efforts to deliver innovative technologies that enhance the performance of John Deere equipment and allow customers to improve their operational performance and better manage costs.

Stone joined Deere & Company in 2002 as a project manager and has since held numerous executive leadership positions at the company. Prior to joining Deere, Stone worked for General Electric and before that was an officer in the U.S. Army. He has a B.S. degree in mechanical engineering from the United States Military Academy and an MBA from Harvard Business School.

Deere & Company provides advanced products and services to its customers who cultivate, harvest, transform, enrich and build upon the land to meet the world's dramatically increasing need for food, fuel, shelter and infrastructure. Stone says, "This year, we surpassed a significant milestone of having our precision agriculture technology adopted in more than 100 countries and have well over 100 million acres engaged in our digital ecosystem."

i3 had the opportunity to learn about Deere's latest advances and their plans for CES 2019.

Q Can you talk about the cross section of farming and technology?

A Our world is changing, from the rapidly increasing population and globalization of resources, to the impact of human interaction on the land. In fact, the Global Harvest Initiative predicts we'll have about 2.5 billion more people to feed on this planet by 2050. These changes are requiring farmers to produce significantly higher crop production, profitably and sustainably, while they deal with a declining rural workforce. This is only going to be possible by bringing precision ag technologies to the farm. Many outside the farming world might not be aware that Deere has been investing in leading edge technologies for many years. Automation, connectivity, artificial intelligence (AI) and machine learning are a few key technologies we're focused on to build a continually smart, evolving and more efficient farm.

Q How has your business model changed?

A Getting the most out of a farming operation has always been challenging, but today's farmers face conditions that dictate a new level of effort and concern for their operations, such as changing weather patterns and the availability of arable land. As the challenges became more pronounced, farmers could take advantage of technology advances to optimize farming operations. Deere has always partnered closely with farmers to advance the use of technology on the farm and over time, it became clear that customers needed more and more insights to solve their needs. A clear opportunity emerged for Deere to drive advancements in technology to bring new answers to these evolving customer needs. It meant bringing the tech revolution to the farm to work in combination with Deere machinery to deliver economic impact to the farmer.

As a result, Deere made a strategic investment to ensure its role in the technology revolution on the farm with the ISG. Outside of Deere's five traditional product platforms and operating globally, ISG has roughly a thousand engineers, developers, data scientists and computer scientists who design and develop the hardware and software that make Deere machines smarter, more precise and more productive. ISG helped capitalize on the

Photography by Seth Lowe

use of technologies such as GPS, vision, sensors, robotics and machine learning. Adding this capacity opened the route to precision agriculture, providing software and data-based solutions that work with equipment and analyze outcomes to solve complex problems on the farm.

Q How is the collected data used and transmitted? Can you explain how the MyJohnDeere platform works?

A Data is essential for farming operations today. Think of our machines as platforms for software and data. Our machines collect the highest quality and most relevant data from each job done in the field. Sometimes, this data is analyzed and acted upon in near real time within the machine itself or bringing an operator or remote manager into the loop by streaming data to a mobile device to help quickly identify and address any issues or problems that may come up. Our large ag machines leave the factory with a 4G LTE modem with Wi-Fi and Bluetooth and transmit data to mobile devices as well as to the cloud. This connectivity also allows machines to share data with each other while operating together in the field to ensure optimal precision and accuracy of the job being done.

Farming generates a ton of data. We built up a large data platform in the cloud and have developed a robust set of web and mobile apps for farmers to store, visualize, secure and analyze their data. Additionally, since most farmers don't farm alone, the John Deere Operations Center has over 100 connected software companies offering tools and services that farmers can elect to connect with and utilize. No other company has such a large and diverse ecosystem as the Operations Center. Our extensive APIs enable a collaborative approach across agriculture. The Deere-led eco-system provides farmers with insights for decision making and Deere equipment with intelligence to automate complex operations, both of which are critical to managing the 1,500 variables that can be associated with each acre of farm land. With this online platform, farmers can access, view, archive, manage and share a wide variety of business information right from their smartphone, tablet or computer whenever and wherever they need it. This tool connects customers with their trusted advisors and gives them the ability to make choices about the use and flow of the data. Now farmers can store their data in a system that never forgets.

> **"Automation, connectivity, AI and machine learning are a few key technologies we're focused on to build a continually smart, evolving and more efficient farm."**

Q How is GPS incorporated?

A It is important to note that John Deere has our own, captive GPS company in Torrance California called Navcom Technologies whom we acquired in 1999. Our technology allows for accurate localization to within one inch and we have leveraged this technology to now allow our machines to steer themselves through the field on precise guidance lines. Think of the benefits: a farmer using this technology will never plant the same row twice, never miss a row and never spray the same row twice. Most estimates would say that using Deere GPS technology will save a farmer 10 percent of total input costs due to less wasted seed, fertilizer, fuel and time.

GPS technology is also essential to precise data capture, which in turn enables a farmer to make more informed decisions. For example, through GPS technology, farmers today can create geospatial maps of data collected each planting season which can show a farmer what areas of their land was most successful in growing the crop and areas they might want to avoid. Having that insight captured for many years, in some case up to twenty, enables better decision making and more automation of the individual jobs as the farmer can tell the machine where it wants the seeds to go.

Q Is this just for commercial farming?

A Our technologies are used in over 100 countries in the world on farms focused on row and broad acre crops. To provide you with some context, of the 309 million acres of land in the U.S. that grows a crop, 99 percent of it is used for row crops like corn or broad-acre crops like wheat. The other one percent is used for fruits, nuts and vegetables. We are focused on evolving farming practices for both types of crops using AI, robotics, data science and sensors.

Q Is there a learning curve to using this equipment?

A As with any technology, having a comprehensive understanding may not happen overnight, but we're focused on making the technology impactful and easy to learn. Most people are surprised to hear that farmers are some of the most tech-savvy professionals in the world. We're seeing customers at all ages and backgrounds embracing and using the technology. We continue to invest heavily in building up capabilities in Digital User Experience research, a truly fascinating and important space.

Q Can you talk about your presence in Silicon Valley?

A In the spring of last year, we announced the creation of our John Deere Labs in downtown San Francisco to create a physical presence in Silicon Valley for prospective partnerships and to advance new technologies in AI, machine learning and robotics. Late last year, Deere also acquired Blue River Technology, a Silicon Valley startup, to further strengthen our core capabilities. Blue River Technology's main product, See&Spray — a smart sprayer system that can distinguish weeds from plants in a field — has the potential to reduce herbicides use by up to 90 percent based on field tests. That is truly

a breakthrough, and while we are a couple years away from full production, we see great promise in this technology and for many other Deere machines. Together, we're helping farmers move from making and implementing decisions at a field level to addressing the needs of each individual plant.

This strategy and vision puts Deere in a unique position to offer software engineers, machine learning engineers and data scientists an opportunity to work for a company that is not only developing cutting-edge technology but helping transform one of the only industries that impacts every single person in the world.

Q What tech areas do you think will most significantly impact farming in the coming years?

A The challenges associated with farming are not going to ease over the coming years, so we'll continue to see growth in smart technology such as AI and machine learning on the farm. AI and machine learning will become as core to Deere as engines and transmissions are today. In fact, we have a camera sensor on board our new S700 Combine Harvester that uses a convolutional neural net to moditor harvested grain quality and make recommendations to optimize other settings to ensure the best outcome. Think about that — John Deere has machine learning systems in production, in customer hands today. We envision a world where agriculture machines not only navigate without human intervention, but they will perform millions of micro jobs per day better than a human. By continuing to automate more and more machine elements of the operation, the farmer will be able to focus on other, non-autonomous parts of the business.

Machine learning and computer vision technology will begin to open the opportunity to farm at an individual plant level. Machines will be designed to sense, understand and tend to the needs of every plant, maximizing yield and productivity, and reducing costs. Data will play an ever more important role. We'll see more precise and actionable data generated from the equipment that will not only help improve analysis and better decisions by the farmer but will also help drive the machine learning and autonomous systems I mentioned already. Finally, as autonomy increases, we'll see more and more farmers interacting with their farm through intuitive user interfaces outside of the machines on the field. I recently met a farmer who said he expects to manage his entire farm from his smartphone by the time he is 40. He is 35 today.

Q When did John Deere first move into digital farming?

A John Deere has consistently pushed the boundaries of what's possible with technology on the farm, starting with the introduction of our first mechanically powered tractor 100 years ago. More recently, we ushered in the first elements of autonomy to the farm 20 years ago with the acquisition of NavCom, where we integrated highly-precise GPS navigation and self-driving technology into our tractors and other equipment. This was a groundbreaking development which enabled farmers to focus on the other key elements of their operation such as setting adjustments taking place in the cabs of our equipment, rather than focusing on driving in a straight line. We've since elevated this technology to equip farmers with machines that not only drive themselves but have the flexibility to control other machines and make smart decisions.

In addition to focusing on other elements of the operation, one critical benefit of this technology is having data on things like the exact positioning of where seeds are placed, year-over-year, in a geo-spatial map which enables a level of actionable insight not previously attainable. The insight gleaned from this documentation, spanning 20 years in some cases, has enabled more precise job automation and will be foundational as we continue innovating.

The introduction of IoT was another major disrupter for the farming world, and we've delivered wireless, data and sensor technologies to simplify operational decisions, enable machine-to-machine communication and aid in fleet management. A great example of this technology in action is our remote service capabilities, which enables John Deere

Photography by Seth Lowe

dealers to remotely check the health of farmers' machines proactively. If an alert comes up, the service technician is notified instantly and can remotely analyze the root cause and, in many cases, even solve the issue remotely, without the farmer even knowing about the issue in the first place.

The John Deere Intelligent Solutions Group (ISG) is a division of Deere that creates advanced AI, machine learning, IoT, mobility, guidance and automation technology to ultimately improve our customers' productivity, efficiency and profitability. Through partnerships and R&D, we continue to innovate at a scale that's faster and more advanced than anyone else in the industry and will continue to lead the charge to bring intelligence to farm equipment to enable farmers to feed the world.

We're shifting from bigger, faster and stronger machines, to solutions that are more automated, easier and precise. We're also proving that not only does "Nothing Run Like a Deere," but "Nothing Thinks Like a Deere" too.

Q What is precision agriculture? Has this resulted in higher yields and other benefits?

A Precision agriculture is all about using technology like sensors, GPS, data, AI and automation to make more informed and accurate decisions. Before the introduction of precision agriculture technology, all fields and crops were treated as if they were the same and had the same needs. For example, by applying the same amount of fertilizer down over the entire field, famers ended up having waste in some areas because the soil couldn't hold the nutrients and serve the plant at that level in all spots. To better design, develop and bring advanced precision technologies to market, we developed John Deere's ISG. ISG is at the core of Deere's innovation, working across all divisions to make sure that the company is aligned in technological advancements. The use of precision ag not only results in higher yields, but these machinery systems also enable farmers to increase their output while controlling costs, conserving land and water resources and reducing the overall environmental footprint of agriculture.

Q Can you talk about your participation at CES?

A This year's CES is huge for us. We're going big. Our booth will be located on the lower level of South Hall (LVCC, South Hall 2 – 26408) within the artificial intelligence section. We're excited about this space because attendees will have the opportunity to speak with our team and see in person the intricate technologies that farmers are using today – from sensors to AI, connectivity and everything in between. They'll get an up-close view of our latest combine, or what we like to call our interconnected factory on wheels, right on the show floor. It will be hard to miss! On top of that, you won't just see cars in this year's self-driving lot. It will be hard to miss the big green tractor driving around the lot showing off our automated technology.

Q What are your global goals for the company?

A Farmers need to contend with a lot of challenges stemming from a growing population and unpredictable weather. At the same time, we're seeing an increase in urbanization and a decrease in arable land and skilled workers in rural areas. Our goals revolve around our farmer customers. We strive to bring leading edge technologies to solve problems and capture opportunities that will make Deere customers the most profitable and sustainable farmers in the world. This year, we surpassed a significant milestone of having our precision agriculture technology adopted in more than 100 countries and have well over 100 million acres engaged in our digital ecosystem. On top of that, 25 percent of the world's arable land is being farmed with Deere technology. Our global growth isn't just rooted in products, but in bringing connectivity to rural areas in South America, Africa and India so that the technology works. It's also driven by a deep customer understanding of regional-specific farming practices which drove each technology value proposition required for customer adoption. ■

GO ONLINE: Read the entire interview at **CTA.tech/i3.**

Singapore Named 'Innovative Champion' by CTA

In the *2018 International Innovation Scorecard*, produced by CTA, Singapore is ranked the sixth most innovative country in the world. According to the scorecard, Singapore is a "playground for innovative tech," outranking every other country in its percentage of highly-skilled employees and tax friendliness. The report also praised the country for its high levels of ethnic diversity and having little unruly regulation on self-driving vehicles and drones. Learn more at **www.internationalscorecard.com**.

INTERNATIONAL FOCUS

SINGAPORE

INTEL, MICROSOFT TO SUPPORT AI WORKSHOP

AI Singapore — a national initiative to enhance Singapore's artificial intelligence (AI) capabilities — unveiled a new program in late August called AI for Everyone, which will provide free AI training to 10,000 participants. The program also aims to assuage fears that AI will replace jobs. AI for Everyone features a series of three-hour workshops over the next three years. Materials for these workshops will be provided by the program's content partners, Intel and Microsoft.

Singapore Government Launches $30 Million Clean Tech Grant

Singapore's Senior Minister of State for the Environment and Water Resources Amy Khor in September announced a new $30 million grant for businesses to offset the cost of efficient cleaning technologies. Waste management companies looking to enlist technologies such as automated street cleaners and smart waste bins can receive up to $250,000 per company. The grant will be available until January 2020.

Facebook to Build $1 Billion Data Center

Facebook selected Singapore as the location for a new $1 billion data center, slated to open in 2022. The new facility will run on 100 percent renewable energy and use a liquid cooling system to reduce the amount of water used by 20 percent. The new 11-floor, 170,000 square foot site is expected to create hundreds of jobs in the western Singapore region.

From top right: Joyt/Getty Images, Courtesy of Facebook, Jonathan Chiang/Getty Images, Peter Hermes Furian/Alamy, Martin Puddy/Getty Image.

A TECH TO WATCH

Making Machines Think Like Humans

Right at the start, I want to invoke a temporary restraining order: Nowhere in this column will I use the phrase "machines will never think like humans." Once upon a time no one thought humans would ever fly in a machine, so I will be careful about saying what machines can do.

With that disclaimer, even with the advent of artificial intelligence (AI), computer programs that think like humans are far beyond where we are now. Today's AIs are powerful and skilled machines (or chips) that can "learn" in new ways. The obvious evidence of the improved powers of AI are gadgets like smart speakers with virtual assistants, being able to unlock your iPhone via face recognition, online apps that anticipate your next purchase and upcoming self-driving vehicles.

We've also watched IBM's Watson defeat human contestants on the game show "Jeopardy," and Google's AlphaGo beat the world's best players of the complex Chinese board game Go.

AI Breakthroughs

Machine learning involves training computers to perform tasks based on examples, rather than solely on programming. Deep learning has made this approach more powerful by using artificial neural networks that loosely mimic how our brain cells work, forming adjustable connections between different network parts. The machine can then learn from its experience and build up an ability to interpret similar data in the future.

But even after deep learning, an AI computer still must gather facts about a situation through sensors, compare this information to its stored data, run through possible actions, choose the action likely to be successful, and finally "remember" to replicate this action the next time it encounters the situation.

The difficulty is that all the impressive progress we've made to date is mostly due to learning systems that take advantage of large quantities of human-provided data. The main obstacle we face in duplicating human learning is how to get machines to learn in an unsupervised manner. They need to become more adaptable. We eventually want machines that can learn a new skill from just one or two examples, duplicating the human ability to work successfully in entirely new situations.

Supervised learning is not how humans learn. Children can learn just by observation. Teachers don't tell a child "this is water and water is wet." They experience it for themselves and know it with certainty after just one trial.

In 1950, Alan Turing, a computing pioneer, conceived a test to measure the progress of a computer exhibiting intelligent behavior equivalent to, or indistinguishable from, that of a human. The Turing test works like this: One of two partners in a conversation is a machine. A person communicates with both the machine and human via text on a screen and must guess whether the typed responses are being written by the human or the computer. The more often the AI is mistaken for a human, the better it is. When the human cannot reliably tell the machine from the other human, the machine has passed the test.

Part of the difficulty of developing truly intelligent machines is that we don't understand how natural intelligence works. Our brain contains billions of neurons and we learn by establishing electrical connections between different neurons. But we don't know exactly how these connections add up to achieve higher reasoning, not to mention inference, instinct and self-awareness.

Machine reasoning will improve as we develop systems that continuously sense, interact and learn from the world. But building a machine that can replicate key facets of human thinking will take time. ■

"Machine learning involves training computers to perform tasks based on examples, rather than solely on programming."

CES 2019 See the latest in AI, robotics and the smart home.

C4 TRENDS

The Promise of 5G at Home

5G is becoming reality with carriers rolling it out in limited markets. Combined with the scaling of the Internet of Things (IoT) and artificial intelligence (AI), 5G offers new capabilities beyond enhanced broadband, including the promise of hyperconnectivity. With the added demand of sending and receiving data from IoT devices, ranging from refrigerators to dog collars, people will expect instantaneous gratification with 5G's increased transmission speeds and amplified bandwidth.

In 2019, 5G will impact gaming, displays and TV experiences. 5G will boost AI — including virtual assistants such as Amazon's Echo and Google Home. Early applications will include fixed wireless access for the home and connected shuttle services in cities. Ultimately real-time information will let cars talk to other cars, making roads safer and more efficient with always-on connected cameras, sensors and alarms.

The key to 5G lies in "how we take trials and learnings and make them consumable products," says Igal Elbaz, SVP of wireless network architecture and design at AT&T. 5G will be a game changer in entertainment. It promises to deliver 4K and 8K Ultra High-Definition, 3D and holographic video, as well as augmented reality (AR) and virtual reality (VR) applications for gaming and immersive TV.

> **"By 2035, 5G will enable $12.3 trillion of global economic output and support 22 million jobs worldwide."**

Immersive Experiences

With 5G, be thoroughly immersed in the comfort of your home as if you were at an events venue with new digital services and content for connected stadiums. For instance, live sports coverage could be broadcast with a 360-degree view from the athlete's perspective.

In early 2018, Verizon used a prototype 5G network to stream live, 360-degree stereoscopic video from the Super Bowl in Minneapolis to VR headsets in New York City. It provided a virtual in-stadium experience to fans, including high-resolution replays on secondary screens that employed multiple 4K and HD video streams.

In Japan, NTT DOCOMO has hosted "new sensory music live events,' employing a range of image technologies such as head-mounted displays and 3D-holographic image projection technology to give remote viewers the sense of a live performance. "8K video transmissions are ideal for customers who want a more realistic live experience of sports and music," according to DOCOMO. "In combination with technologies like AR and VR, it has the potential to change the way we enjoy these things in the future."

Vicky Coif, CTO at Warner Bros. says, "We're engaging with 5G because we recognize 5G is going to impact how fans and consumers engage and interact with our content. But not just that — if you look at our production and distribution operation, it's going to change fundamentally how those work as well. It's going to improve how our creatives and employees function on a day-to-day basis."

Connected Screens

Although smartphones will still be used, 5G can deliver video streams to many different displays. Every wall, surface and screen could become an entertainment window, letting consumers enjoy HD video without expensive hardware. Low-cost slim-line screens could remotely access interactive entertainment from cloud-based servers.

In 2020, Foxconn plans to produce 5G-connected displays supporting ultra-sharp 8K. Hollywood is beginning to produce movies in 8K, and Japanese public TV company, NHK, plans to broadcast the 2020 Tokyo Olympics in 8K. Meanwhile, personal 8K video cameras are becoming available from manufacturers like GoPro.

5G is expected to generate new investment across the ecosystem. "By 2035, 5G will enable $12.3 trillion of global economic output and support 22 million jobs worldwide," says Ronan Dunne executive vice president and group president of Verizon Wireless. "5G is creating the conditions to bring pieces together and harness talent to build new opportunities. It will herald a new Renaissance," adds Dunne. ■

Millionsjoker/Getty Images

CONTACT:
Reach Susan at
susan@c4trends.com

CES 2019 See how 5G enables everything from smart cities to artificial intelligence.

PIPE LINE

The Standard for Energy Management

Connecting Homes to the Smart Grid

As consumers and homeowners, we are using more electronic devices and appliances, and looking for ways to conveniently connect those products to our home network. We expect our gadgets to "stay on," but that can also mean higher energy bills. Being able to determine our energy usage and adjust usage based on personal needs can help consumers manage their energy costs.

The smart grid vastly improves our nation's energy infrastructure by allowing for instant, real-time information sharing between an electric utility and its customers. With the right equipment, consumers can monitor and manage their homes' energy use. This same equipment also enables the electric utility to digitally respond to changing electricity demands or conditions, maximizing network efficiency and minimizing costs for both utilities and their customers alike.

ANSI/CTA-2045-A, *Modular Communications Interface for Energy Management*, outlines specifications for a communications interface (known as a modular communications interface or MCI) that facilitates communications between residential devices and the smart grid for applications such as energy management. This interface can pass simple communication through standard protocols, allowing energy management signals and messages to be exchanged among devices in a home and the smart grid system. These devices can include consumer products such as sensors, thermostats or appliances, as well as energy-related equipment such as energy management hubs, energy management controllers and residential gateways.

As explained by Dr. Kenneth Wacks, Chair of CTA's Modular Communication Interface for Energy Management Committee:

"Utilities worldwide are investing heavily in smart grid infrastructures to ensure a reliable supply of electricity and to accommodate new technologies for power production. Smart grid programs are being offered to consumers for energy conservation, and for energy management to align demand for power with available supplies. Consumer devices equipped with ANSI/CTA-2045-A interfaces can participate in energy management programs such as demand response and can interconnect with distributed energy resources including local generators (wind and solar) and energy storage devices."

Chesky_W/Getty Images

CTA Standards

ANSI/CTA-2045-A, *MCI for Energy Management*

ANSI/CTA-2045.1, *MCI for Firmware Transfer Message Set*

ANSI/CTA-2045.2, and ANSI/CTA-2045.2, *Amendment 1 MCI for Generic Display Message Set*

ANSI/CTA-2045.3, *MCI Interface for Thermostat Message Set*

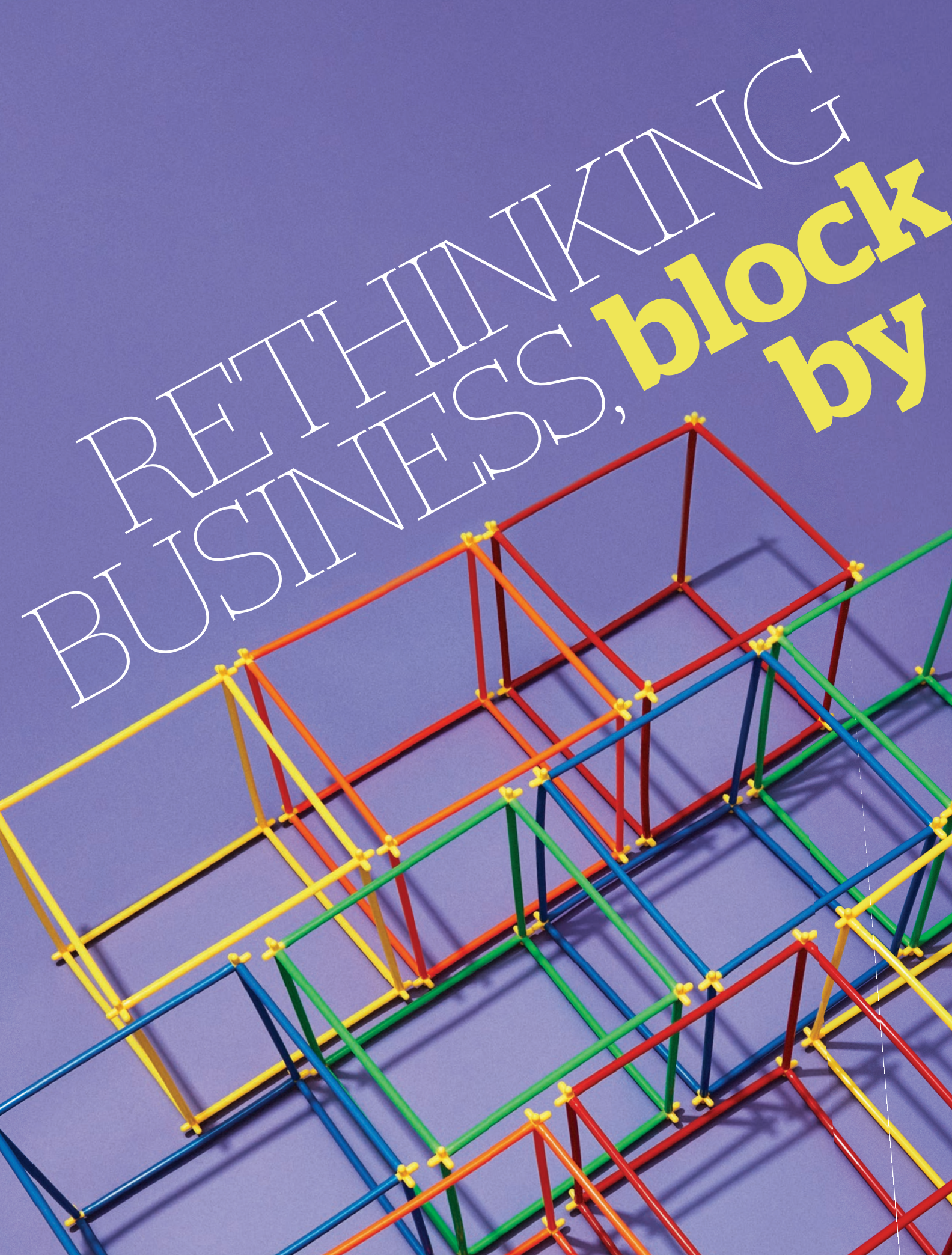
A Look at One Case

Con Edison in New York has made CTA-2045-compliant modules available to customers buying packaged terminal air conditioners typically found in hotels, hospitals and apartment buildings. Under the Con Edison program, the utility can remotely adjust a customer's thermostat on hot days when the demand for power is high, saving both the customer and Con Edison money. The customer is always in control, though. Customers are electronically notified when their thermostat has been adjusted by the utility and the customer can manually override the utility's action. The program is part of Con Edison's strategy for maintaining reliable service during extreme weather conditions.

ANSI/CTA-2045-A, revised in March 2018, has several companion standards for smaller interface designs and device profiles including message sets for thermostats, firmware transfer and generic display. Members of CTA's Modular Communication Interface for Energy Management Committee have made efforts to harmonize ANSI/CTA-2045-A with international standard ISO/IEC 10192-3, Modular Communications Interface for Energy Management.

CTA's standards committee is considering additional message sets for lighting control and solar inverters. Contact Leslie King: lking@CTA.tech for information on how to get involved. ■

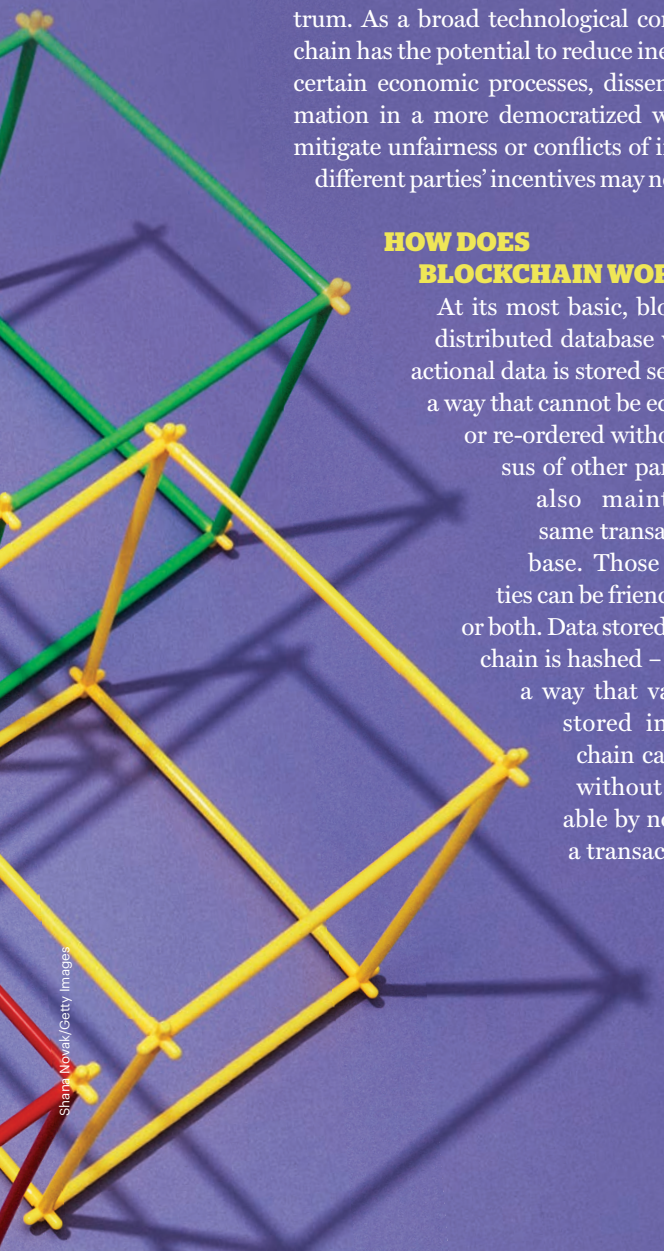
RETHINKING BUSINESS, **block by**



block

BY JACK CUTTS

Depending upon whom you ask, blockchain is either the next big thing in tech or is just more of the dross drummed up by the never-ending tech hype cycle. Like many things in the world of tech, the reality likely will fall somewhere in between those two extreme ends of the spectrum. As a broad technological concept, blockchain has the potential to reduce inefficiencies in certain economic processes, disseminate information in a more democratized way and help mitigate unfairness or conflicts of interest when different parties' incentives may not be aligned.



Shana Novak/Getty Images

HOW DOES BLOCKCHAIN WORK?

At its most basic, blockchain is a distributed database whose transactional data is stored sequentially in a way that cannot be edited, deleted or re-ordered without a consensus of other parties who are also maintaining the same transactional database. Those counterparties can be friend, foe, neither or both. Data stored in the blockchain is hashed – encrypted in a way that values or info stored in the blockchain can be verified without being readable by non-parties to a transaction.

Unlike encryption/decryption, data that is properly hashed cannot be unhashed, greatly bolstering its security and usefulness for this type of application. Using hashing in this way, a doctor's office, for example, could verify your Social Security number by having the patient give them the hashed value of their number which the doctor's office could compare against the hashed value stored in the blockchain. Similarly, the blockchain can store images, video clips, code or anything that can be stored digitally — all securely hashed.

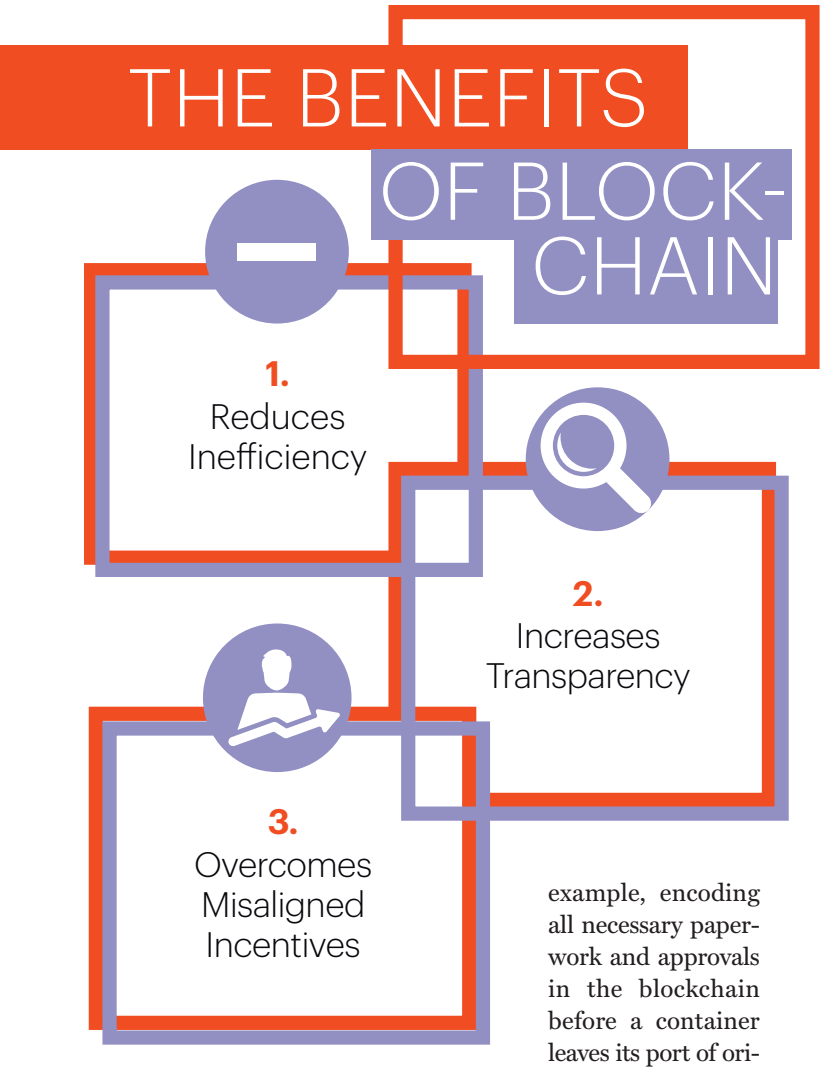
REDUCING INEFFICIENCY WITH BLOCKCHAIN

As startups around the world have proven, there are plenty of antiquated business models out there that are ripe for disruption by someone who is willing to rethink a process, become more customer-centric, or anger more established players.

One industry ripe for this disruption is the shipping industry. The increasingly globalized nature of commerce means that transoceanic shipping is as important as ever for the free flow of goods around the world.

Perhaps emblematic of that importance, long-haul shipment of goods often come with hundreds of pages of paperwork to help it pass through the hands of the various ports, dock workers, insurers, transport companies and governments it interacts with on the way to its destination. At best, shippers use a 60-year-old system called electronic data interchange (EDI), whose best days are well behind it. Delays in certain key pieces of paperwork and transmittal of data can delay a shipment for hours, days or even weeks.

Some heavy hitters within the shipping and tech industry are setting out to change that. IBM and Danish shipping titan Maersk teamed up on a new project called TradeLens that uses the power of blockchain to help goods move faster and more efficiently around the world. Projects like TradeLens seek to streamline shipping by, for



example, encoding all necessary paperwork and approvals in the blockchain before a container leaves its port of origin. Normally, the alternative is waiting weeks or months for contracts to be executed and payments to be made to the various parties involved in a shipment.

Further, using the power of smart contracts — code that is embedded in the blockchain and executed when certain conditions are met — a payment to a port could be triggered automatically once cargo is inspected and approvals get obtained, allowing a ship to easily set sail for its next waypoint.

The mortgage underwriting process can also benefit from blockchain. Now, each party requiring information requests copies of relevant documents individually using delivery methods as diverse as electronic upload, email, fax, courier and carrier pigeon. A blockchain that can encode frequently requested documents and keep them safe could be a boon to hopeful home buyers during an extremely stressful and invasive time.

Imagine a mortgage underwriting process where the potential buyer inputs all relevant financial documents into the blockchain, making the title company, the buyer's agent and so forth readily available for the underwriting bank.

INCREASING TRANSPARENCY WITH BLOCKCHAIN

Blockchain technology can also use the power of the "distributed ledger" to increase transparency among parties to a transaction and, potentially, those who have oversight over a certain industry or group of companies.

One of the primary causes of the housing bust of the late 2000s was overleverage. Many individuals and small-time investors got caught up in the housing boom and spent more on their house (or houses) than they could afford. Money was cheap, so to speak, and lending standards were lax compared to prior eras in American history.

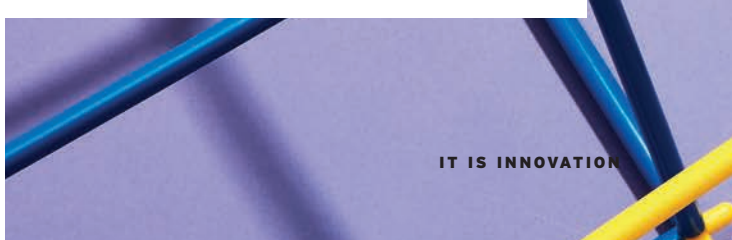
Many banks were overleveraged as well. Not only did certain banks make loans that turned out to be bad bets, many investment banks traded in collateralized debt obligations (CDOs) that were derivative securities designed to securitize and sell cash flows generated by mortgage payments made by individuals.

However, because of the nature of the derivatives trade in CDOs, there was nothing stopping a mortgage on the house at 123 Pine Street in Miami from being securitized and sold three, five, even 20 times in a short time span. If the mortgagee pays on time, then all is well, and banks make money. However, if the mortgagee defaults, the economic damage spreads beyond the lien holder to all the banks holding CDOs based on the underlying mortgage.

The damage from default on that mortgage has the potential then to be three, five or even 20 times worse. In some cases, banks packaged derivative CDOs made of other CDOs (dubbed a "CDO-squared"), bringing about the potential for exponentially more financial harm.

What if blockchain allowed all parties and potential parties to a transaction to see exactly who owned each side of a financial transaction, thereby making an opaque transaction more transparent? What if a central bank, for example, could use blockchain to determine which local markets were the most overleveraged in the CDO market and use that information to warn banks, adjust underwriting standards or modulate interest rates to mitigate risk?

By using blockchain to tie all CDOs and CDOs-squared back to the underlying asset, parties making a transaction could untangle a mess of intertwined transactions to determine just how



leveraged an asset really was, thereby allowing them to price their risk accurately.

Another interesting use of blockchain to increase transparency comes from the world of the Internet of Things (IoT). The blockchain's ability to store video footage could be used to store video feeds from a police officer's body camera. If data from the body camera were stored not just on the camera itself but uploaded to a cloud-based blockchain each maintained by, for example, the police department, the police union and the state's attorney general, then footage could neither be added, deleted or edited to cover up misdeeds or corruption.

In this example, the blockchain increases transparency by being a solution that overcomes the misalignment of incentives between a police department, a union representing employees and an attorney general's office looking to stamp out corruption or other transgressions. By encoding data into the blockchain in multiple locations, video footage cannot "go missing" or be altered. Events like turning off a body camera or device failure could also be encoded in the blockchain for all to see and verify.

OVERCOMING MISALIGNED INCENTIVES WITH BLOCKCHAIN

A third major benefit of blockchain is its ability to overcome misaligned incentives and asymmetry of information in certain situations. Real estate is another tradition-bound industry that is on the cusp of significant disruption. Anyone who has ever bought or sold a house can tell you about the opacity of the negotiation process between the buyer's and seller's agents. It is not uncommon for sellers' agents to negotiate the sale price of a home over the course of hours or days while the seller waits by the phone for news of the final sale price.

Sellers can inquire as to the details of offers made on a property, but the timing and nature of bids from potential buyers, especially in multiple-bid situations, are often not disclosed or glossed over. Further, in a competitive bidding situation, the seller's agent is the only party to the transaction who holds all the information on bids and other negotiated terms. It is not inconceivable that a seller's agent, who is motivated first and foremost to generate a successful sale, might steer a home sale away from a buyer who offers more money than the next highest bidder simply because the high bid carries more risk for the underwriter and therefore might inadvertently scuttle a sale at the eleventh hour.

Blockchain can help solve a couple of issues inherent in the scenario described above. If bids are encoded in blockchain, the timing and quantity of bids can be known by all parties and potential bidders. Second, technology exists to determine if an incoming bid is higher or lower than a bid already recorded in the blockchain, even if that value is hashed and not human-readable.

That way, a home seller can verify the quantity, timing and competitiveness of incoming bids while a buyer's agent can bid enough to be the high bidder without causing their client to overpay for a home. It is important to point out that the majority of buyer's and seller's agents are honest people working in the best interest of their respective clients, but it is rare to find an economic system or arrangement that cannot benefit from some measure of increased transparency and reconciliation of incentives.

NO SILVER BULLET

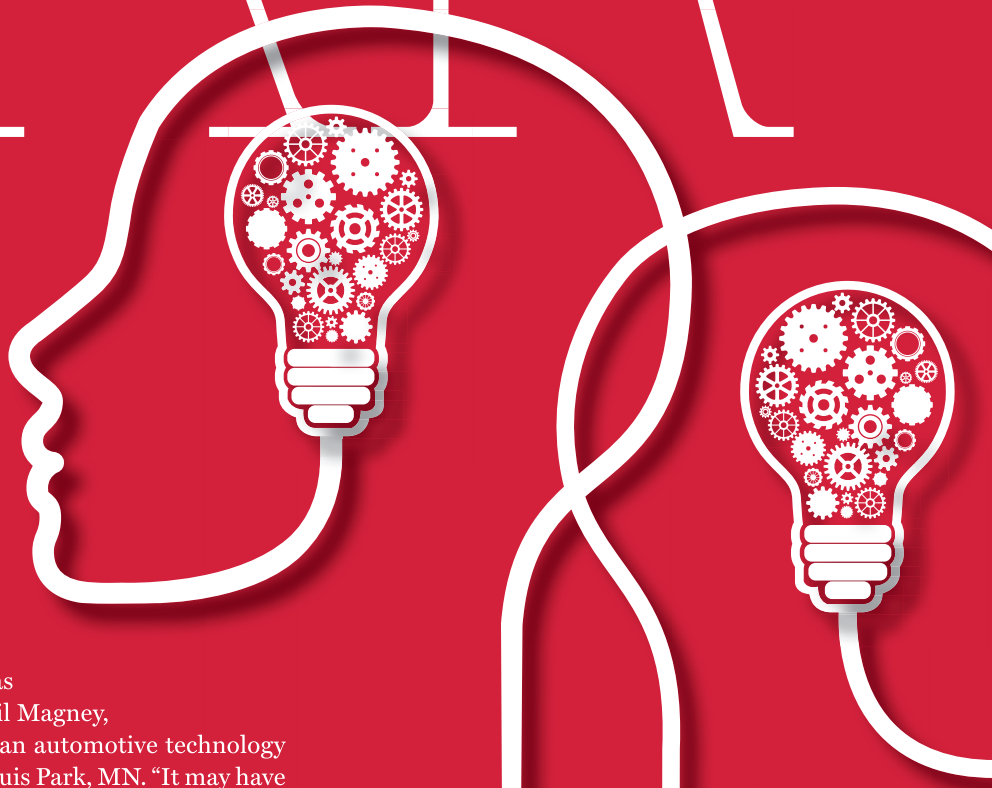
Blockchain is not the perfect solution to every problem. Many of the problems described above could, in theory, be solved with a database and a well-crafted and vigilantly enforced legal framework. The power of blockchain to solve these challenges lies primarily in its distributed nature along with its ability to be both open to inspection (and therefore transparent) while also protecting its data from loss, theft, alteration or misuse.

Further, there is a potential cost of non-participation if certain players in an industry like shipping or real estate choose not to work within the blockchain ecosystem. Imagine being the only port in southeast Asia to still require faxed paperwork or being the last real estate agent in town who only accepts bids over the phone and won't disclose relevant details.

Blockchain is still in its infancy. Many exciting projects with interesting applications of the technology have been announced. Many of those projects will never make it beyond the press release. Some will fail because they were misapplications of a headline-grabbing hot-this-year buzzword. But we will surely see unique situations where blockchain is the best and most logical solution to a problem that, as of yet, we have failed to solve. ■

Shana Novak/Getty Images

CAR SMA

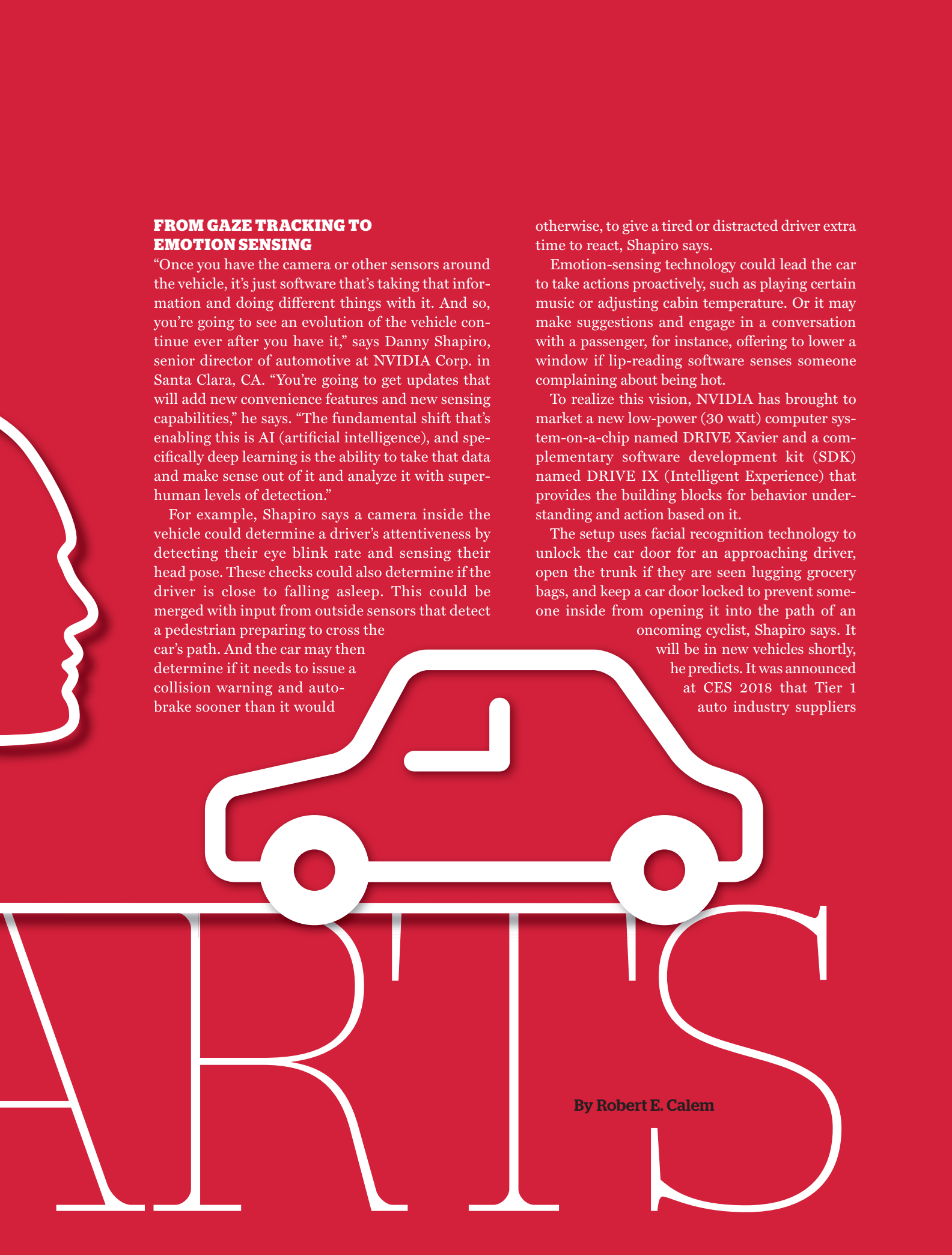


The computers, sensors and software in cars are getting so smart they may eventually detect whether the driver and passengers are happy or sad, comfortable or uncomfortable, alert or distracted. And as a result, driving automobiles can be made safer and more enjoyable.

"Driver monitoring is extremely important for active safety systems as well as automated systems," says Phil Magney, founder and principal at VSI Labs, an automotive technology applied research firm based in St. Louis Park, MN. "It may have been a nice-to-have feature beforehand. Now you can say it definitely is a must-have feature."

Nevertheless, he says, car occupant monitoring overall remains in a state of flux — particularly regarding user experience.

Triloks/Getty Images



FROM GAZE TRACKING TO EMOTION SENSING

"Once you have the camera or other sensors around the vehicle, it's just software that's taking that information and doing different things with it. And so, you're going to see an evolution of the vehicle continue ever after you have it," says Danny Shapiro, senior director of automotive at NVIDIA Corp. in Santa Clara, CA. "You're going to get updates that will add new convenience features and new sensing capabilities," he says. "The fundamental shift that's enabling this is AI (artificial intelligence), and specifically deep learning is the ability to take that data and make sense out of it and analyze it with superhuman levels of detection."

For example, Shapiro says a camera inside the vehicle could determine a driver's attentiveness by detecting their eye blink rate and sensing their head pose. These checks could also determine if the driver is close to falling asleep. This could be merged with input from outside sensors that detect a pedestrian preparing to cross the car's path. And the car may then determine if it needs to issue a collision warning and auto-brake sooner than it would otherwise, to give a tired or distracted driver extra time to react, Shapiro says.

Emotion-sensing technology could lead the car to take actions proactively, such as playing certain music or adjusting cabin temperature. Or it may make suggestions and engage in a conversation with a passenger, for instance, offering to lower a window if lip-reading software senses someone complaining about being hot.

To realize this vision, NVIDIA has brought to market a new low-power (30 watt) computer system-on-a-chip named DRIVE Xavier and a complementary software development kit (SDK) named DRIVE IX (Intelligent Experience) that provides the building blocks for behavior understanding and action based on it.

The setup uses facial recognition technology to unlock the car door for an approaching driver, open the trunk if they are seen lugging grocery bags, and keep a car door locked to prevent someone inside from opening it into the path of an oncoming cyclist, Shapiro says. It will be in new vehicles shortly, he predicts. It was announced at CES 2018 that Tier 1 auto industry suppliers

ARTS

By Robert E. Calem

would receive first shipments of DRIVE Xavier early this year.

In fact, AI is a "very pragmatic" way to understand both the driver's engagement and the context in which he's operating, says VSI Labs' Magney. "You can pick up on many different attributes and many different elements." But the technology's need for training data is never-ending and "nothing is ever finished," he adds.

For Eyeris, a four-year-old Palo Alto, CA, company specializing in deep learning-based emotion recognition software, the pursuit of driver monitoring discussions emerged early to much skepticism as well as interest, says Founder and CEO Modar Alaoui. He first presented "driver monitoring that incorporates emotional distraction as a measure for determining cognitive workload" at the 2014 TU Automotive conference in Detroit, when driver monitoring focused only on eye gaze and head position tracking technology. He adds, "We argued that is not enough to determine attention or distraction because a person can still be looking at the right spot, their eyes are open and their head is still in the right direction, but they could be highly emotionally distracted."

"By mating action, activity and body tracking with face analytics, we derive a wholistic interpretation of the human behavior inside the vehicle."

Modar Alaoui
Founder & CEO
Eyeris

In 2017, Eyeris began working on emotional AI for monitoring a person's face and upper body region employing standard (2D) cameras and showcased this technology at CES 2018 in a Tesla Model S demo car equipped with five cameras that track the driver and all passengers.

"We also released an algorithm for action recognition and activity prediction, which uses body tracking as a prerequisite," Alaoui says. It recognizes, for instance, that the driver is smoking, texting, eating or drinking. Although the driver's head and eyes are looking at the right place, he might be reaching out to the glove box or trying to open a bottle of water, which of course translates to distraction.

"By mating action, activity and body tracking with face analytics, we derive a wholistic interpretation of the human behavior inside the vehicle," he says. A higher layer of algorithms called a decision-making AI engine then responds to this interpretation and informs the vehicle — allowing it to passively or actively react, such as by readying a collision avoidance technology to take over. Further, Eyeris' technology predicts imminent distraction on a second-by-second basis, Alaoui says.

Beyond safety, Alaoui anticipates Eyeris' technology could be used in shared self-driving cars to tailor vehicle performance and interior and infotainment features — including the suspension's ride quality, ambient lighting and streamed content — corresponding to the number of passengers and their genders, ages, activities and moods.

"The future of mobility is going to depend hugely on human-centric data in the ridership economy," he declares. "This is really going to change transportation as we know it."

While vehicles like the Tesla Model 3 and the 2018 Cadillac CT6 today have one camera in the cabin to watch the driver alone, "future generations of vehicles are going to have an average of

between three and six cameras inside the car" to track all occupants, Alaoui says. He expects the first cars with three cabin cameras to be in dealerships next year, and next-generation cars to include as many as seven cabin cameras.

The company's demonstration vehicle at CES 2019 will contain 10 cameras, Alaoui notes.

At least one driver-facing camera is a necessity in any Level 3 self-driving car, like the CT6, says Christian Reinhard, vice president and head of customer projects at Elektrobit, a supplier of embedded and connected software and services for the automotive industry, based in Erlangen, Germany. Level 3 requires the car to cede control to a human under certain conditions, and the camera confirms that a person is piloting. However, "you can really do a lot with the camera," Reinhard proclaims. "You can even detect the heart rate of the passengers using the camera, and other health data." And this can lead to a variety of health applications inside the car, he adds.

Indeed, emotion-recognition and physiology monitoring are popular subjects among automotive user experience designers now, says Jacek Spiewla, user-experience manager of advanced development at Mitsubishi Electric Automotive America in Northvale, MI, which makes driver monitoring systems for automakers. But scant attention has been paid to "what are we actually going to do with this information. You can't ultimately determine whether somebody is distracted from the driving task," he says. There can be indications, "but I really don't know whether you're spacing out or not," he contends.

ID'ING WHO'S WHO AND WHAT'S WANTED

Also at CES 2018, Rinspeed AG — a Swiss car design firm — unveiled its Snap "skateboard and pod" self-driving concept car with another way to identify the vehicle's passengers and conform it to them: four iris scanners in drop-down screens supplied by Gentex Corp. The biometrics technology identifies each person and personalizes the seat position, HVAC controls, streaming audio and other settings according to user-determined presets. In addition, it facilitates secure access to cloud-based work files or e-commerce.

For in-cabin monitoring, "the holy grail would be one camera that does everything," says Craig Piersma, director of marketing at Gentex in Zeeland, MI. "That's just not as easy as it sounds."

On the other hand, VSI Labs' Magney says, people are generally unwilling to be watched by a camera. "I'm a little leery of that whole approach, frankly," he adds.

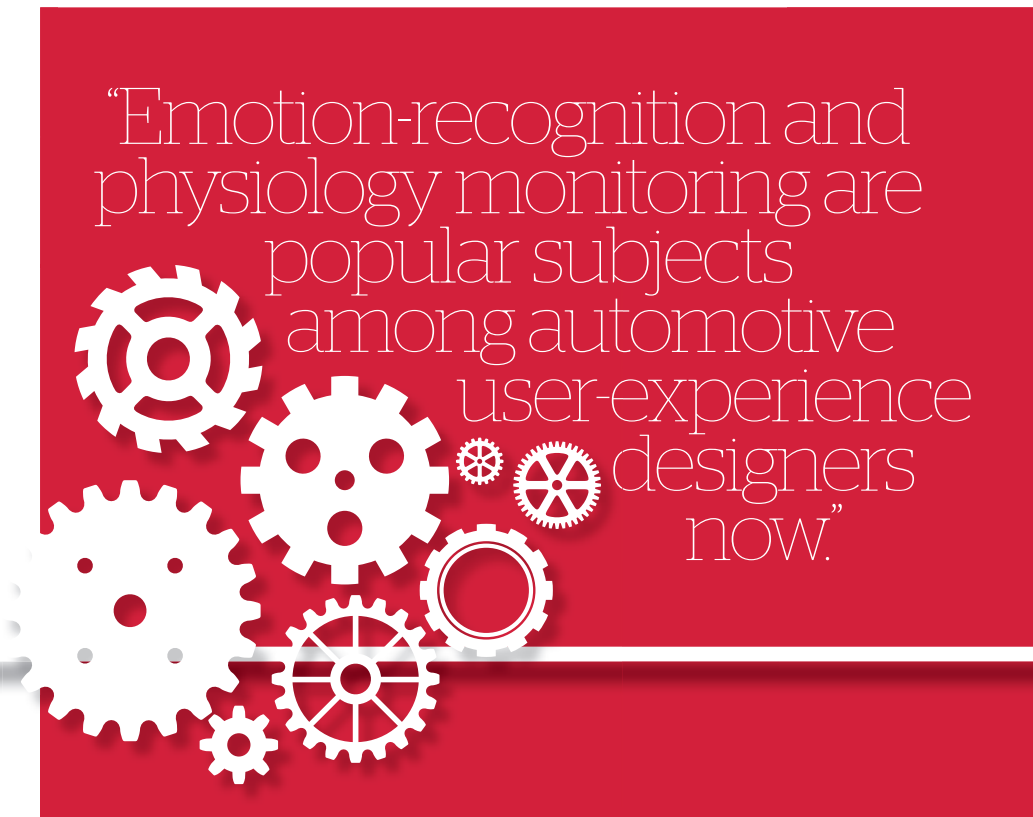
A further possibility is identifying a driver or passengers by their voice pattern to customize the in-cabin experience, says Daniel Sisco, director of cockpit systems at Renesas Electronics America Inc., in Milpitas, CA. On-screen user-interface choices could be fewer or greater depending on the audience. "That's well within reach technically," he says.

Fingerprint identification of drivers is coming, too, and ultimately augments both computer vision and voice biometrics in self-driving cars, says Sunil Thomas, vice president of automotive at semiconductor maker Synaptics Inc., in San Jose, CA. "We think a fingerprint sensor is the entry point," Thomas says. To begin with, it could be put on the vehicle's "engine start" button for theft deterrence and to enable user-defined functions — and he expects this to be on the market in 2020.

Fast forward five years, and Thomas foresees voice interactions extending outside the vehicle, as well — cars in effect listening to and conversing with pedestrians. "We have some experimental versions of that currently," he says.

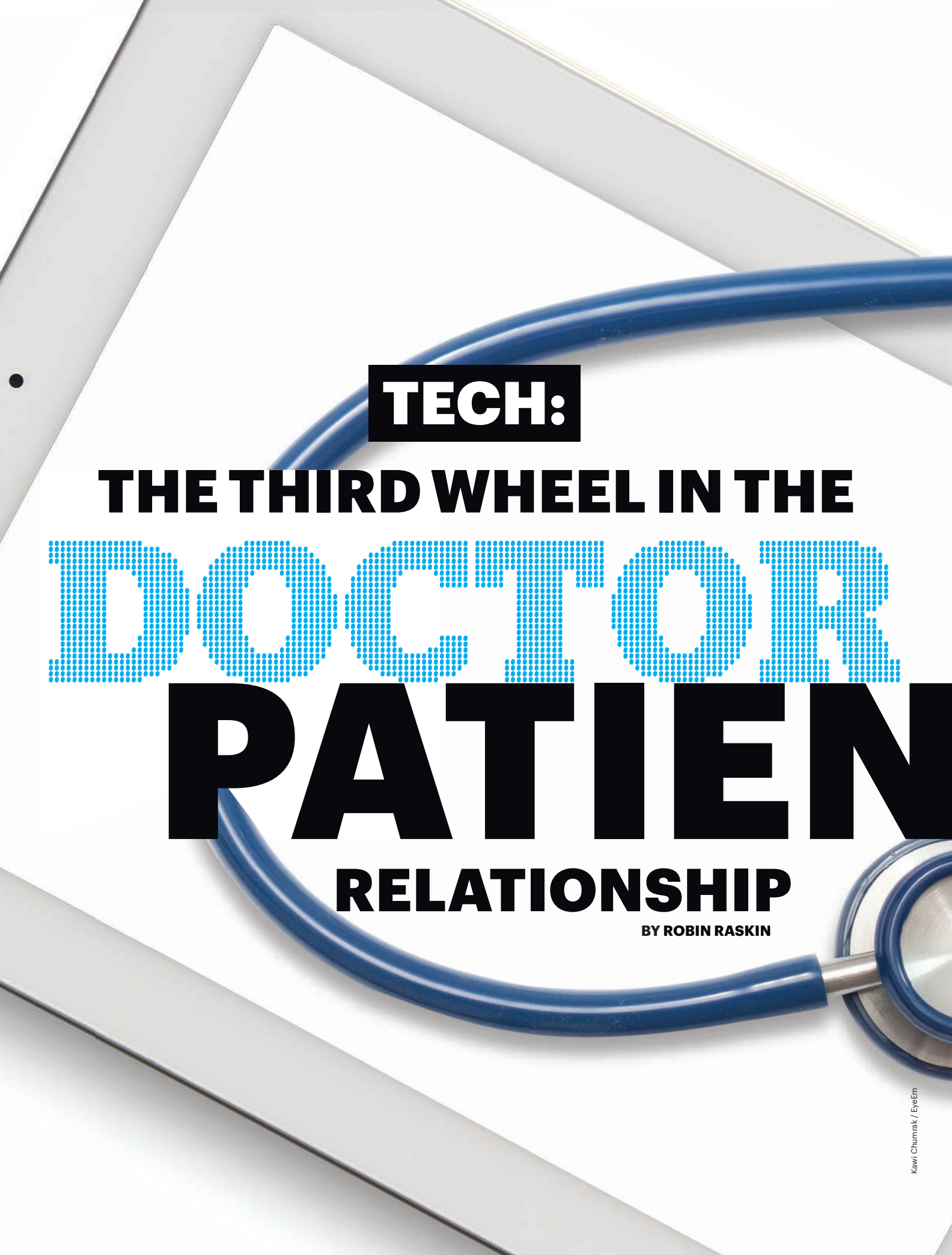
"Technologies are there and capabilities are there," concludes Synaptics' Thomas. But the auto industry must "open its mind to think a little bit differently, to bring these technologies into their cars faster," he declares. ■

CES 2019 See the latest in self-driving cars and vehicle intelligence.



TECH: THE THIRD WHEEL IN THE DOCTOR PATIENT RELATIONSHIP

BY ROBIN RASKIN



Kawi Chumrak / EyeEm

A decade ago, physicians struggled to cope when their patients came in armed with reams of Google printouts that explained their symptoms. Today, that same patient is often generating personal data through the use of apps and wearable devices. As more patients rely on a host of new technologies and services, rather than a traditional doctor's office visit, the medical profession is re-examining the traditional doctor/patient relationship, making room for the third wheel: tech.

Tech adoption, along with the expanded depth of what devices and apps can monitor and detect, is well documented. According to a 2018 survey by Rock Health, the number of respondents adopting at least one digital health tool increased from 80 percent in 2015 to 87 percent in 2017. Nearly 70 percent of Americans have used mobile platforms to handle their health issues and 80 percent use some kind of wearable device to stay updated about their health

activities. A Deloitte study indicates that DIY health spans generations. While millennials are more likely to use digital health tools, seniors are actively using apps or websites for refilling prescriptions or prescription reminders.

A HEALTHCARE SHOPPING SPREE

Today's health and wellness consumer can shop for health tech just about anywhere - pharmacies, supermarkets, big box stores, cosmetic superstores, convenience stores and online retail, in partnership with their physicians or not. Walgreens, CVS, Costco and Amazon are just a few of those stepping up their digital health game with more products and services.

Best Buy made news this summer when it acquired GreatCall, a company that offers mobile products and wearables catering to older citizens, caregivers and those who need emergency help. At the same time Best Buy is testing a service called Assured Living to help older adults age in places with tech assistance. And the store's digital health and wellness footprint has expanded to carry a variety of devices from baby monitors and pre-natal care to fitness devices, smart thermometers, blood pressure devices and more. For example, Walgreens' Find Care Now option offers immediate telehealth care online and a suite of apps to manage everything from prescriptions to smoking cessation.

Health purchases often occur outside of traditional stores, too. Fitness clubs like Orangetheory Fitness use heart rate monitors during group workouts. Weight Watchers is redefining itself as a wellness company, rather than a weight loss company. The company learned that roughly 1.3 million unique members have a synced fitness device; 1.8 million unique members engaged on Connect, the company's digital social network community; and 2.6 million members used the barcode scanner to track food.

THE DOCTOR IS HOME

Digital health offers many alternatives to a doctor's office visit. Tytocare, a new telehealth platform, looks like a small docking station. Consumers can plug various adapters into it to capture data from their ears, throat, lungs and more. Data is relayed via smartphone to the doctor, where it can be evaluated. Alivecor's KardiaMobile, an electrocardiogram (EKG) monitoring system, eliminates the need for multiple sojourns to the doctor's office by offering a special fingertip pad that records the EKG and transmits the data via Bluetooth to your mobile device.

TODAY'S HEALTH AND WELLNESS CONSUMER CAN SHOP FOR HEALTH TECH JUST ABOUT ANYWHERE.

Smart cameras enable another sort of diagnosis tool. After you receive its special kit, Healthy.io, analyzes your urine for conditions like infection or pregnancy. SkinVision offers regular skin cancer screenings by smartphone. At home genetic testing has also become more refined. Color looks at your propensity for inherited diseases like breast and lung cancer through in home genetic testing. Finally, on the rehabilitation and retraining side, apps like Brainpower provide mental workouts for students

Caiaimage/Andy Roberts/Getty Images

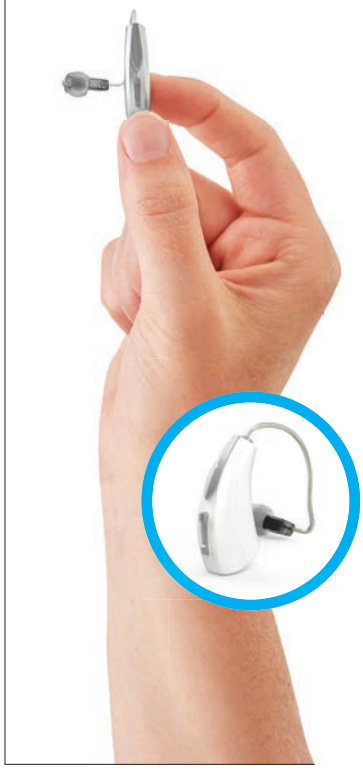
with ADHD or autism. Apps for everything from depression to stress management are hoping to replace drug therapies.

THE PHYSICIAN'S DILEMMA

Medical professionals are feeling the disruption, but ethical, legal and insurance reasons are constraining technology from an innovative takeover. While orthodontists make a living on expensive (not to mention painful) metal braces, companies like Invisalign have raised excitement by making a faster, more comfortable alternative that depends on frequent digital scans of the teeth (not making molds) and frequent modifications of a plastic computer-printed invisible brace.

Further, audiologists have learned to differentiate their services from over-the-counter hearing devices and Personal Sound Amplification Products (PSAPs). Those who want to amplify sound and tune it to their own levels can choose from offerings from dozens of companies including Audicus and Resound. A new generation of "hearables" are adding functionality beyond audible improvements. Ryan Kaudel of Valencell, maker of a hearable chip technology, points to Starkey, a large hearing aid brand, that recently announced a hearing aid that tracks physical activity, cognitive health, and features Amazon Alexa connectivity. Valencell also partnered with Sonion to make biometric sensing universal in hearables and hearing health devices.

A NEW GENERATION OF "HEARABLES" ARE ADDING FUNCTIONALITY BEYOND AUDIBLE IMPROVMENTS.



Neutrogena's SkinScanner is a dermatologist-in-a-box, thanks to the handheld device which has 12 high-powered LED lights, a 30 times magnification lens and highly accurate sensors to measure above and below the skin's surface. It captures the size and appearance of pores, the size and depth of fine lines and wrinkles and the skin's moisture, and then gives you an analysis and prescriptive advice. ■

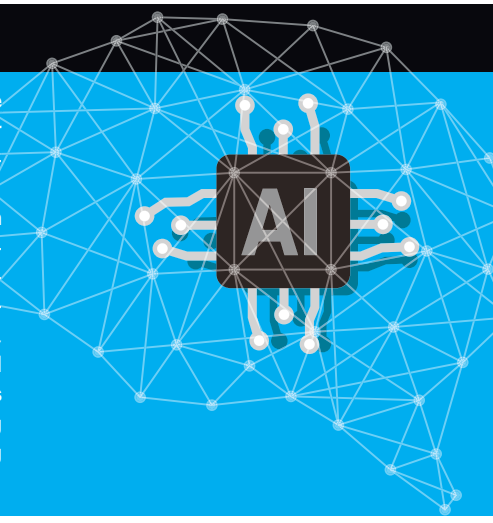
AI: The New Key to the Kingdom

While consumers are experimenting with healthcare devices, they are generating an unprecedented amount of data that can be used to teach computers to make correct medical diagnosis, tailor personalized medicine and learn how to treat illness.

Google's Deep Mind, an AI engine, is already predicting certain eye diseases with the same accuracy as a physician. The FDA-approved software, Viz.ai, analyzes brain scans and notifies healthcare providers of potential strokes in patients based on what it learned from analyzing millions of scans.

Apple's iWatch 4 features an alert for low heart rate, an electrocardiogram reader, a gyroscope for fall detection and Apple offers an open API for medical apps. These features make it an important collector of mega amounts of health data.

Drug companies, traditionally high-tech laggards, are moving forward to create personalized health solutions and new pharmaceuticals. CB Insights says top pharmaceutical companies including Novartis, Sanofi, GlaxoSmithKline, Amgen and Merck have all announced partnerships in recent months with AI startups aiming to discover new drug candidates for a range of diseases including oncology and cardiology.



JANUARY 8-11, 2019 | LAS VEGAS, NV

CES 2019 Brings Tech Advances to Vegas

CES® 2019 is the global stage for innovation – the largest and most influential technology event on the planet. Today, every company is a tech company and CES is where tech business gets done. It's the proving ground for transformative tech including 5G connectivity, artificial intelligence, augmented and virtual reality, smart cities, sports and robotics. Everyone fom global companies to tech startups come to launch products, build brands and partner to solve societal challenges. CES 2019 will feature 4,500 exhibiting companies – including more than 1,200 startups from over 40 countries – showcasing tech to improve the world.

Taking place January 8-11 in Las Vegas, NV, CES 2019 is fast approaching. Take a sneak peek on how to best navigate the show and get a glimpse of what you'll see this January.

KEYNOTES AT CES 2019

IBM Chairman, President and CEO, Ginni Rometty, will headline the CES 2019 keynote stage, opening the show on Tuesday, January 9 at 8:30 AM in the Venetian's Palazzo Ballroom. Rometty will share a unique outlook for how technology — built on a foundation of responsibility and trust — will significantly improve how businesses operate and people work and live. Technologies such as AI and quantum computing, when built on a foundation of trust and transparency, will drastically change business and society for the better.

AMD President and CEO Dr. Lisa Su's keynote will provide a view into the diverse applications for new computing technologies — from solving some of the world's toughest challenges to the future of gaming, entertainment and virtual reality with the potential to redefine modern life.

The keynote program will also include LG President and Chief Technology Officer Dr. I.P. Park and Verizon CEO Hans Vestberg.

C SPACE

C Space at CES brings together the world's innovators, marketers and creatives in one venue. Discover disruptive trends and how they will change the future of brand marketing and entertainment. Experience new technologies that change how consumers behave and learn from leaders in content creation, major studios and top advertising firms at keynotes and panels. C Space features conferences, keynotes and exhibits from companies like Google, Hulu, NBCU, NeuLion, Nielsen, Sirius XM, Snap, T-Mobile and Vevo. C Space is the place to share content, creativity and technology with other like-minded professionals.

Unveiled New York

CES Unveiled New York kicks off the CES season with a networking celebration featuring emerging tech trends. This exclusive event helps companies to build relationships and allows media to experience some of the leading technologies that will be at CES 2019.

CES UNVEILED LAS VEGAS

CES Unveiled Las Vegas is the official media event of CES, welcoming press and industry analysts from more than 150 countries, before the official start of CES. The venue allows innovative startups and established global brands to break news early to journalists.

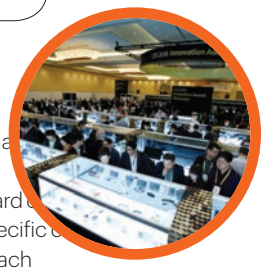
This annual press event draws more than 1,500 influential media from around the world and features the CES 2019 Best of Innovation Awards Honorees and tabletop displays from more than 180 local and global tech companies. CES Unveiled Las Vegas takes place on January 6, in the Mandalay Bay, Shorelines Exhibit Hall.

CES MARKETPLACES

With 11 official venues, CES spans more than 2.5 million net square feet of exhibit space, features 24 product categories and more than 20 Marketplaces. CES Marketplaces are exhibit areas that group new technology markets and feature up-and-coming products, services and companies. Check out the following Marketplaces at CES 2019:

- **3D Printing**
- **Accessibility**
- **AI & Robotics**
- **AR/VR & Gaming**
- **Baby Tech**
- **Design & Source**
- **Digital Money**
- **Drones**
- **Enterprise**
- **Eureka Park™**
- **Family & Kids Technology**
- **Fitness**
- **Health & Wellness**
- **iProducts**
- **Resilience**
- **Self-Driving Technology**
- **Sleep Technology**
- **Smart Cities**
- **Smart Home**
- **Sports Zone**
- **Tourism**
- **Wearables**

CES INNOVATION AWARDS

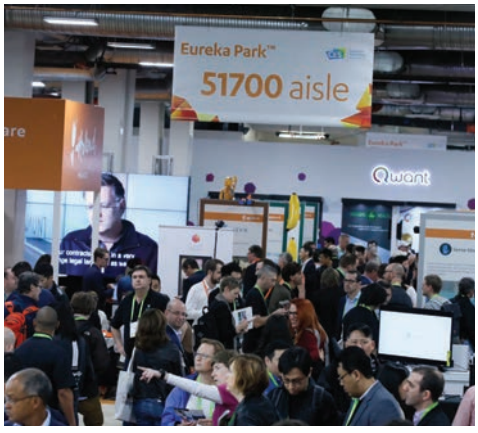


The annual CES Innovation Awards program celebrates outstanding product design a engineering in brand-new consumer technology products.

The Innovation Awards program recognizes two levels of honorees among 28 award

- **Honoree:** A product or technology that scores above the threshold set for a specific
- **Best of Innovation:** Given to only the highest-rated product or technology in each category — or to multiple, in the event of a tie.

For more information, visit **CES.tech/Innovations.**



EUREKA PARK

The Eureka Park Marketplace at CES 2019 will be the largest startup event on the planet, with more than 1,200 startups from more than 40 countries showing off the latest innovations in tech. Innovators come here to make connections and create new opportunities for success. Meanwhile, investors also come to Eureka Park searching for the next unicorn. And global media come to look for their next story. Corporations come to look for partnerships and acquisitions. Come to the Eureka Park Marketplace — located in the Sands Expo — to meet the world's newest innovators.

VENUES AT CES 2019

Venues are grouped into three geographical areas: Tech East, Tech West and Tech South. **Tech East** spans the Las Vegas Convention and World Trade Center (LVCC), Westgate Las Vegas and Renaissance Las Vegas. **Tech West** includes the Sands Expo, The Venetian, The Palazzo, Wynn Las Vegas and Encore at Wynn. **Tech South** stretches across ARIA, Park MGM/Park Theater and Vdara.

EXTREME TECH CHALLENGE:

FROM CES TO THE VIRGIN ISLANDS

An Island Getaway for Entrepreneurs

A tweet from tech billionaire Richard Branson best describes the Extreme Tech Challenge: "We are looking for people and ideas that can literally change the world."

It may seem like a lofty goal, but as one of the largest and most prestigious tech competitions, XTC prides itself on giving the world's most innovative businesses a platform to pitch their ideas to investors, businessmen and Branson himself. For this year's competition, roughly 600 companies entered the "Ultimate Startup Adventure," but only three get to go to the finals on Necker Island, Richard Branson's 74-acre private island.

Usually known for its picture-perfect beaches and sustainable flamingo population, the three businesses spend their time on Necker Island pitching their company to Branson and others. When they're not going through intensive Q&A sessions and meeting major tech influencers, they can usually find time for some snorkeling and windsurfing.

But before the island getaway, the competitors must go through a rigorous process where the many applicants are narrowed down to 25 companies, then 10. Those 10 semi-finalists go to CES, where they pitch their companies to a lineup of influential judges, including CTA President and CEO Gary Shapiro, Samsung Electronics President Young Sohn and Plug and Play Tech Center Founder Scott Robinson.

The competing companies – whose work ranges from healthcare to drones and 3D printing – come from all over the world to compete. These companies also exhibit their work in CES' startup area, Eureka Park™.

XTC is designed to help entrepreneurs who are "natural winners." In other words, "Someone who is not afraid to try things out and also someone who is not afraid to fail and if it happens (which it will), gets up an gives it another go," said XTC's COO, Sabine Schindlbauer.

Three companies from the CES event are chosen for the workcation of a lifetime in Necker Island. XTC hopes all participants use the opportunity to network with the many Fortune 500 businesses within the circle, meet mentors and feel more empowered through the experience.

"Applicants get unprecedented access to incredibly accomplished serial entrepreneurs, investors, mentors, advisors and innovators that can help them scale much quicker and with much less friction," Schindlbauer said. "The Extreme Tech Challenge certainly has all components of a regular tech competition, but on top of that we create unique experiences and thereby encourage our applicants think outside of box as well."

Previous winners and XTC finalists have shown that that competitors are worthy of the spotlight, with products and ideas that could revolutionize what we know about technology. In 2018, Vantage Robotics won XTC with the Snap drone, a portable, affordable and durable drone camera. ReDeTec, another 2017 finalist, showed the Protocycler, the "first and only system for recycling waste plastic into new filament." For more information, visit: **www.extremetech-challenge.com.**

Presenting the CT Hall of Fame

HONORING EXCELLENCE

The CT Hall of Fame honors the innovators that have made the consumer technology industry the vibrant marketplace that it is today. Determination, resolve, creativity and vision are among the attributes that the inductees to the CT Hall of Fame possess. The program serves as a bridge from the past to the present, enabling younger generations to build on the foundation laid by their colleagues before them.

These leaders create, promote, merchandise and advance the products, services and technologies that connect, inform and entertain consumers. Created in 2000, the CT Hall of Fame will increase to 261 members with the 14 new honorees inducted at this annual dinner. We honor these influential leaders who have contributed their talents to help to grow the $377 billion consumer technology (CT) industry.

"The CT Hall of Fame honors the exceptional visionaries in our industry," said Gary Shapiro, president and CEO, CTA. "The new class of inductees includes engineers and inventors, business executives, retailers and a journalist who drove new solutions and technologies that made a difference in our lives."

Last year at the Rainbow Room, the 2017 CT Hall of Fame dinner honored 12 individuals whose work enhanced the lives of consumers.

THE JUDGING PROCESS: The class was selected on February 27, 2018, in New York City by media and industry professionals, who met to discuss the nominations submitted by manufacturers, retailers and journalists. The judges used the democratic process of the most votes to select the new class. We thank the following judges for volunteering their time and expertise:

2018 CT HALL OF FAME JUDGES

RICK ALBUCK, 2020 COMPANIES
MELISSA ANDRESKO, LUTRON ELECTRONICS CO. INC.
TOM CAMPBELL, VIDEO AND AUDIO CENTER
MARGE COSTELLO, COSTELLO COMMUNICATIONS
BOB FIELDS, BEACON TECHNOLOGIES GROUP
PAUL GLUCKMAN, *CE DAILY*
PAM GOLDEN, GLA COMMUNICATIONS
CHERYL GOODMAN, SONY ELECTRONICS INC.
SUZANNE KANTRA, *TECHLICIOUS*
NANCY KLOSEK, *DEALERSCOPE*
GREG TARR, HD GURU.COM
STEVE TIFFEN, THE TIFFEN COMPANY
JOHN TAYLOR, LG ELECTRONICS USA
STEWART WOLPIN, TECHNOLOGY WRITER/HISTORIAN

Consumer Technology
HALL OF FAME

INNOVATORS/ TECHNOLOGISTS
Edgar Villchur
Acoustic Research
Dr. John Cioffi
Father of DSL/Infinity Group

FOUNDERS/ EXECUTIVES
John Briesch
Sony

DISTRIBUTORS/ RETAILERS
Robert Cole
World Wide Stereo
Mike Romagnolo
DOW Stereo/Video

JOURNALIST
Rick Doherty
Envisioneering Group

INDUSTRY ADVANCEMENT
Peter Lesser
X-10 USA

THE 2018 CLASS ALSO INCLUDES TWO TEAMS WHO COMBINED EFFORTS TO BETTER THE INDUSTRY:

TEAM
Kathy Gornik, Jim Thiel
Thiel Audio

TEAM
Niklas Zennström, Janus Friis, Jaan Tallinn, Priit Kasesalu, Ahti Heinla
Skype

GO ONLINE: Nominate an industry leader for the CT Hall of Fame that you believe has made a significant impact on the industry by filling out the form at **CTA.tech/halloffame**.

DISTINGUISHED MEMBERS OF THE CT HALL OF FAME

2018

Briesch, John
Cioffi, Dr. John
Cole, Robert
Doherty, Rick
Lesser, Peter
Romagnolo, Mike
Villchur, Edgar
Team:
Niklas Zennström,
Janus Friis, Jaan Tallinn,
Priit Kasesalu, Ahti
Heinla
Team: Kathy Gornik,
Jim Thiel

2017

Grand, Marcia
Harris, Arlene
Issa, Darrell
Kamen, Dean
Kurzweil, Ray
Lazaridis, Mike
Mohr, Mitch
Tandy, Charles
Team: Dr. Leonardo
Chiariglione,
Dr. Hiroshi Yasuda
Team: Frank McIntosh,
Gordon Gow

2016

Cooper, Sidney
Haartsen, Dr. Jaap
Lorsch, David B.
Pagano, Chuck
Smith, Steve
Spira, Joel
Tiffen, Nat
Yamauchi, Hiroshi
Team: Norm Hunt,
Ed Tuck, Don Rea
Team: Dr. Peter Bing-
ham, Dr. Jim Carnes, Dr.
Curt Crawford, Dr. Jae
Lim, Jerry Pearlman,
Donald Rumsfeld

2015

Borchardt, Robert
Campbell, Tom
Feldstein, George
Hayes, Vic
Lee, Noel
Mitchell, Bernie
Schwartz, Wilfred
Toole, Dr. Floyd

2014

Conn, C.W.
Gerzberg, Dr. Levy
Ivey, Loyd
Lee, Dr. David
Maloney, James
"Cowboy"
McCarthy, Gerald
Mossberg, Walter
Westergren, Tim
Team: George Antheil,
Hedy Lamarr
Team: Victor & Janie Tsao

2013

Basu, Dr. Samar
Barton, Jim
Burrell, Gary
Greenberg, Manning
Hoff, Dr. Marcian
Kao, Dr. Min
Katayama, Mikio
Machida, Katsuhiko
Omidyar, Pierre
Ramsay, Michael
Tang, Dr. Ching
Tweten, Jim
Tweten, Len
Van Slyke, Steven
Whitman, Meg

2012

Briskman, Robert
Boyle, William
Citta, Richard
Dybdahl, Bjorn
Engelbart, Douglas
Ergen, Charles
Finley, Larry
Gregg, Fansy & Henry
Koo, I. H.
Lee, Byung-chull
Smith, George

2011

Baer, Ralph
Bloomberg, Sandy
Harari, Dr. Eli
Hubbard, Stanley S.
Masuoka, Dr. Fujio
Metcalfe, Dr. Robert
Runco, Sam
Shannon, Dr. Claude
Viterbi, Dr. Andrew
Team: Ivan Berger,
Lancelot Braithwaite

2010

Christopher, Dr. Lauren
Friedman, Rachelle & Joe
Kraft, Richard
McCann, Frank
Mondry, David & Eugene
Philips, Frederik
Sotoloff, Al
Upson, Cynthia
Weber, Dr. Larry
Team: Dr. Ivan Getting,
Dr. Bradford Parkinson

2009

Cohen, Maurice,
Norman & Philip
Flaherty, Dr. Joseph
Jacobs, Dr. Irwin
Jobs, Steve
Neretin, Aaron
Shalam, John
Stinson, Walt
Terk, Neil
Wiley, Richard
Team: Karl Hassell,
Ralph Mathews

2008

Abt, Jewel & David
Clayton, Joe
Dunlavey, Dean
Fantel, Hans
Hartenstein, Eddy
Kutaragi, Ken
Lieberfarb, Warren
Sennheiser, Dr. Fritz
Sharp, Richard
Team: Martin Cooper,
Donald Linder

2007

Allen, Paul
Bose, Dr. Amar
Crutchfield, William
Day, J. Edward
McDonald, John
Sasson, Steven
Schulze, Richard
Weinberg, Art
Team: Dr. Karlheinz
Brandenburg,
Dr. Heinz Gerhäuser, Dr.
Dieter Seitzer

2006

Doyle, Jack
Galvin, Robert
Heilmeier, George
Holonyak Jr., Dr. Nicholas
Ladd, Howard
Richard, Alfred J.
Roach, John
Team: Dr. Donald
Bitzer, Gene Slottow,
Robert Willson
Team: Andrew Grove,
Gordon Moore

2005

Crane, Ken
Donahue, Joseph
Elias, Harry
Fezell, George
Gold, Saul
Levis, Art
Luskin, Jack
Matsushita, Masaharu
Winegard, John
Team: William Hewlett,
David Packard

2004

Blumlein, Alan Dower
Brief, Henry
Gerson, Robert E.
Kai, Ken
Kalov, Jerry
Klipsch, Paul
Ohga, Norio
Paik, Dr. Woo
Wozniak, Steven
Team: Richard Frenkiel,
Joel Engel

2003

Borchardt, Herbert
Feldman, Leonard
Immink,
Kees A. Schouhammer
Kasuga, William
Kent, Atwater
Steinberg, Jules
Takayanagi, Kenjiro
Tushinsky, Joseph
Wurtzel, Alan

2002

Alexanderson, Ernst F.W.
Appel, Bernard
Baker, W.G.B.
Boss, William E.
Ekstract, Richard
Fisher, Walter
Gates, Raymond
Lear, William Powell
Polk, Sol
Sauter, Jack K.

2001

Berliner, Emile
Fleming, Sir John
Ambrose
Gernsback, Hugo
Jensen, Peter Laurits
Muntz, Earl
Poniatoff, Alexander M.
Westinghouse, George

2000

Abrams, Benjamin
Adler, Robert
Armstrong, Edwin
Baird, John Logie
Balderston, William
Bardeen, John
Bell, Alexander Graham
Blay, Andre
Brattain, Walter
Braun, Karl Ferdinand
Bushnell, Nolan
Crosley Jr., Powel
DeForest, Lee
Dolby, Ray
DuMont, Allen
Edison, Thomas
Eilers, Carl
Farnsworth, Philo T.
Fessenden, Reginald
Aubrey
Fisher, Avery
Freimann, Frank
Galvin, Paul
Ginsberg, Charles
Goldmark, Peter
Harman, Dr. Sidney
Hertz, Heinrich
Ibuka, Masaru
Johnson, Eldridge
Kilby, Jack
Kloss, Henry
Koss Sr., John
Lachenbruch, David
Lansing, James B.
Marantz, Saul
Marconi, Guglielmo
Matsushita, Konosuke
McDonald Jr., Cmdr.
Eugene
Morita, Akio
Noyce, Robert
Poulsen, Valdemar
Roberts, Ed
Sarnoff, David
Scott, Hermon Hosmer
Shiraishi, Yuma
Shockley, William
Siragusa Sr., Ross
Takano, Shizuo
Tesla, Nikola
Wayman, Jack
Zworykin, Vladimir

CONSUMER TECHNOLOGY HALL OF FAME

John Briesch

SONY EXECUTIVE
(1949 –)

BRIESCH ESTABLISHED SONY AUDIO AS A LEADER IN PORTABLE AUDIO, COMPONENT (HI-FI) AUDIO AND CAR STEREO.

Diversification is often the key to a company's long-term success and John Briesch was the key to Sony's. In the early 1980s, as Sony's vice president of audio marketing, Briesch headed the company's full expansion into audio components and spearheaded the industry's drive to successfully bring the compact disc to market.

Born in Chicago to John and Genevieve, Briesch earned a B.S. from Northern Illinois University in 1971. After two years in the Army, Briesch looked for a marketing/sales position in a dynamic, growth-oriented industry.

Briesch joined Sony in 1975 as a Midwest sales rep, rising to national Hi-Fi sales manager in 1981. In 1982, he was promoted to vice president of audio marketing and created the marketing and distribution strategy for Sony Audio products, which had been distributed and sold by Superscope. Using Sony's Walkman and the pending CD as foundations, Briesch soon established Sony Audio as a leader in portable audio, component (Hi-Fi) audio and car stereo.

Briesch understood establishing a new music format would require a total change in consumer habits and a redesign of the music industry. Vinyl records and compact cassette tapes were cheap to produce, had a high replacement demand and retailers had established packaging/racking displays for LPs. Plus, there were no CD manufacturing facilities in the U.S. From 1982 through 1984, Briesch and his team visited almost every music company in America, along with more receptive artists and engineers, to introduce not only CD technology, but to explain the business model and the potential for future format expansion such as CD-ROM and video. He signed licenses with a variety of labels to produce and sell limited CD titles in the U.S., which lead to Sony building the first U.S. CD manufacturing plant in Indiana.

To ensure fast consumer acceptance for CD, Briesch created and co-chaired the Compact Disc Industry Group, working with record labels and hardware competitors to market the new technology. During these CD promotions and selling activities, Briesch also earned a professional master's degree from Harvard in 1984.

Frustrated by the lack of audio options for children at Toys R Us, Briesch, now a father of young children with his wife, Cindy, led the U.S. effort to design and launch the My First Sony products in fall of 1986.

In 1987, Briesch became president of Sony's Consumer Sales Company, and quickly transformed Sony into a total direct sales operation, eliminating its distributors.

In April 1989, Briesch was promoted to president of Sony's Consumer Products Group. Under his guidance, Sony's annual consumer electronics sales revenue surpassed $6 billion – five times its previous totals – and Sony became the leading market shareholder in the U.S. consumer technology industry with leading shares in portable audio, digital imaging, home audio products and premium television products. Briesch also led Sony's introduction of DVD, satellite receivers, HDTVs and telephones.

In July 1998, Briesch was tapped to lead Sony's Business Systems Group, and led the company's efforts to market directly to end users via a co-branded credit card in partnership with Citibank: the Sony Card, which would attract more than 900,000 customers and $2 billion in annual revenue. Briesch also chaired Sony's first e-commerce effort in the U.S., SonyStyle.com, which launched in November 2000.

After retiring from Sony in January 2010, Briesch became an independent consumer electronics, credit card and loyalty marketing consultant. ■

CONSUMER TECHNOLOGY HALL OF FAME

Dr. John Cioffi

"FATHER OF DSL"
(1956 –)

FORMS OF DSL NOW CONNECT NEARLY 75 PERCENT OF GLOBAL INTERNET HOMES AT FASTER PER CUSTOMER SPEEDS THAN CABLE BROADBAND, THANKS TO DR. JOHN CIOFFI, FOUNDER OF DSL MODEM MAKER ASSIA AND KNOWN AS THE "FATHER OF DSL."

Early online internet access was slow and inefficient through plain-old telephone lines. That is, until Digital Subscriber Line, or DSL, the first broadband data-transmission technology. Forms of DSL now connect nearly 75 percent of global internet homes at faster per customer speeds than cable broadband, thanks to Dr. John Cioffi, founder of DSL modem maker ASSIA and known as the "father of DSL."

Cioffi was born on November 7, 1956, in Park Forest, south of Chicago. Cioffi's father, John, worked in insurance, while his mother, Lorraine, was a stay-at-home mom. Cioffi got a taste of his future on a family trip to 1964's New York World's Fair, where a demonstration of AT&T's videophone fascinated him.

After graduating in 1978 as the valedictorian of the University of Illinois' engineering school, Bell Labs hired him and paid for his graduate work at Stanford University. Cioffi spent six years shuttling cross country between Bell Labs' Holmdel, NJ, facilities and Stanford, where he earned both his master's and Ph.D. in electrical engineering. Cioffi worked at both institutions to help quadruple the speed of 2400 bits per second (bps) early voice-band modems to the then adaptive echo-cancelled full-duplex modems at speeds of 9600 bps and later higher. He also helped Bell Labs solve echo-cancelation problems for the then-contemplated Integrated Services Digital Network (ISDN) – the beginnings of DSL.

In 1984, Cioffi joined IBM's San Jose lab to work to increase hard drive bit density using AI algorithms. In early 1986, Stanford promoted Cioffi to an electrical engineering assistant professor, where he continued working on DSL.

Cioffi proposed a significant architecture change: they pursed a "single-carrier" method, which was limited by the lack of AI. Cioffi's proposed smarter system learned each phone line's specific disturbances, and then applied machine learning to adjust the transmission format. Cioffi and Ph.D. candidate Peter Chow's proposed method was called Discrete Multi-Tone (DMT) modulation and the specific machine-learning algorithm used "bit-swapping." DMT pushed data speeds to 1.5 megabits per second (Mbps) – "good enough" for video. In 1991, Cioffi separately co-founded Amati Communications.

In January 1993, the DSL "Olympics" was held in Miami to determine a DSL standard. Amati's DMT-enabled Prelude ADSL modem could transmit faster than 6 Mbps, four times the speeds of other proposed designs from AT&T/Lucent, Bellcore and Broadcom, and was unanimously agreed to by more than 200 voters. On March 10, 1993, Cioffi's DSL technology was officially declared the U.S. standard by the American National Standards Institute (ANSI), followed by the European Telecommunications Standards Institute (ETSI) a few months later, and International Telecommunication Union (ITU) two years later.

In 1995, Amati successfully went public and was bought by Texas Instruments in 1997. Cioffi, who had returned to Stanford, and a new group of Ph.D. students, developed Dynamic Spectrum Management (DSM) and "vectored DSLs," which increased DSL speeds to 150 Mbps. These vectored methods form the basis for Massive MIMO LTE and Multi-User MIMO (MU-MIMO) Wi-Fi systems.

From 2003 to 2004, Cioffi, his wife Assia and former students founded ASSIA (Adaptive-Spectrum-and-SIgnal-Alignment), which serves 40 telcos globally with more than 150 million DSL/wireless subscribers.

CONSUMER TECHNOLOGY HALL OF FAME

Robert A. "Bob" Cole

FOUNDER, WORLDWIDE STEREO
(1948 –)

RATHER THAN JUST SELL BOXES, COLE STRIVES TO DO GOOD VIA PASSIONATE CUSTOMER SERVICE, IMPROVING PEOPLE'S LIVES AND INSPIRING EMPLOYEE LOYALTY.

Successful careers are often peppered with radical shifts, and that is particularly true with Bob Cole. He put a career in clinical psychology on hold to found World Wide Stereo, Philadelphia's most successful independent AV retailer, by following a simple philosophy: "Do well by doing good."

Born November 12, 1948, in Long Branch, NJ, Cole developed a strong work ethic at an early age. At 13, he cleaned houses, worked in a hardware store and flipped burgers at McDonald's. By 16, he was a union laborer doing carpentry, ironwork, masonry and exercising horses at Monmouth Park, learning essential business lessons along the way.

He left home at 17 and worked his way to a BA in psychology from LaSalle College. While attending college, he was a house master at an orphanage and worked at an experimental psych facility, Spruce House, which was to open many doors for him in psychology. He earned a master's degree in clinical psychology from Temple in 1974. Concurrently, Cole worked at the Albert Einstein Community Mental Health Center in Philadelphia where he created its Partial Hospitalization Program – which became the national model for the National Institute of Mental Health – rising to Clinical Director.

In 1978, funding for his clinical work ended and, with it, his ability to work directly with patients. Unhappy, he left one month after marrying the love of his life, Karen. Using his love of music and gadgets as a compass, Cole decided to open a stereo store despite a lack of experience and funding. Cole worked for the retail franchisor, World Wide Stereo, to resuscitate failing stores. When the franchisor went out of business, Cole opened his own 1,500-square-foot store in the Northern Philadelphia suburb of Montgomeryville, PA. He borrowed $2,000 from a friend to show some solvency and to convince a bank to loan him an additional $16,000 without collateral.

First to step up were car stereo manufacturers, the only suppliers willing to extend a line of credit. Well before stereo TV, he wired his demo TVs to a stereo system creating a whole new category and gaining attention.

A memorable moment in Catholic school provided him with his retail philosophy. Cole was in sixth grade when his teacher, Sister Mary Dora, asked him, "How are you doing Robert?" He replied, "I'm doing good, sister." She gave him a rap upside the head and told him the Pope did good. "You need to do well, Robert." He replied, "Why can't I do well by doing good?" That got another rap, but the philosophy stuck. Rather than just sell boxes, Cole strives to do good via passionate customer service, improving people's lives and inspiring employee loyalty. WWS experiences low staff turnover, has amassed a loyal customer base, and is active in both local and national charities.

Cole opened a second World Wide Stereo location in Ardmore, PA, in 2000 and then opened a large distribution center in 2016. Withstanding recessions and competition from big box and local rivals over four decades, World Wide Stereo remains a Philadelphia institution, with 2017 sales reaching $56 million and trending to $70 million in 2018.

In 2013, World Wide Stereo was named by *CEPro* magazine as a "Top Ten Integrator" and 29th overall in the Top 100 list of the largest custom electronics integrators in the U.S. He is also the PROsource 2018 dealer of the year. Clearly, Bob Cole has done quite well by doing good. ■

CONSUMER TECHNOLOGY HALL OF FAME

Richard Doherty

ENGINEER/JOURNALIST/ANALYST
(1952 – 2016)

[DOHERTY] WAS MORE THAN JUST A JOURNALIST, ACTING ALSO AS A KNOWLEDGEABLE AND QUOTED CONSUMER TECHNOLOGY AND ENGINEERING CONSULTANT AND ANALYST.

It is rare for a journalist to both seek quotes and be sought for quotes. But Richard "Rick" Doherty – a familiar sight in the front row at consumer electronics press conferences armed with a camcorder perched atop a monopod – was more than just a journalist, acting also as a knowledgeable and quoted consumer technology and engineering consultant and analyst.

Born in Jamaica, Queens, NY, on January 22, 1952, the family moved to Levittown to take advantage of better schools. Doherty's parents provided him with both knowledge and inspiration. His mother Gertrude was a legal secretary for a leading patent attorney, while his father Norman worked as a machinist and inventor. Father and son would later share many patents, working together in his father's Doherty Technology Corporation lab, where he taught the youngster that the seemingly impossible doesn't always have to be.

Young Doherty worked odd jobs to buy equipment and publications, including NASA operations manuals. Throughout his youth, he participated in science fairs, exploring topics such as electroplating, anodization, lasers and holograms.

While attending Pratt Institute in New York, Doherty ran communications for the Pratt Urban Vehicle Design Team. The prototype received several awards for innovative features, including one of the first rearview cameras with an in-dash display installed in a passenger car. He helped finance his education via Mad Rick's Electronic Repair, fixing or installing student electronics.

After graduation in 1970, Doherty spent two years as an engineer at Data General, moved to Lourdes Industries as chief engineer, then started freelancing for *EE Times* as a tech reporter in 1981. In 1983, he joined the publication full-time as a senior tech writer, and founded The Envisioneering Group, hiring diverse experts from varied specialties to consult on engineering projects and conduct technology market research.

Doherty spent 11 years at *EE Times*, covering every major technology development of the late 1980s and early 1990s, and continued to write after ending his fulltime job in 1994. He also grew The Envisioneering Group, building his reputation as both a knowledgeable tech reporter as well as an insightful source for tech reporters.

Doherty also indulged his playful side; in 1975 and 1979 he competed in the Cannonball Run, a larger-than-life cross-country automobile race. For the competition, he planned, designed, engineered and built a dream machine decked out with everything an electro-physicist could devise to drive faster, safer and longer without stopping. In 1981, Doherty organized – and won – his own cross-country race, the U.S. Express, with all entry fees, less expenses, donated to local charities. That same year he married his wife, Carolyn. The couple honeymooned at CES, and both their daughters, Heather and Sabrina, attended their first trade shows while still in diapers.

A life-long space enthusiast, in 1986, Doherty both witnessed and assisted in the investigation of the Space Shuttle Challenger disaster. In 2003, Doherty was nominated by longtime friend Steve Wozniak for a seat on the Presidential Medal of Technology Award Selection Committee during both the George W. Bush and Barack Obama administrations.

Doherty was a member of numerous industry societies and sat on the board of many standards and technical working groups including various Institute of Electrical and Electronics Engineers societies, numerous Society of Motion Picture and Television Engineers digital TV and HDTV standards committees and was on the CES Advisory Committee. His vast field of knowledge combined with his quick wit made him a favorite go-to expert when an independent opinion was needed. ■

CONSUMER TECHNOLOGY HALL OF FAME

Kathy Gornik and Jim Thiel

CO-FOUNDERS, THIEL AUDIO

(1947 –)

(1947 – 2009)

BETWEEN GORNIK'S MARKETING PHILOSOPHY AND THIEL'S ENGINEERING PROWESS, THIEL AUDIO BECAME A BONAFIDE SUCCESS.

For nearly 40 years, a small company in Lexington, Kentucky, churned out speakers designed to give even the biggest audiophile goosebumps after hearing them. Thanks to their high-quality speakers, Thiel Audio – the revolutionary business co-founded by Jim Thiel and Kathy Gornik – became the yardstick all other speakers were measured against. Thiel's success has made the two founders some of the most ubiquitous and influential leaders in the home audio and consumer technology industries.

Thiel Audio started in 1976, when Jim Thiel started building custom electronic components for studio and stage applications. Born on September 29, 1947, in Covington, KY, the young Thiel always loved music, taking piano lessons and playing in a band during high school. Thiel also displayed a keen interest in science, especially electronics, creating sound reproduction gear and attempting to build flying machines during his early school years. After college, he realized there was still room for improvement in loudspeakers and started Thiel Audio despite a lack of professional experience.

As he developed his business, Thiel recruited his younger brother Tom, an expert wood worker, and a few college friends, including Kathy Gornik, who went on to be Thiel Audio's president and essential business leader. As the fourth of nine children of second-generation Slovenians, Gornik quickly picked up on the challenges and strategies behind running a business while working at her family's high-end men's clothing shop. Her strong work ethic served her well and she graduated from the University of Dayton with a B.S. in education in 1969.

Thiel Audio initially operated on a shoestring budget, financed mostly by friends and family and equipped with an array of used tools. To save money during their first trip to CES in Chicago in 1977, Thiel and Gornik packed their own food, for example. Over time, Gornik helped jumpstart the company, driving around mid-Atlantic states selling loudspeakers to independent audio dealers.

Between Gornik's marketing philosophy and Thiel's engineering prowess, Thiel Audio became a bonafide success. After several years of trial and error and a focus on engineering, in 1980 the company's floor-standing Thiel CS3 brought the fledgling company high sales, a genuine place in the industry and, most importantly, profitability. On the lead-up to their success, Gornik turned down most dealer applications, waiting to do business with only the best in the market – a strategy which allowed the company to double their annual revenues each year for five years running. Under Gornik's fiscal leadership, Thiel was profitable each year except 1991.

But above all, Thiel Audio cared about customers. Gornik often told new employees about the three tenets of Thiel Audio: "Satisfy the customer, satisfy the customer and satisfy the customer."

While Gornik led the business side, Thiel designed all his speakers and their parts, assembling each one in Lexington. In his designs, Thiel committed to the concepts of phase- and time-coherence in his pursuit of loudspeaker accuracy, leading to some unique technical features. Ultimately, he created the Coherent Source design concept, which gave his company's speakers a sonic edge along with their iconic alpha designations.

Thiel's affordable high-end speakers became legendary during his lifetime, winning nearly every award extant, including six Audio/Video International Product of the Year Awards. Meanwhile, *Inc.* Magazine named Gornik the Kentucky/Southern Indiana Region "Entrepreneur of the Year" in 1993. In 1994, she helped create and served as the first chairperson of the High-Performance Audio subdivision of CTA, from 1995-97 she served as chairperson of CTA's Audio Division, in 1998-2006 she served on CTA's executive board, in 2003-04 as chair, in 2007 was chair of its Small Business Council, and from 2010-12 served on its Business Industry Leaders.

After a fight with cancer, Jim Thiel passed away in 2009. The company was bought by a private equity firm in 2012 and Gornik retired. Since then, she has served on various education boards.

CONSUMER TECHNOLOGY HALL OF FAME

Peter Lesser

FOUNDER, X-10 USA
(1935 –)

THE SEEDS FOR TODAY'S FAMILIARITY WITH THE SMART HOME WERE PLANTED BY THE INTRODUCTION OF X-10 HOME AUTOMATION TECHNOLOGY IN 1978.

The smart home is now a familiar concept. But the seeds for today's familiarity with the smart home were planted by the introduction of X-10 home automation technology in 1978, and grown by X-10 USA, founded by Peter Lesser.

Lesser was born in 1935 in New York City. His facility with mathematics led him to enter the pre-engineering program at Queens College of the City of New York in 1951. Lesser earned a B.S. from Queens College and a B.S. in electrical engineering from Columbia University in 1956, then an MBA from Harvard in 1960.

After four years at IBM, Lesser was persuaded by a former manager to form and run a new division at computer manufacturer Olivetti to sell the company's Programma 101, the first self-contained desktop computer. In 1973, he was named vice president of marketing at General Instrument's microelectronics division, which made chips for the first mass-produced chip-based calculators and Atari's *Pong*.

The GI chips Lesser sold had been designed by Pico Electronics. By 1975, chip prices had dropped precipitously, so Pico developed a remote-controllable turntable called the Accutrac and gave Lesser a demo.

While the Accutrac failed, Lesser saw value in remotely controlling a wider variety of home gear such as lights and appliances. He asked Pico to come up with a remote-control solution that didn't use IR or ultrasonics since neither could penetrate walls, or RF because of FCC restrictions.

Pico's engineers designed and patented a protocol that passed signals through standard home electrical wiring. Since the Accutrac project had been dubbed X-9, Pico called the home control effort X-10.

In 1978, Lesser started selling the X-10 system, consisting of a 16-channel command console, a lamp module and an appliance module. He soon followed by adding a wall switch module. Two years later a timer was introduced. After a demo, Sears was dazzled, and the system got a full page in the retailer's January 1979 catalog. Sears installed X-10 demo consoles in all its 800 stores. Lesser then sold X-10 to Radio Shack, which featured it in both their catalog and its 5,000 stores.

X-10 proved popular with tech early adopters and engineers. When Fry's Electronics opened its first store in Sunnyvale, CA, X-10 played a significant part of the franchise's success. In 1980, X-10 began producing products for Leviton and, in 1984, GE introduced its X-10 Homeminder, a set-top box and remote that allowed control of the X-10 system from a TV and away-from-home control via phone lines. Several PC interface control modules followed as well. In 1984, Lesser and his Pico partners bought out BSR's interest, and Lesser became president of X-10 (USA) in 1984. In 1989, the company introduced the world's first low-cost DIY wireless home security system, followed by several other security monitoring systems and services.

While X-10 achieved a level of success with major retailers, the company suffered one big problem: it was alone in the market. With no competition, X-10 by itself couldn't build a totally new market with mainstream consumers. But within the industry, X-10 was hailed for establishing a product and market that had never existed.

Lesser retired as president of X-10 USA in 2000. In December 2003, Lesser was elected to the board of VOXX International. Lesser also served as a member of CTA's executive board from 1999 to 2000, and Industry Executive Advisor from 2005-2010. ■

CONSUMER TECHNOLOGY HALL OF FAME

Michael Romagnolo

FOUNDER, DOW STEREO/VIDEO
(1944 –)

ROMAGNOLO ATTRIBUTED HIS SUCCESS TO BEING NIMBLER THAN HIS LARGER COMPETITORS AND SHIFTING QUICKLY WHEN HE RECOGNIZED A PROMISING TECHNOLOGY WAS BEING INTRODUCED.

When consumer technology companies had new technologies to introduce, the first person they'd call was Mike Romagnolo at San Diego's DOW Stereo/Video, which, for over 30 years, has been the first to sell more than two dozen new products.

Soon after he was born in Jersey City, NJ, in 1944, Romagnolo's family moved to San Diego. After graduating high school, he found work in sports and commercial fishing boats.

He soon discovered there was no future in fishing. In 1968, after getting married to Sandy, Romagnolo answered an ad for a salesman at Mr. TV, a local three-store chain. After six months, his boss asked him to run a failing location. While building up the store's business by expanding into stereo consoles, Romagnolo and his wife realized they could accomplish the same thing on their own.

In spring 1969, Romagnolo bought four stereos with his $1,000 tax return and got four more stereos on consignment. Romagnolo called his rented 1,000-square-foot North Park store Anchor Stereo. After the eight stereos quickly sold, he ordered more, developing relationships with manufacturers. Romagnolo expanded both his inventory and locations, adding a 2,500- and then a 3,500-square-foot store in the area around San Diego State University.

Romagnolo's success was built on finding and developing talented and loyal individuals and recognizing the need for financing in the days before ubiquitous credit cards, especially for college students. Romagnolo set up his own financing department, advertising payment plans for as little as $10 a month.

A retailer called DOW Sound City, a seller of higher-end audio systems, was the area's dominant seller of component stereos. But when Dow went bankrupt in 1971, Romagnolo bought the retailer's inventory, name and the lease for its main store at 37th and El Cajon Boulevard, down the street from Anchor. Most importantly, he also got the contacts with higher-end brands. After a few months, Romagnolo closed his other three locations and focused on DOW's 7,000-foot store.

Romagnolo picked up the lines he needed and also opened an on-premise installation subsidiary up the street. In 1981, he added video and TV, and he consolidated all his operations into a single 15,000-square-foot, two-story building 10 blocks away. In 1983, he added a 9,000-square-foot location by the San Diego Sports Arena.

Over the next 14 years, Romagnolo expanded to a total of 10 DOW Stereo/Video stores, including locations in Chula Vista, east El Cajon, Vista, La Jolla and Clairemont. Other than financing, Romagnolo attributed his success to being nimbler than his larger competitors and shifting quickly when he recognized a promising technology was being introduced. DOW's penchant for showcasing new tech created a cool-factor bond with tech-savvy customers, as well as a trusting relationship with manufacturers looking for high-profile national retail exposure for their next-gen technologies.

Over the years, DOW became known as a "launching pad." Consumers lined up for hours for a chance to be the first to buy more than two dozen new technologies first sold at DOW including 8mm camcorders, large screen direct view TVs, Super VHS players, digital audio tapes, CD-Rs, digital cell phones, DVD players, satellite TVs and HDTVs. Highly-promoted first-day availability of new gear by "D-O-W DOW" attracted thousands of early adopters, along with national, and often international, media coverage, most featuring DOW spokesperson Tom Campbell.

In April 1999, DOW was awarded the Smithsonian Award for Heroic Achievement in information technology. Once having reached this height, Romagnolo sold DOW Stereo/Video and retired.

CONSUMER TECHNOLOGY HALL OF FAME

Skype Founders

NIKLAS ZENNSTRÖM
(1966 –)

JANUS FRIIS
(1976 –)

JAAN TALLINN
(1972 –)

PRIIT KASESALU
(1972 –)

AHTI HEINLA
(1972 –)

Calling folks around the world used to be an expensive proposition, by both standard phone lines and especially cellular. But in August 2003, using software on a personal computer connected to the internet, a Swede, a Dane and three Estonian coders united to launch Skype, the first mainstream voice over internet protocol (VoIP) calling service, whose software has been downloaded more than a billion times and has more than 300 million active users daily

Niklas Zennström,born February 16, 1966, in the Stockholm, Sweden, suburb of Järfälla, earned degrees in business administration from Uppsala University and engineering physics from the Royal Institute of Technology, then spent a year at University of Michigan. In 1991, he got a job in Amsterdam at the European telecom operator Tele2, and helped build the company's dial-up internet service.

In 1996, Zennström met Janus Friis at Tele2. Born June 26, 1976, in Copenhagen, Friis dropped out of high school to work at the Danish ISP CyberCity before getting a job to lead Tele2's customer support. Zennström and Friis together launched get2net, another Danish ISP. But the pair left Tele2 and, in January 2000, Friis moved into Zennström's tiny Amsterdam apartment to develop the peer-to-peer music sharing application Kazaa, along with three engineers from Tallinn, Estonia: Ahti Heinla, Priit Kasesalu and Jaan Tallinn. The three school friends had co-founded games studio Bluemoon Interactive in 1989, and created the first Estonian commercial computer game, Kosmonaut.

Born May 2, 1972, in Tallinn, Heinla's parents were both computer programmers, teaching him to program at age 10. After co-founding Bluemoon, he attended the University of Tartu, and then worked as a programmer on the Swedish Everyday.com web portal in 1999, which brought him to the attention of Zennström and Friis. In 2002, Heinla was named chief technical architect of Skype, overseeing the creation of its underlying technology.

Kasesalu, born April 10, 1972, worked with Tallinn as a programmer for a local hardware manufacturer of 8-bit PCs for use in public schools in 1986, then earned a degree in automation and system technology from Tallinn Technical University. With Heinla and Tallinn at Bluemoon, as well as Zennström and Friis, he helped develop Kazaa along with several other peer-to-peer services before becoming a core library developer for Skype.

Tallinn, born February 14, 1972, was programming Z80-based Yamaha MSX computers when he met Heinla and Kasesalu in 1988. He earned a B.S. in theoretical physics from the University of Tartu in 1996.

CONSUMER TECHNOLOGY HALL OF FAME

Skype Founders

By 2003, Kazaa had become the world's most downloaded internet software. At its height, Kazaa constituted 50 percent of all internet traffic, but also attracted lawsuits from record labels. The pair sold Kazaa and co-founded Joost, an interactive TV service, and another peer-to-peer software development company.

While working between Amsterdam and Estonia on various projects, the five programmers racked up extensive international phone bills. Looking to lower these expenses, they wondered, "Why can't we talk over the internet?" The five decided to leverage their peer-to-peer technologies and create a VoIP communication system.

Originally dubbed Skyper – a compressed version of "sky peer-to-peer" – the "r" was dropped so the group could procure a .com domain. After a year or so, tired of testing the system with other engineers, Zennström tried calling an old school friend in Singapore. After 45 minutes of catching up on old times, it was clear to Zennström that Skype worked.

But would consumers sit in front of PCs to make phone calls over the internet? It turned out that free – or close to it – international calling overcame potential user objections; people "got" Skype immediately. It launched on August 29, 2003 and was downloaded 10,000 times. Within a month, it attracted a million users, 4.1 million in its first business quarter, and 19.8 million in its first year. Skype call quality was so good, a user said his mother could hear him smoking. Skype soon was acquiring five new users every second, virtually 500,000 new users per day. After a 17-month development period, Skype added video chatting in December 2005. "Skype" soon became a byword for internet voice and video calling worldwide.

WITHIN A MONTH, [SKYPE] ATTRACTED A MILLION USERS, 4.1 MILLION IN ITS FIRST BUSINESS QUARTER, AND 19.8 MILLION IN ITS FIRST YEAR.

With a nearby college supplying freshly-minted computer science graduates, ambitious new developer hires poured in, and Skype soon outgrew its Tallinn HQ. The company also started to attract deep-pocketed suitors. In October 2005, Skype was bought by eBay for $3.1 billion. In 2009, Zennström and Friis led a consortium of private investors to re-acquire a controlling interest in Skype, which then went through a period of corporate restructuring and technical rebuilding to make the system usable on smartphones. Over the years, Skype improved service by adopting cloud technology as well as dedicated "supernodes" hosted in data centers. They also developed a network of beta testers to ensure smooth usage. In 2011, a more robust Skype was sold to Microsoft for $8.5 billion.

Zennström, an avid yacht racer, founded and became CEO of tech investor Atomico in 2006, and, in October 2015, was tapped to head the new European Tech Alliance (EUTA), promoting Europe as a tech hub. In 2007, Zennström and his wife Catherine founded Zennström Philanthropies to support human rights, fight climate change and encourage environmental entrepreneurship. Along with Friis in 2006, Zennström was named one of *TIME Magazine*'s 100 Most Influential People, received a Wharton Infosys Business Transformation Award and was voted Entrepreneur of the Year in the European Business Leaders Awards (EBLA). In 2009, the Swedish KTH Royal Institute of Technology awarded him its KTH Great Prize and he received a Lifetime Achievement Award from the Oxford Internet Institute in 2011. In 2013 was awarded a Swedish King's Medal as well as a gold medal by the Royal Swedish Academy of Engineering Sciences.

In 2006, along with the shared *TIME Magazine* and Wharton honors, Friis won the "It Prize" from the Danish IT industry. With Heinla, Friis co-founded Starship Technologies in 2014 to develop small self-driving unmanned delivery robots for cities.

Heinla serves as Starship Technologies' co-CEO and CTO. He also helped organize Let's Do It 2008, during which 50,000 volunteers – four percent of the country's population – helped clean up the Estonian countryside in one day, inspiring the global World Cleanup Day held each September. In 2003, Heinla, Kasesalu and Tallinn co-founded Ambient Sound Investments.

Tallinn also co-founded the Cambridge Centre for the Study of Existential Risk and Future of Life Institute, and the medical consulting firm MetaMed, is on the Board of Sponsors of the Bulletin of the Atomic Scientists and has served on the Estonian President's Academic Advisory Board. He is also an active angel investor and a former investor in and director of the AI company DeepMind. ■

CONSUMER TECHNOLOGY HALL OF FAME

Edgar Villchur

INVENTOR, ACOUSTIC SUSPENSION SPEAKER
(1917 – 2011)

THERE IS NOT A MORE IMPORTANT INNOVATOR IN THE DEVELOPMENT OF MODERN CONSUMER SOUND REPRODUCTION THAN EDGAR VILLCHUR.

There is not a more important innovator in the development of modern consumer sound reproduction than Edgar Villchur. He invented and patented the acoustic suspension speaker, which became the basis for nearly all loudspeakers that followed and founded Acoustic Research to sell them. Villchur also invented the direct-radiator tweeter, one of the first dome tweeters, the independent suspension turntable, and technology used in nearly every hearing aid sold.

Edgar Marion Villchur was born in Manhattan on May 28, 1917, the only child of Russian emigres Mark and Mariam. He earned both his undergraduate and his master's degree in art history from the City College of New York in 1939. The following year, Villchur was drafted into the Army Air Corps, where he trained as an electronics technician and was made responsible for his squadron's radio operations in the Pacific, rising to captain.

After the war, Villchur opened a radio shop in Greenwich Village, repairing and building custom Hi-Fi sets, taught the first college course in sound reproduction at New York University and married Rosemary Shafer with whom he had two children. He also worked for the American Foundation for the Blind, inventing a turntable that automatically dropped the tone arm slowly onto a record, a technology he later added to AR turntables.

In 1952, Hi-Fi speakers were huge boxes to effectively reproduce bass, featuring open backs because speaker designers discounted the effect of the cabinet. Villchur began tinkering with smaller, closed-back designs in his basement workshop, replacing the nonlinear mechanical spring with a linear air cushion to reduce distortion. He built a prototype from a plywood box, and his wife, a draftswoman during the war, sewed the pattern for the flexible surround out of mattress ticking.

Speaking to his acoustics class at NYU in spring 1954, he hinted at his ideas being more effective for producing bass. One student, Henry Kloss, stayed after class, eager to learn more. Student and teacher perfected the design, which received a patent in 1956. Villchur tried unsuccessfully to license the technology, but speaker makers thought the design impossible. So Villchur founded Acoustic Research (AR) in Kloss' Cambridge, MA, loft, and the pair produced the AR-1, introduced at the New York Audio Show in 1954, along with its successor, the lower-priced AR-2, in 1956.

The AR-3 combined both acoustic suspension and his new direct-radiator tweeter, patented in 1959, would later be displayed at the Smithsonian Institution's Information Age exhibit. In 1961, he invented the independent suspension turntable that reduced skipping, motor noise and vibration. The smaller AR-4 in 1964 was a hit with college students.

Villchur promoted his new speakers by sponsoring "live versus recorded" concerts around the country. A string quartet would alternately play a piece of music or mime it to their own recording played through the AR speakers, with listeners rarely able to detect a difference.

Sales soared and by the mid-1960s, AR had captured nearly a third of the home speaker market. Competing speaker brands began licensing Villchur's design, then copying them, and a new market for smaller home speakers was born.

Villchur was president of AR, known for its progressive employment and liberal repair policies along with star-studded ads, until 1967 when he sold the company. He then founded the Foundation for Hearing Aid Research, and developed a prototype of the multichannel compression hearing aid. But he purposely didn't patent the design, altruistically allowing hearing aid makers to widely deploy the design that has become the industry standard. ■

ARE YOU CES READY?

The most influential technology show on the planet is returning to Las Vegas, January 8-11, 2019.

With 4,500 exhibiting companies – including more than 1,200 startups – it's the proving ground for new innovations.

It's all ready for you, if you're CES ready.

Register today at CES.tech.
#CES2019

CES® Consumer Technology Association™

THE PACE OF TECHNOLOGY

Encouraging Innovation to Prosper

Ikon Images/Getty Images

POLICY UPDATE

Understanding Trump's Tariffs

The trade war with China is charging forward and the implications on the U.S. could linger into the future. On September 24, the U.S. began collecting 10 percent tariffs on $200 billion in Chinese imports – this tariff will shift to 25 percent if things are not resolved by January. On top of that, the U.S. is collecting tariffs on washing machines, steel and aluminum. Combined all these tariffs will cost the economy $30.4 billion and eliminate nearly 100,000 jobs according to the Tax Foundation.

How Does this Affect the Tech Industry?

In the latest round of tariffs – $200 billion list – the Trump Administration spared $10.5 billion worth of connected devices imported from China, such as fitness activity trackers, smart speakers, smartwatches, wireless earbuds and wireless headphones. While this was a small victory for many in the tech industry, others weren't as lucky to find their products taken off the lists.

By exempting these products, the Trump Administration may feel it has helped certain Americans. But all tariffs are taxes and they create trade wars.

On the list remain $11.5 billion worth of networking goods, including modems switches, routers and $11.6 billion worth in printed circuit assemblies (PCA), which accounts for 68 percent of all U.S. PCA import.

Wild Pixel/Getty Images

As an unintended consequence of a tariff on PCA, American manufacturers of products that rely on imported Chinese PCAs will cut orders some six to 12 percent from suppliers because the cost will rise by nine to 23 percent. These costs ultimately will be passed on to American consumers and could increase prices on electronics by up to six percent. More, tariffs on PCA will cost the U.S. economy anywhere between $110 million to $613 million annually, for the ten percent and 25 percent tariffs respectively.

What Impact will this have on Businesses?

Tariffs will cost the U.S. money, jobs and our innovative spirit. During the United States Trade Representative hearing in August, this is what CTA member companies said:

Aaron Emigh, Co-founder and CEO of Brilliant, a Californian company that created a smart home control device: "It would cost approximately a million dollars and take many months to relocate manufacturing outside of China. These costs and timelines are not practical for Brilliant, as a small startup company with modest resources. Essentially, the proposed tariffs amount to a punitive tax on selling US technology, manufactured by a US company, to the domestic market."

Mark Karnes, vice president, strategic planning and business development of Illinois' Cedar Electronics, maker of aftermarket products such as CB radios, jump starters and dashcams: said, "The products that are impacted at the 25 percent tariff level have a dramatic effect on 60 percent of our company's annual revenue. The dramatic increases in our product costs are making us less competitive with our foreign-based competition and the substantial loss of income from our main product categories of

our business will force us to cut jobs in the U.S immediately."

China tariffs directly impact the livelihood of U.S. small businesses.

What is at Stake?

At stake is 5G and cloud computing.

Taxing network equipment and other vital components used in 5G technology will raise the cost of U.S networking infrastructure by hundreds of millions of dollars and reduce the incentives to improve it. Rolling out the next generation of wireless networks, which runs 100 times faster than the current 4G, requires fewer obstacles, not more. Otherwise, the U.S. will fall behind China.

Also, the networking equipment, like routers, in data centers will cost more. And the services cost will rise on the internet service providers (ISPs) that access those data centers. Additionally, the ISPs' costs would rise between 10 and 25 percent on each product, such as the modems they import. Those costs and fees could pass on to someone else in the supply chain until they reach the consumer.

As a result, American consumers will face an internet of things tax. The first will be on the networking products they buy at retail stores or online, and the second will be in the form of increased costs associated with accessing the internet and tapping into the cloud. A 25 percent tax could slow U.S. output by $332 billion over the next ten years.

These cost increases will make it difficult for the U.S. to lead in 5G innovation, something President Trump has been adamant to do. And without the processing power needed to make 5G applicable in artificial intelligence, self-driving vehicles, smart city infrastructure and increased rural connectivity, the Trump Administration is making it harder to achieve any technological advancements. ■

Future of Work:

Demand for Skilled Tech Workers Rises

The U.S. unemployment rate is at a nearly 50-year low, but CTA's second annual *Future of Work* survey found 92 percent of its small business members still need skilled tech workers, up six points from 2017. At the same time, optimism about finding qualified candidates shrunk two points to seven percent while three quarters (74 percent) of respondents say it will be hard to find candidates with the right skills, three points higher than last year.

Many companies also are looking how to best reskill their current workforce to retain their top talent. Of the 37 percent of respondents who anticipate their company will displace workers because of technological change, about half of them (57 percent) also plan to reskill and retain their workers.

For example, AT&T is committed to reskilling 35 percent of its employees by 2020 as part of a $1 billion effort that includes online courses and collaborations with universities to prepare workers for new jobs and career advancement. "Rather than the wholesale hiring of new talent from outside, we launched several years ago a significant effort to help our employees learn the skills to prepare for the jobs of the future at AT&T. We're working constantly to engage and reskill our over 250,000 employees, and to inspire a culture of continuous learning," says Dahna Hull, SVP, human resources, AT&T Communications.

IBM is investing in public school system reform through its Pathways in Technology Early College High (P-TECH) school. The six-year program bridges the gap between high school and college to help students earn a degree that prepares them for the jobs of the 21st economy. "We're shifting mindsets and recognizing that not all candidates need traditional degrees – rather, it's their skills that matter most. With our focus on 'new collar' jobs, IBM is creating pipelines to employment and new opportunities for learning and skill development in emerging technologies such as blockchain, AI and cybersecurity," says Kelli Jordan, talent leader, New Collar Initiatives, IBM.

For case studies on how CTA members are working to train and upskill Americans, visit **CTA.tech/FutureOfWork**. ■

GUEST BLOG

Consumers Save $3.5 Billion in Energy Consumption

By NCTA – The Internet & Television Association

The industry's green efforts to reduce energy consumption through voluntary agreements are paying off. In July, D+R International's audit on home internet equipment found that devices such as modems and routers were nearly 20 percent more energy efficient than they were prior to the voluntary agreement for small network equipment, and the good news continues.

D+R released its latest data, which reported the strongest year yet in achieving savings under the voluntary agreement for set-top box energy efficiency. Consumers saved a tremendous $3.5 billion ($1.4 billion in 2017 alone) and avoided more than 20 million metric tons of carbon dioxide emissions in the past five years since the award-winning program was implemented. The signatories of the agreement include pay TV providers, manufacturers and energy efficiency advocates.

The report found that national set-top box annual energy consumption has declined by 34 percent in the five years under the voluntary agreement, even as set-top boxes have been upgraded and enhanced with new features and functions. More, from 2016 to 2017, the industry saw its year-over-year energy savings increase by nearly 50 percent as the parties implemented more rigorous energy levels that became effective in 2017.

D+R reported that DVRs, once the most energy-intensive type of set-top box, are a key area of savings. D+R found that new DVRs use 46 percent less energy than those that were purchased prior to the agreement, and that nearly all DVRs today were purchased under the agreement's commitments.

More, consumers are using fewer DVRs because of whole-home technologies that enable them to watch recorded content on multiple TVs using a single DVR, and because of apps that enable customers to watch the service providers' video services without any operator-provided set-top box on smart TVs, tablets or using low-power devices such as an Apple TV or a Roku device.

D+R released its latest data, which reported the strongest year yet in achieving savings under the voluntary agreement for set- top box energy efficiency.

Tracking Savings

To help track energy savings resulting from consumer use of apps, revisions were made to the voluntary agreement that require service providers to track and report the number of devices that customers used to access their content in the prior year, and to identify the platforms on which their apps are available. Every provider reported supporting between four and 14 platforms — such as Samsung, LG, Roku, Apple TV, Amazon Fire TV, Google Chromecast and Android — with more platforms under development. In 2017, consumers used more than 100 million devices to access the pay TV providers services using these apps, compared to just over 200 million set-top boxes.

This is the first time that actual app usage data from the major U.S. service providers has been available, and it shows that consumer adoption of video apps is off to a strong start. As NCTA General Counsel Neal Goldberg said, "One-third of all devices used by consumers to access [multichannel video programming] services in 2017 were not operator provided set-top boxes, and as that percentage continues to increase, consumers will save even more energy in addition to enjoying more choice in how they watch video."

"To date, the Voluntary Agreement has brought progress in set-top box energy efficiency — in the form of energy and cost savings — to more than 90 million U.S. households," said Jennifer Amann, buildings program director for the American Council for an Energy-Efficient Economy. "We look forward to continuing to work with the industry to ensure ongoing improvements to set-top boxes and related advances that will save consumers even more on energy costs while reducing emissions."

For more information on the energy efficiency voluntary agreements and a list of signatories, visit **www.energy-efficiency.us/** ■

POLICY IN ACTION

The Business of Selling Services Online

Disruptive companies such as Airbnb and Amazon are helping individuals sell their services online – whether its renting a basement room, giving a cooking lesson or selling handmade goods. These companies allow anyone with a passion to become an entrepreneur.

This is true of Amazon seller Elena Castaneda, founder and CEO of Bling Jewelry, who started her business with a credit card and an Amazon account. After ten years in business, Bling Jewelry employs 40 people and sells to customers in almost a dozen countries. A share of her success is due to the opportunities Amazon provides small businesses.

"Amazon gives you every possible tool you can think of to manage your business and make it successful," says Castaneda. She attributes some of her success to Amazon Prime Day, where she has been able to achieve growth and hire more employees. "Sales generated on Prime Day have helped us expand our team and move into a larger office space in New Jersey. In fact, since moving to our new space, we have already hired 10 new employees," adds Castaneda.


Elena Castaneda

In general, small business owners view online retailing as a way to boost sales. According to a 2018 Insureon and Manta poll, over two-thirds (68 percent) of small businesses say Amazon's marketplace has a positive impact on businesses sales.

Another e-commerce experience helping boost small business activity – while assisting individuals to make extra income – is hospitality service Airbnb. As more travelers want to experience cities like residents do and not as tourists, the short-term rental platform has helped increase tourism to more diverse neighborhoods, generating greater support for local businesses.


Angelica Melendez

For example, Airbnb reports it hosted 236,000 guests in Washington, DC in 2016, and guests spent $160 million in local businesses. District resident Angelica Melendez is one of those hosts, and helped drive foot traffic to her neighborhood's shops, as she used the platform to help pay for her mortgage while she attended graduate school. She often opens her home to interns looking to offset the high cost of living in the nation's capital.

"I'm providing a different kind of service to make a job accessible," says Melendez. She hopes visitors – especially young people – view the short-term rental platform as more than just a tourism app.

The 21st-century new economy has changed how businesses operate, shifting away from "us versus them" to helping individuals thrive. To survive in this new economy, companies must invest in their users – whether it be Amazon sellers or Airbnb hosts – because their success is critical to a company's standing. ■

The 21st-century new economy has changed how businesses operate, shifting away from "us versus them" to helping individuals thrive.

Ikon Images/Getty Images

FACES OF INNOVATION

CEO and Co-founder, **Angelo Stracquatanio**

Apprentice.io is proving that tech's incorporation in the workplace is very beneficial. Its industrial augmented reality (AR) glasses are changing how scientists, engineers and manufacturers interact with complex work environments and give an unparalleled sense of control and efficiency. The innovative glasses allow professionals to work hands-free while having access to pertinent information to help them reach their full potential.

Q How did Apprentice get its start?

A I had close relationships with professionals in the pharma and biotech space who would talk about the billion dollar losses, massive production delays and lost batches all caused by human error. Hearing these stories completely changed the way I thought about how humans operate in complex, compliance-driven environments. With my background in development, I knew that with the right technology, these errors were avoidable. I began to develop a solution to address these pain points and empower the scientists and engineers operating in the lab or manufacturing suite.

Q How does Apprentice incorporate AR in its products?

A We developed the first conversational augmented reality and artificial intelligence platform to significantly improve complex workplace processes conducted by scientists in the lab or operators/engineers in manufacturing suites. We use AR and machine learning to provide users with live AR demonstrations, SOPs, direct real-time feedback for performance correction and hands-free data capture. We also use AR for risk-free training, audit-readiness and global communication, ushering in the next wave of human potential. Our pharma and biotech clients are specifically using our AR tech to conduct research and safely manufacture drugs that most of us have either heard of or take regularly.

Q How is it helping create a safer workplace?

A We like to say that we don't just augment reality; we augment human ability. The Apprentice platform magnifies human capability, which directly increases safety, control and reliability in the workplace. With our solution, users are equipped with all of the critical data they need in order to understand a task and perform it flawlessly. It will alert users before an error is made and provide the correct next steps.

Q Can you talk about the software behind Apprentice?

A Our technology is built industry compliant and platform independent, able to run on various devices from ARCore/ARKit for mobile, through monocular smart glasses like RealWear HMT, to full immersive AR on HoloLens or Magic Leap smart glasses. Our solution experts first evaluate each of our customer's needs and then determine which type of device, or combination of devices, will be most beneficial for each unique environment.

Q How do you see AR changing in the next five years?

A AR has evolved into one of the most promising digital technologies. It is transforming all major enterprise industries and changing the way companies compete for space. The truth is that when applied smartly, AR can unleash a workforce's fullest potential. Industry leaders are realizing this and are accepting this tech as the way of the future. Imagine easily visualizing procedures and checking for errors before making them or intelligently scanning and recording data just by looking at it. AR is all about the user experience and discovering new ways that technology can help humans achieve goals and learn from that interaction.

On the consumer side, AR will continue to bring new opportunities for engaging with customers and creating a brand experience. Enterprise AR will become a common solution for building a stronger workforce. With the ability to communicate in real time across the world and the capability to access critical data at a moment's notice, the possibilities are endless. ■

ADL

NATIONAL CONSUMER TECHNOLOGY INDUSTRY

AWARDS TRIBUTE & INDUSTRY DINNER

ZIEGFELD BALLROOM • NEW YORK

SAVE THE DATE

11.10.18

HONORING

RICK ALBUCK
Vice President
Business Development | 2020 Companies

STEPHANIE DISMORE
Vice President & General Manager
Americas Channels | HP Inc.

MICHAEL PETRICONE
Senior Vice President
Government Affairs | CTA

DANIEL PIDGEON
Co-Founder | Starpower

DAVID PIDGEON
Co-Founder/CEO | Starpower

For more information or to purchase tickets visit www.adl.org/consumer-tech
or contact Beth Katznelson at bkatznelson@adl.org

Established in 1913, ADL is the premier, civil rights/human relations agency fighting all forms of bigotry. Its mission, celebrating diversity and respect for human individuality is achieved with outreach programs through a network of Regional and Satellite offices.

TECH HUB

"At the Hardware Club, Community Comes First"

Hardware companies are known as some of the riskiest investments in Silicon Valley, but a successful one has the possibility to define an industry and change consumers' lives. Just look at companies like Apple, Fitbit and GoPro.

Alexis Houssou deals with the highs and lows of hardware startups every day as the co-founder and president of Hardware Club, a venture firm that exclusively deals with hardware. But Houssou cares about much more than signing the check, spending the past three years making Hardware Club a community where roughly 500 startups of all sizes and types network and share advice.

Before starting the company, Houssou invested in multiple hardware businesses but noticed each of his investments suffered similar challenges, like distribution or Chinese manufacturing. So, Houssou set out to create a place where companies could work together to solve these problems.

"Hardware is hard, definitely, but one of the easiest ways to make it more approachable is connecting to other people and gaining information," Houssou says. "I would bet that everyone in Hardware Club could find at least one other company that is going through — or already overcame — the same problem as you."

Hardware Club describes itself as "stage agnostic" instead of an accelerator or incubator, since just three percent of member companies have investments with it. Instead, the firm focuses on bringing together startups of all levels to provide mentorship and advice. Once a member is accepted, startups join for free and have access to all other members, as well as community events and unique opportunities at trade shows. Participants immediately recognized the value of flexibility and access at Hardware Club.

The VC has allowed dozens of companies to come to CES since 2015. In 2018, Hardware Club brought 18 companies, including 3D-body scanning scale Shapescale and internet-connected helmet Cosmo Connected. CES continues to be essential for many Hardware Club members, introducing them to distributors, investors and manufacturers. For 2019, Houssou plans to bring a total of 23 member companies to their "CES alley."

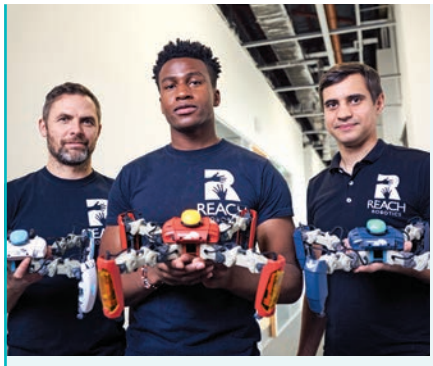
"CES is the best way for our members to meet the whole system behind the industry," Houssou says. "It's not just about launching a company — it's a week where you can focus on connecting to the community." ■

Alexis Houssou, co-founder and president of Hardware Club.

CES 2019 More than 1,200 entrepreneurs and startups will showcase innovation at Eureka Park.

Hardware Club Members

With hundreds of members around the world, Hardware Club features some of the most exciting companies in transportation, robotics and smart home. Here are two companies positioned to become household names.



REACH ROBOTICS: At CES 2018, dozens of attendees gathered around a large box in front of Reach Robotics' booth to see spider-like robotics crawl around. The attendees were watching MekaMon, the flagship product of the Hardware Club member. Users can control the robots on their phone and through a combination of remote control and VR, use them to play different games or fight other MekaMon. Reach Robotics envision their creation as the future of gaming — an unforgettable experience that makes playing both digital and physical.

COWBOY: Described by Hardware Club as the "Tesla of e-bikes," Cowboy is looking to revolutionize urban travel in the age of the smartphone. The European company, now worth over $1.3 billion, creates a high-end bicycle complete with a brake light, removable battery and an accompanying app for your phone that acts like a dashboard with navigation, ride stats and GPS.

B

57
Advice for Entrepreneurs
Options Always Lead to Success

STRATEGIES TO GROW THE INDUSTRY

Insights to help improve the bottom line

Jorg Greuel/Getty Images

C SPACE

Streaming: It's All About Connections

As streaming video accelerates its juggernaut into homes worldwide, its role in the media economy continues to shift. Although mobile and dedicated over-the-top receivers will continue to play a significant role in fulfilling viewers' appetites for streamed programs, the growing adoption of smart TV sets is very important. One reason is the increased demand for reliable quality of the signal.

A recent report by real-time streaming platform Phenix, *The Streaming Wars*, found that more than half of viewers abandon a poor-quality stream in 90 seconds or less. The report found about 27 percent of streaming customers "don't think 'live' is worth paying for" if there is consistently poor quality.

Another analysis by Limelight Networks concluded frequent buffering interruptions make viewers abandon a program. It found two-thirds of viewers will stop watching a video after two rebuffers — crucial in programming such as live sportscasts. Limelight's State of Online Video report found that 60 percent of global consumers are more likely to watch live sports online if they are guaranteed not to experience viewing delays.

> **"27 percent of streaming customers "don't think 'live' is worth paying for" if there is consistently poor quality."**

It's about Content and Competition

The big-buck commitments of Netflix and Amazon to produce original programming will keep viewers tuned into the subscription video-on-demand (SVOD) channels. Netflix has commissioned more than 250 new programs, says Ampere Analysis; doubling the 229 original shows now on the company's servers. Amazon Prime Video has about 105 original titles and is expected to create an equal number of new shows and series, Ampere says.

Audience and program segmentation is also important. Netflix's new shows — largely comedy and science fiction — are aimed at young audiences, while 29 percent of Amazon's new titles will be drama series that appeal to older viewers.

Ampere also found that YouTube, Apple and Facebook are boosting their original show distribution. The three stalwarts have a total of 65 shows in their pipelines. "All the major players are expanding the number of original commissions in the face of an increasingly competitive market," says Ampere analyst Richard Cooper.

But, streaming video faces several hurdles, notably audience fragmentation. Concerns include capabilities, such as second-screen access, that distract viewers and make it more difficult to break through the clutter. Two-thirds of the ad-tech respondents in a Viant study say ad clutter is now a major barrier.

Data Deluge on Streaming Media

One factor stands out: steaming media is immensely popular. The Limelight study found in the U.S., young binge viewers watch nearly three hours of programs (two hours 56 minutes) during a session; well above the global average of two hours seven minutes). In contrast, online viewers above 60 years old watch just one hour seven minutes at a time, Limelight says.

As technical challenges are resolved, and programming proliferates, price may become a more dominant factor in streaming. More than half of streaming customers say price increases would be the major reason to cancel an SVOD service — slightly more than the percentage of cable customers who will cancel based on price increases. Today most SVOD customers also are (for now) cable TV subscribers. The Limelight study found that cable customers are supplementing, not replacing, traditional TV with online video. Cable subscribers pay for an average of 1.2 streaming services, while non-cable subscribers buy just 0.7 services.

And that's why quality differentiators are now so important. The Phenix study — with its bias toward live programming concluded that nearly one-fifth of customers who use a streaming service "would be likely to switch platforms if there were an alternative with a better 'live' option." ■

CES 2019 Experience the latest technologies related to advertising and marketing analytics at C Space.

iStockphoto/Getty Images

BRIGHT LIGHTS, BRIGHTER IDEAS.

Las Vegas is the destination for next-gen pioneers. A place where the impossible meets the believable. It's a city built on bright ideas, so it shouldn't be a surprise that Vegas hosts the global stage for consumer innovation each year. If you innovate, you'll find yourself here.

LAS Vegas®

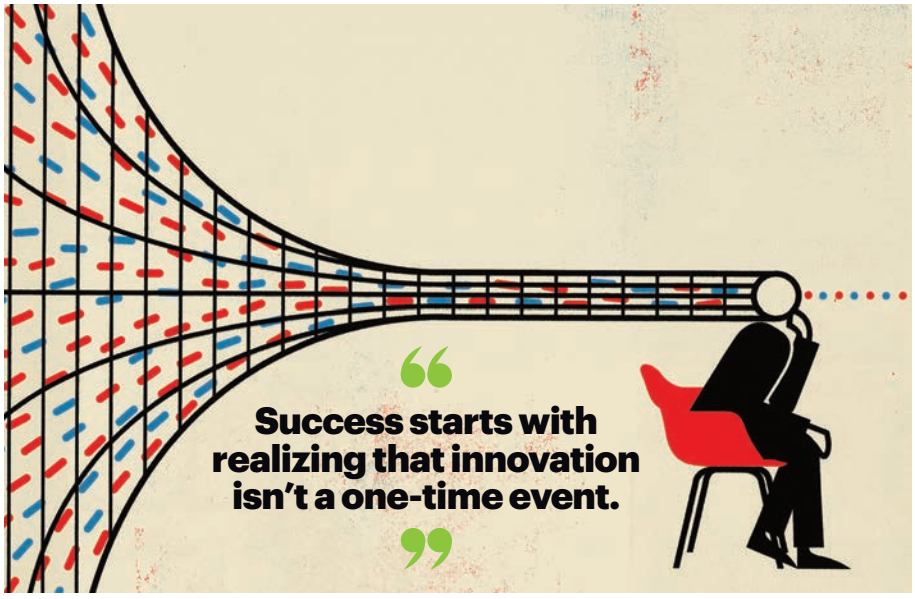
VegasMeansBusiness.com

FORWARD STRATEGIES

New Technologies Take Center Stage

How to turn your consumer tech company into a powerhouse of innovation

Sales of high-tech products are expected to hit $377 billion this year, with an annual increase of six percent, according to a recent CTA report. But with new advances coming in fields ranging from artificial intelligence (AI) to smart home solutions, how can industry leaders stay competitive?



The secret to keeping ahead of the curve isn’t to slash costs to the bone or take fewer chances. Rather, it’s to double down on innovation and take more risks in the form of small, cost-effective learning experiments designed to help your business grow its capabilities and become more adaptable and forward thinking.

Success starts with realizing that innovation isn’t a one-time event. It’s an ongoing series of activities that every organization should engage in, and a process of self-reinvention. The more rapidly and affordably you can bring new solutions to bear with feedback from real-world shoppers, the faster you can streamline strategies to succeed.

To fuel these ventures, don’t cut expenses when planning your business strategy. This approach promotes short term gains at the expense of long-term growth and competitive advantage. Instead, reassess the products’ and programs’ value to the organization then funnel savings gained by shelving initiatives that are underperforming into more productive activities that help drive organizational growth.

Pioneering New Solutions

As fast as disruption occurs today, finding ways to streamline efforts and digest the consumer feedback that comes with them is crucial to sustaining market leadership. Creating systems that allow you to optimize efforts and try out new strategies and solutions don’t have to be expensive or time consuming.

For example, one global multinational cloud services and storage firm rolls out new apps every six weeks for under $20,000 on a year-round basis. Others regularly hold hackathons or host global innovation contests where workers vote on ideas to turn into product pilots. Others offer both employees and external parties access to open innovation portals where customers or partners can suggest ideas for new solutions.

Hundreds of technology tools and providers offer solutions for building an innovation framework or quickly testing new concepts. As a result, the process of turning your organization into a dynamo of innovation can be simple and affordable when you tap into the power of high-tech tools. Analytic programs and Internet of Things (IoT) solutions can help you invent your way to success by:

- Monitoring consumer behavior and predicting solutions shoppers need before they realize it.
- Letting employees pool resources to create minimum viable products (MVP).
- Leveraging networks of connected devices to better anticipate inventory needs and allocations, which products to stock and how to maximize sales conversion rates.
- Accessing white-label solutions for quickly and affordably creating or redesigning custom-branded apps and online services; rolling out new programs or platforms; or adding new plug-and-play features to existing software or service solutions.

Mastering innovation isn’t so much about embracing a methodology as it is a mindset. The more comfortable you are with routinely stretching your comfort zone and capabilities, the easier the process of successful innovation will be. ■

Scott Steinberg is the author of Millennial Marketing: Bridging the Generation Gap. *His website is AKeynoteSpeaker.com.*

Mitch Blunt/Getty Images

By Jake Sigal

ADVICE FOR ENTREPRENEURS

Options Always Lead to Success

Jorg Greuel/Getty Images

> **Be careful: Reducing options can lead to a downward spiral.**

Positive thinking and hard work are a clear path to success. However, an unusually high number of economic and political events have recently challenged the viability of some businesses in the CTA community. This is not the first time the tech community has faced adversity, but this is the first time in 10 years it's happened with so many potentially dark possibilities looming on the horizon.

When I started my first company in 2008, there were probably more dark futures, but I either didn't see them or they weren't as easy to see. Economic outlooks these days are like a 10-day weather forecast: They're always interesting, but they're only right half the time.

I've always been a saver. I learned at an early, pre-bar-mitzvah age from my father to put away a percentage of everything I've earned for a rainy day. It wasn't a matter of if I'd need it, it was when I'd need it. What I didn't learn until I hit my 30s is that it isn't about saving, it's about creating options. It's not what the money could buy, it's the options the savings create and how it makes me feel.

Exploring Possibilities

For me, this cycle of creating options through deal flow, different structures and product roadmap forks not only provides sound business solutions, it creates the right attitude that enables success.

I've written in past *i3* articles about the importance of communicating with all stakeholders. However, no amount of communication can replace the need for options. Options take time to work out and doing that can distract from the core mission. For non-entrepreneurial employees and clients, even discussing options can induce fear and uncertainty.

Imagine finishing an all-day product planning session and declaring, "OK, now everything that we just planned may not work, and if it doesn't, let's pivot." Think about telling your vice president of sales, "Great job. But if this pending purchase order doesn't come through, we need you to go out and book the team on another project." These things happen when you're looking at options.

While my staff would probably never admit it, I'd bet that openly discussing the options caused more than one person to lose a lot of accrued confidence in our company's ability to execute. Though increasing options is always better for business, the cost options create is real. Pivoting is the king of all options and carries an internal luxury tax to deploy.

Still, the way in which options are pitched and created is as important as the options themselves. I always have a Plan C, but typically only share up to Plan B. About once a month, we are left with only one viable option for one reason or another after a scenario shakes out.

Be careful: Reducing options can lead to a downward spiral. It's a riptide that's very difficult to get out of unscathed. With the constant barrage of negative economic forecasts, policy changes and client rollbacks, it's easy to scale back options to fit the needs. Stay in front of the shifting political and economic conditions by keeping your options calculated and open. Options always lead to success. ■

RETAIL STRATEGIES

How to be an Independent Fish in the Pond of Mega-Retailers

The holiday shopping season is critical to the success of consumer technology (CT) suppliers and retailers. When many consumers think about buying tech, Best Buy, Amazon, Walmart and the mega-retailers that dominate the industry's sales often come to mind.

But privately-held regional retailers and custom installers are thriving today. They provide consumers with good value, including delivery and installation if needed. And they provide their suppliers with a distribution channel where their midrange to upscale products can be demonstrated, explained, installed and sold at profitable price points.

Three executives with leading regional CT resellers contributed to this edited "virtual" roundtable to explain the role of independent retailers and installers:

● **Eddie Maloney**, president of Cowboy Maloney's Electric City, operates a 13-store electronics, appliance and furniture business based in Jackson, MI, with his brothers Con and Johnny. Founded by their father, CT Hall of Famer John "Cowboy" Maloney in the 1950s, the company sold the first color TVs in the 50s, then years later sold DirecTV — Sirius' first car audio system — and DishNet.

● **Walt Stinson**, CT Hall of Famer and co-founder of ListenUp, founded in 1972 in Colorado, helped to introduce CD players in the U.S. Known as an AV and control systems installer and designer for commercial and residential markets, ListenUp is also an upscale brick-and-mortar and e-commerce retailer that operates five hybrid custom design showroom/retail locations — four in Colorado and one in New Mexico.

● **Ben Willis** is executive merchandiser with Queen City Audio Video Appliances, a family-owned retailer that has been in business for more than 65 years. It has a similar mix of products as Cowboy Maloney's and operates six stores in the Charlotte, NC, area.

"Our sales associates are very knowledgeable. We provide them with intensive training three or four times a year on technology and product features."

Eddie Maloney, president of Cowboy Maloney's Electric City. His father "Cowboy" Maloney was inducted into the CT Hall of Fame in 2014.

Q What do independent retailers provide to consumers that mega-retailers don't?

Willis: Clarity. The average consumer is still very confused about 4K, 1080p and the like. So, the consumer comes in, sometimes they will buy something else or just look around. They are afraid they will make a bad decision. We train our team on the features of every product in a category. [Qualifying the customer] and providing the right solution is critical to us. And you need to provide on-time delivery and installation. We provide a tremendous mix and support premium products versus mass commodity products. If you

Gunnar3000/Getty Images

show consumers the differences they can step themselves up to a better-quality TV. It is hard to see the differences between a $399 55-inch TV and a $1599 model online.

Maloney: Our sales associates are very knowledgeable. We provide them with intensive training three or four times a year on technology and product features. We explain to our customers why the same size TV is $499 versus $1499. And we can match pricing from Best Buy and Walmart as well as provide quick delivery and installation. Online retailers can't match us based on service. We also do a lot of local advertising, internet ads and TV in our markets on a consistent basis.

Stinson: The big difference is services. Mass merchants focus on selection and price. We focus on quality-curated products, services and system design. We tend to focus [on customers] who are getting into a project and will have labor attached to it. That is usually a higher-ticket sale involving products at the top end of a manufacturer's line. Our customers appreciate getting the right product. While we take for granted the differences between OLED versus QLED or 4K versus non-4K TV, consumers struggle with it, versus our career installers and salespeople who live and breathe the technology.

Q Industry executive Joe Clayton once said if a retailer understands the price, volume, mix and the consumers' wants and needs, you can pretty much give them what they want. Is that still true?

Willis: There is no question that qualifying the customer today is more important than ever, to find out what they want and need. We have to help determine what their expectations are. A vast majority of consumers who are disappointed with their electronics don't realize what they were buying. We need to help consumers make the right decision for their needs. Consumers are wary of making an incorrect decision, so sometimes they'll make no decision. You need to be involved in a conversation to find out what they expect and need.

Maloney: A lot of our customers want a face-to-face meeting for our sales associates to show the differences between the technologies we sell. Millennials like to go to brick-and-mortar stores to see what they like and then order online. The ironic thing is sometimes millennials buy online and try to ask us to exchange what they bought [from an online retailer] for something we have in our store. That happens more than you would think. Our big thing is that we can guarantee prices [on electronics] with Walmart and Best Buy. And most importantly, if a customer is in our store we can describe the features of the product, tell the story and explain it.

Stinson: If consumers want a less complex item they will go online. But when consumers go to brick-and-mortar they go because they are confused and afraid to make the wrong choice. Salespersons must guide confused consumers. Sometimes they can make an incorrect decision online. That's why manufacturers still need strong brick-and-mortar distribution, as well as online. For many customers this is a complex decision and there is a lot of value for them to speak to an expert. As for our online sales, we work closely with higher-end brands that need to be online but do not want to undercut [pricing] for their brick-and-mortar distribution. We want a healthy ecosystem, we want to perpetuate it and are very concerned about it.

Q How do privately-held retailers and installers contribute to their communities?

Willis: Many studies indicate that plenty of dollars go back into local communities from independent retailers. We think of ourselves as a retailer with a conscience. We provide technology like TVs for local [charity] events. And we try to contribute to our local communities and hire locally, especially since we opened two stores in the past year.

Maloney: We do as much as we can to make local charitable contributions, be involved with the local Chambers of Commerce and get involved in city programs where our stores are located. Cowboy Maloney is built on relationships. When it comes to recruiting and hiring, if we see a sales associate that shows real potential, we give them extra training and responsibility to make sure they grow and continue to be better than the people down the street.

Stinson: We have a great story based on our success in the industry and community involvement. One of our vendors gave us a "career builder" award for training people who have left us yet remain in the industry in key positions. Our company policy supports non-profits in the performing arts for the public to get involved to experience better sound in live music performances and support local musicians. We provide sound, video and overall tech support. It is important for local companies like ours to remain healthy to provide good jobs and tax bases for the communities we serve. ■

"There is no question that qualifying the customer today is more important than ever, to find out what they want and need."

Ben Willis, executive merchandiser of Queen City Audio Video Appliances

"If consumers want a less complex item they will go online. But when consumers go to brick-and-mortar they go because they are confused and afraid to make the wrong choice."

Walt Stinson, CT Hall of Famer and co-founder of ListenUp

Steve Smith was the former editor-in-chief of TWICE.

BY THE NUMBERS

Residential 5G Broadband Brings Speed to Consumers

Following several years of testing and standards development, network providers will for the first-time begin offering consumers 5G wireless connectivity. While many use cases exist for 5G, including for edge computing, IoT devices, mobile devices, medical applications and self-driving cars; fixed-wireless residential service is among the most impactful for consumers in the near term.

Broadband access is paramount for economic opportunity and consumers have come to expect internet speeds good enough to simultaneously connect multiple devices for a variety of purposes, such as streaming content, gaming or basic internet searches. According to the Federal Communication Commission's *2018 Broadband Deployment Report*, 90.8 percent of the U.S. population has access to 50 megabits per second (Mbps)/5Mbps broadband connection (though just 64 percent of the U.S. rural population). This means millions of Americans are limited to either a zero or a single broadband provider.

Residential 5G service will increase both consumer access and competition with low latency, high-speed wireless data connections in the home. Earlier this fall, Verizon launched its 5G residential service with AT&T expected to begin mobile 5G service by year end. This will be followed by Sprint and T-Mobile launching offerings to consumers in early 2019. By 2020, it is estimated that full-scale deployment for both residential and mobile service will be underway and new internet providers may emerge.

The technologies will vary by provider with short, mid- and high-range millimeter waves delivering high-speed access to mobile and fixed-wireless devices at speeds exceeding today's typical fixed-line home broadband connection. To deliver high speeds over limited range spectrum, providers must install antennas at far closer range than traditional cellular towers. Comparatively, 4G equipped cellular towers provide a range of several miles, whereas 5G service is limited in many cases to several hundred feet. This requires the installation of antenna units on existing infrastructure including on lamp posts, telephone poles as well as indoor antennas in public spaces like airports and sporting venues.

AT&T's 5G service will initially be deployed via mobile hotspot devices and utilize a short-range millimeter wave while delivering peak speeds of roughly 1 Gbps. Sprint's 5G network incorporates MIMO (multiple input, multiple output) antennas within the 2.5 GHz spectrum, which allows for dual deployment of 4G and 5G

CTA'S *SALES & FORECAST* REPORT: 5G HOME GATEWAYS

$6 MILLION
Expected wholesale revenue on 50,000 units in 2018

$295 MILLION
Expected wholesale revenue on 2.4 million units in 2019

$960 MILLION
Expected wholesale revenue on 8 million units in 2020

$1.61 BILLION
Expected wholesale revenue on 14 million units in 2021

$2.42 BILLION
Expected wholesale revenue on 22 million units in 2022

James Teohart/Getty Images

on the same equipment. T-Mobile's network provides more widespread coverage compared to other major carriers by using 600 MHz spectrum, though initial data speeds will only be 25-50 percent faster than existing 4G networks. Verizon's residential 5G service utilizes a fixed-base gateway device and accesses the network via high frequency millimeter wave in the 28 GHz spectrum with initial data speeds of 300 Mbps and peak speeds of roughly 1 Gbps.

As consumers begin to adopt residential 5G, many will choose to purchase a home gateway device. CTA forecasts 2.4 million 5G home gateways will ship in 2019, representing $295 million in wholesale revenue. By 2022, shipments will reach 22 million units annually and more than $2.4 billion in annual wholesale revenue. Residential 5G advances home internet connectivity into the next continuum, unlocking new choices for consumers at data speeds once thought to be impossible. ■

CTA FORECASTS 2.4 MILLION 5G HOME GATEWAYS WILL SHIP IN 2019

CES 2019 See how carriers and mobile operators are transforming industries, enabling everything from smarter homes and businesses to self-driving cars with 5G tech.

CT REPORTS

Tech Helps Vulnerable Populations in Need

Hurricanes in the Atlantic Ocean and Gulf of Mexico in the past few years have massively impacted the communities across those regions. When a disaster strikes, it often effects vulnerable populations like the elderly and people with disabilities the most. Consumer technologies can ensure that these populations receive the necessary services when catastrophic events do occur.

After Hurricane Irma struck Florida in 2017, the country was shocked to learn that eight seniors died in a nursing home when the air conditioning was cut off by a blown transformer. When Hurricane Maria struck Puerto Rico, many of the islands deaths were seniors unable to receive medical care. Recognizing the needs of the older inhabitants, FEMA has specific resources on ready.gov to serve this community.

Consumer tech can play an active role in helping these communities plan and respond. A few technologies that can help include:

- **Communications:** Social connections and access to information are two critical pieces to planning and recovery. Many traditional forms of telecommunications like landline or cellular telephone systems are critical. Innovations in mesh networks or using drones to augment coverage in regions with outages can help people connect to alerts. Social media solutions like the Facebook Crisis Response allows users to report themselves safe to their networks.
- **Power:** When the power grid goes down, there are automated operating functions in place to keep systems, and the devices connected to them, online. These include solar solutions like GoalZero and WakaWaka. Generators and battery systems also can help offset periods of time without power.
- **Transportation:** Ridesharing services like Lyft and Uber can help augment public transportation when residents are trying to leave a disaster area. Also, this could be an opportunity for self-driving vehicles to help provide fleets of cars that can operate for long periods of time without suffering the exhaustion of human drivers.
- **Health Tech:** One of the biggest impacts for seniors amid a disaster is losing access to medication or other medical services. Technology can provide medication reminders, health tracking, and alerts to inform individuals and their caregivers about issues before they reach a critical state.

Many of these products and services that aid in the planning and response to a disaster will be at CES 2019. However, there are still lots of opportunities for the technology community to provide innovations to serve these groups. Recently Call for Code, a program supported by IBM and other companies, issued a challenge to developers to create new solutions for disaster response.

The CTA Foundation is excited to see the continued emergence of these types of technologies. Join us as we help support the use of technology in improving the lives of older adults and people with disabilities. Learn more at CTAFoundation.tech. ■

Support the CTA Foundation

Be recognized by the CTA Foundation at CES 2019 and other events

- Be highlighted on the CTA Foundation website and in materials
- Receive opportunities to engage in discussions about these technologies at CES and other events
- Receive opportunities to engage in special research or service projects
- Gain access to staff subject matter experts and in the CTA Foundation network
- Ensure your resources make a true difference to communities in need

Support us at SupportCTAF.org
Follow us on Twitter @CTAFoundation, Facebook and LinkedIn.

Thank you for your support.

CES 2019 The winners of the CTA Foundation's Accessibility Contest will be at Eureka Park.

U.S. Coast Guard/Getty Images

MARKET BEAT

5G – The Future is Now

After years of development and planning, we're finally hearing about the first deployments of 5G technology in the U.S., but 2019 is when 5G initiatives really heat up. Therefore, CES 2019 will be a key focal point in the ongoing narrative of 5G deployment worldwide.

Linghe Zhao/Getty Images

The defining characteristics of 5G include faster speed, greater capacity and lower latency compared to existing 4G LTE technology. 5G is a key requirement to fully enabling emerging technologies like self-driving cars and smart cities. It also has the potential to revolutionize residential broadband and close the digital divide.

Residential broadband today involves buried cables and in some cases fiber to the home, but that may soon change. Verizon recently announced Indianapolis as the fourth U.S. city (in addition to Houston, Los Angeles and Sacramento) to receive its 5G home internet service using "fixed wireless" technology (which promises speeds up to one gigabit per second) before year end. Fixed wireless broadband uses radio waves (instead of cable, copper phone lines or fiber) to deliver an internet connection to households that receive the signal via a "fixed" antenna.

> **"Verizon, T-Mobile and Sprint have announced intentions to form full-on 5G networks ASAP."**

What about Mobile Broadband?

Verizon, T-Mobile and Sprint have announced intentions to form full-on 5G networks ASAP. AT&T has been very vocal about the debut of its 5G wireless network in 12 U.S. cities representing a mix of larger (Atlanta) and smaller (Waco, TX) urban areas. What's significant is AT&T's move represents the first commercial implementation of a 3GPP-standards-based 5G NR (New Radio) network in the U.S. The initial devices to run on AT&T's new 5G network won't be 5G smartphones, they will be 5G "pucks" that work like hotspots.

That said, 5G smartphones are coming. We're getting a view of the first crop of 5G handsets through product announcements like the Motorola Moto Z3 that can become a 5G phone with a special mod. And Sprint is working with LG to deliver the first 5G handset to the U.S. market in the first half of 2019. In July 2018, CTA predicted that 2.1 million 5G handsets will ship in 2019, growing to more than 20 million in 2020. It will be several years (2022 at the earliest) before 5G handsets represent the lion's share of the smartphone market. CES 2019 will give us a better view of 5G handsets and when they will be available.

This leads us to an important point relative to the buzz around 5G — that advancements to the existing 4G LTE network will take place in tandem with 5G deployments. In fact, these upgrades are an important stepping stone on the path to full 5G network connectivity.

An example of what this looks like is AT&T's 5G Evolution initiative happening across many markets, which involves upgrading its 4G LTE network with LTE Advanced features as a "runway" for full-on 5G wireless networks. LTE Advanced uses additional antennas and wider channels to deliver faster speeds to more users. AT&T is also rolling out LTE-LAA, which uses unlicensed spectrum to offer "gigabit-range" speeds. Note: other carriers are working on similar initiatives as precursors to standing up their inaugural 5G networks (likely in 2019) in different U.S. markets.

Consumers can expect faster, better wireless service even before 5G becomes available in their locality. It will take several years before 5G becomes ubiquitous, but it will fuel the American economy to shine ever brighter. ■

CES 2019 CTA's Research Summit at CES provides intelligence on the trends and technologies shaping the industry.

STATS AND FACTS

Understanding 5G and Its Features

There's been a lot of hype behind the benefits of 5G, but a look at the numbers prove this next-gen network is destined for success. While only 2,100 5G wireless handsets will ship in 2019, the next decade marks the technology's grand entrance. In 2020, shipments will skyrocket to 20,259 and then 72,500 in 2021. Meanwhile, 4G use will go down from 169,420 wireless handsets this year to 40,641 by 2022. Consumers will benefit from the upgrade, thanks to 5G's improvements to the mobile network's flexibility, speed, capacity, latency, efficiency and convergence.

5G BENEFITS

Flexibility
- 5G-ready network core to enable flexible service delivery
- Network capabilities delivered on demand for a large number of users and connections

Speed
- Higher speeds than 4G networks
- Speeds upwards of 10Gbps, and an improved distribution of high-speed connections

Capacity
- Supports billions of applications and hundreds of billions of users and endpoints
- Extremely large number of always-on users per cell

Latency
- 1ms versus 4G networks' 10ms to support real-time control and collaboration applications
- Support large number of simultaneous low-latency applications

Efficiency
- Lower power consuption, 1/3 to 1/2 LTE-advanced (LTE-A)
- Deliver significant improvements in battery life performance

Convergence
- Converged fiber-wireless networks deliver efficient backhaul and access services
- Enable connectivity in locations hard to reach via fixed line

ENHANCING LTE IS THE STARTING POINT FOR MOVING TO 5G

KEY BENEFITS OF LTE-A

- Self-organizing networks
- Faster download speeds
- Supports spectrum diversity
- Spectrum friendly technology
- Improved performance at cell edge
- Lower latency

CES 2019

Learn about the latest 5G advances at CTA's Research Summit at CES.

WIRELESS HANDSET SHIPMENT FORECAST (U.S. MARKET - THOUSANDS)

		Forecast				
Year	2017	2018	2019	2020	2021	2022
4G Handsets	167,947	169,420	168,417	151,110	99,346	40,641
5G Handsets	-	-	2,100	20,259	72,500	131,944

Source: CTA

People Images/Getty Images


FREEMAN®
oculus
using digital to make memorable live
experiences
We believe meaningful brand experiences build lasting relationships. And there's no better place to do this than at CES. Whether you're a global brand or a startup, our digital solutions help you create a powerful connection with attendees.
GoFreeman@Freeman.com