

PC
MAGAZINE

2017

TECH TRENDS
THAT WILL CHANGE
THE WORLD IN

2018

COVER STORY
**WHAT'S AHEAD: HOW
TECHNOLOGY WILL
TREND IN 2018**

Industry experts weigh in on how tech will affect our lives in the coming year.

**CONSUMER
ELECTRONICS**

LG X Charge

**RHA MA390
Universal**

**Beyerdynamic MMX
300**

HARDWARE

**Dell Inspiron 27 7000
All-in-One**

**Acer Chromebook
Spin 11**

**SOFTWARE
& APPS**

**Five Top DNA Testing
Kits**

ABBYY FineReader 14



WHAT'S NEW NOW



HANDS ON WITH THE QUALCOMM SNAPDRAGON 845

At the company's Snapdragon Summit, we heard all about the 845's new features and got hands-on time with a reference phone

FAST FORWARD: HOW FASHION AND TECHNOLOGY INTERSECT

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CLEMSON ATHLETICS GOES 'ALL IN' FOR SOCIAL CONTENT

Without the help of a social marketing agency, Jonathan Gantt's team has built Clemson University's social media following into one of the best in the nation



5 COLLEGES WITH MASTER'S-LEVEL SOCIAL MEDIA CONTENT

Social media is the new college brochure.



CAN ARTIFICIAL INTELLIGENCE BE TRULY CREATIVE?

Cutting-edge AI is gradually permeating every aspect of human life and culture—even creativity.



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The Tech World Needs to Get Serious About the Wage Gap



A lot of the best software and slickest ideas you ever see open the machines up to vulnerabilities.



JOHN C. DVORAK

Last Word

TIPS AND HOW TOS



HOW TO CREATE AND SEND ANIMOJI ON IPHONE X

Apple iPhone X owners can insert animated characters in a text message, thanks to the way the X maps your face.

ESSENTIAL TIPS FOR WHATSAPP USERS

You likely don't know everything it can do.

HOW TO WATCH ESPORTS ANYWHERE

Check out video gamer's competitive-player scene.



We Are Already Living in the Future

This month's cover story for the *PC Magazine* Digital Edition is loaded with tech predictions for 2018. We interviewed dozens of engineers, executives, and futurists and got their opinions on where technology is heading—our story is filled with revealing insights from a wide spectrum of industry pioneers. But I want to clarify one thing: We are already living in the future.

This assertion was best expressed by William Gibson, who said, “The future is already here—it’s just not very evenly distributed.” Indeed, while there are important debates to be had about the negative effects of unequal income distribution, unequal “future distribution” may be the more important issue to track.

To see the future, you just have to look in the right places. I’ve been travelling a lot during the past few months and have had the opportunity to see the future right now, all over the world. Here are just a few examples.

I was in Hong Kong a few months ago and got to see what a cashless society looks like—and it looks like an octopus. Octopus is a cashless payment provider operating in that city that allows for NFC transactions to purchase cab rides, parking, convenience store items, and even meals. The company just launched a QR-code-based system to augment Octopus that doesn’t require the presence of NFC readers. Now the market is about to be taken over by WeChat Pay and Alipay, which offer even more ubiquity.

You may not know this if you don't work in law enforcement, but cities across the world have dramatically improved their ability to identify the location of gunfire. Using a network of publicly installed microphones, a service called ShotSpotter can triangulate gunfire within 10 feet and instantly report that location to the police. The sensors can be installed as standalone devices or built into street lights. This technology is currently being used in more than 90 cities, including New York, Chicago, San Francisco, Denver, and Cape Town, South Africa.

In Needham Massachusetts, a company called Bigbelly is making smart garbage bins. Bigbelly bins are solar-powered trash compactors that can separate glass, plastic, and paper recyclables from traditional garbage. The bins need to be cleared 75 percent less often than ordinary bins. And they can be configured to deliver public Wi-Fi. Bigbelly bins are currently installed in all 50 US states and more than 50 other countries.

In cities as diverse as Paris and Kansas City, municipalities are using Cisco Kinetic to track the availability of parking spaces in real time. The technology has made finding spots faster for drivers, reduced traffic congestion, and even increased city revenue with better enforcement reporting.

At the same time, every major city is converting to LED street lighting. Los Angeles spent \$57 million to switch to LED—and since doing so, it has saved \$9 million a year in utility costs. Streetlights also provide a platform for delivering other services, including WAN (wide area networking). By 2020,



In Hong Kong a few months ago I got to see what a cashless society looks like—and it looks like an octopus.



10 percent of US cities will be using street lamps as the backbone for WANs, according to Gartner.

Standing on a street in Washington DC recently, I saw real-time digital billboards that told me when the next bus or train was arriving. They also told me how far away the nearest Lyft or Uber driver was. This represented a blending of public and private data and technology platforms that will replicate across industries.

We live in troubled times, for sure, but they are also amazing times. Here at PCMag, we'll keep looking for those places where the future first appears. We'll endeavor to bring the future to you in these pages with speed, accuracy, and passion. And by reporting on the future, we hope to be a partner to making it available to everyone, equally.

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Those Job-Stealing Robots

John C. Dvorak's December column raised the specter of workers being displaced by robots. Here's how readers reacted online.

The entire history of civilization has been the development of the division of labor, with labor-saving devices making society wealthier and raising standards of living. The Industrial Revolution threw huge numbers of people out of work by replacing hand work with machines. But the ultimate result was a higher standard of living for everyone. True, modern robotics pose new problems for employment that we haven't seen before. But those problems are made much worse by ruling class policies of importing huge numbers of unskilled and low-skilled workers. The upper classes get cheap labor, cheap nannies and gardeners, etc. Everybody else gets lower wages and higher unemployment.

—*Bizarro World Observer*

.....

We've been "losing jobs" to robots for a very long time. But do we want to go back to having people calculating bank interest by hand, operating elevators manually, or hand-sewing every stitch of clothing we wear? In reality, there are jobs that computers are good at replacing and others they can't replace easily. Labor pricing is one place where tipping points are going to shift in favor of computer/robotic replacement of humans. A touch-screen-computer ordering system costs more upfront but saves lots of high-minimum wage labor. Supermarket self-checkout cuts down the number of checkers dramatically.

Manufacturing is more likely to move overseas, which has a heavy surplus of cheap labor (India and China).

—*Jeffrey Clinard*

John's proposition on labour displacement is correct, but the real issue that follows in an economic one. If nobody is working, then where does the tax revenue come from to fuel the publicly funded side of the economy? It's probably impractical to tax the robots that have initiated the problem, and fewer and fewer wealthy people will own all the businesses in their entirety. Ergo, we are going to have to move to taxation systems based on the holding of assets instead of the present one based on earned incomes. By the way, no point in yelling "bloody commie" at me—I'm in my mid 70s and won't be around to see the resolution of these issues, but my grandchildren are going to have to live with it.

—*mmpaca*

Markets and economies have an equilibrium. If nobody has a job because they are displaced by robots, then nobody will be able to buy the things the robots are making, and the factory goes under. And the price of labor gets cheaper such that buying robots is no longer competitive. And 401-Ks have displaced defined-benefit pensions (except for those lucky enough to work for the government). And stop fearing the forward march of technology—that and cheap foreign labor (think of these as cyborgs) is why you're living better now than you ever have. Robots? Bring them on!

—*GlyndonD*

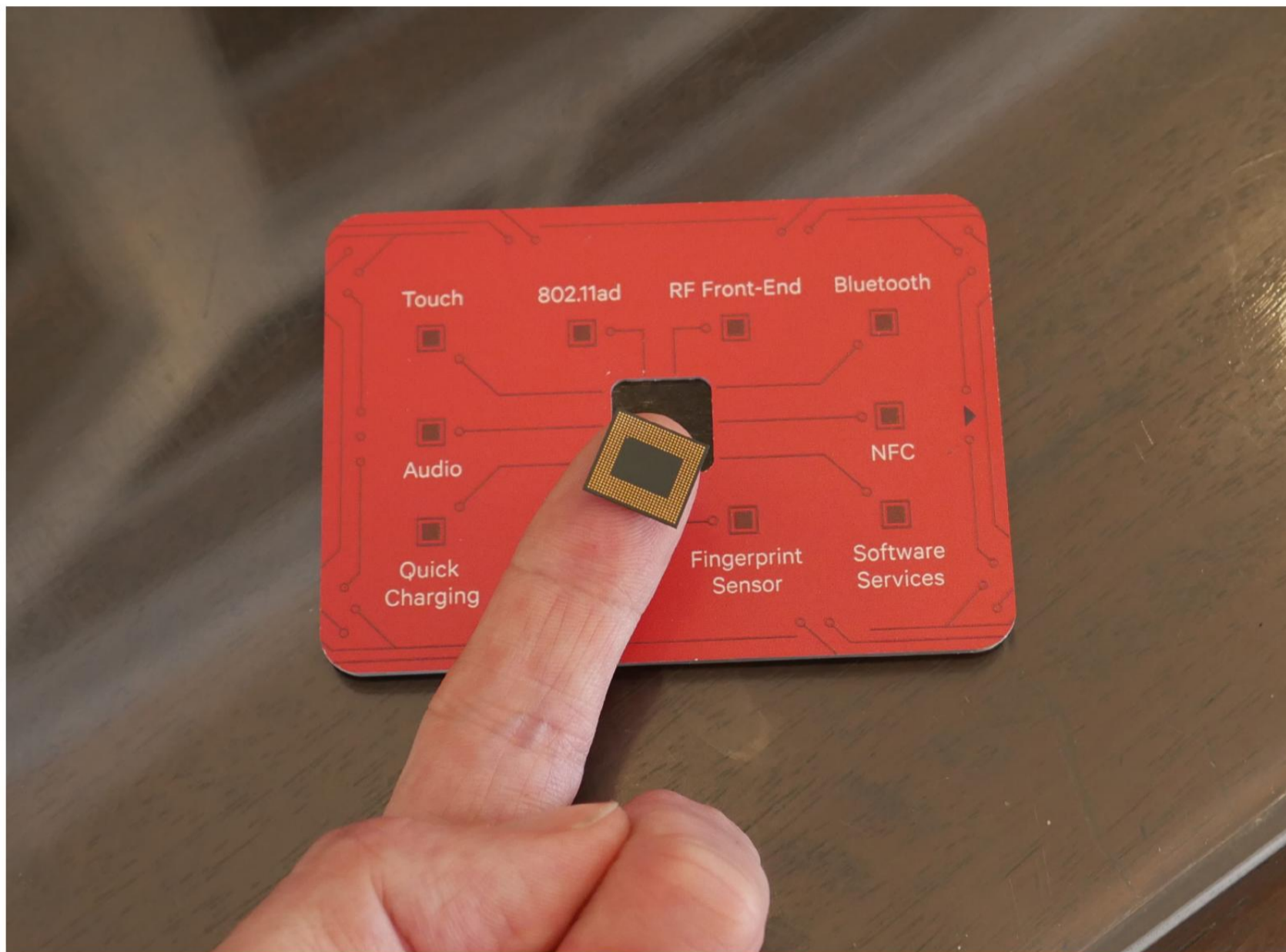
Ask us a question!

Have a question about a story in *PC Magazine*, one of the products we cover, or how to better use a tech product you own? Email us at letters@pcmag.com and we'll respond to your question here. Questions may be edited slightly for content and clarity.



Hands On With the Qualcomm Snapdragon 845

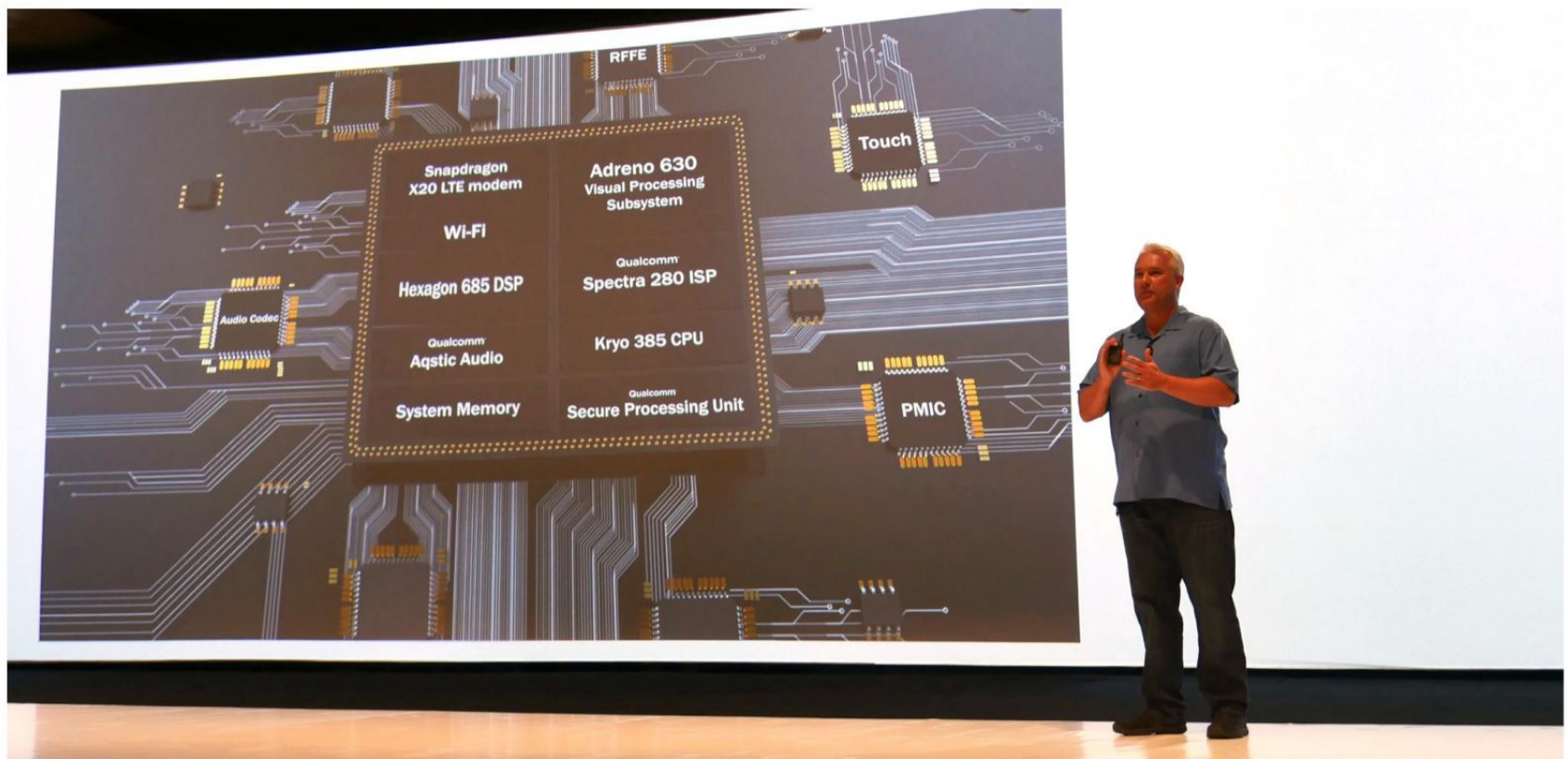
BY SASCHA SEGAN



Qualcomm's new Snapdragon 845 processor will make your photos brighter, your connections faster, and even stretch out the battery life in your wireless headphones. At the company's Snapdragon Summit, we heard all about the 845's new features and got hands-on time with a reference phone. Here are some of the coolest features in the Snapdragon 845.

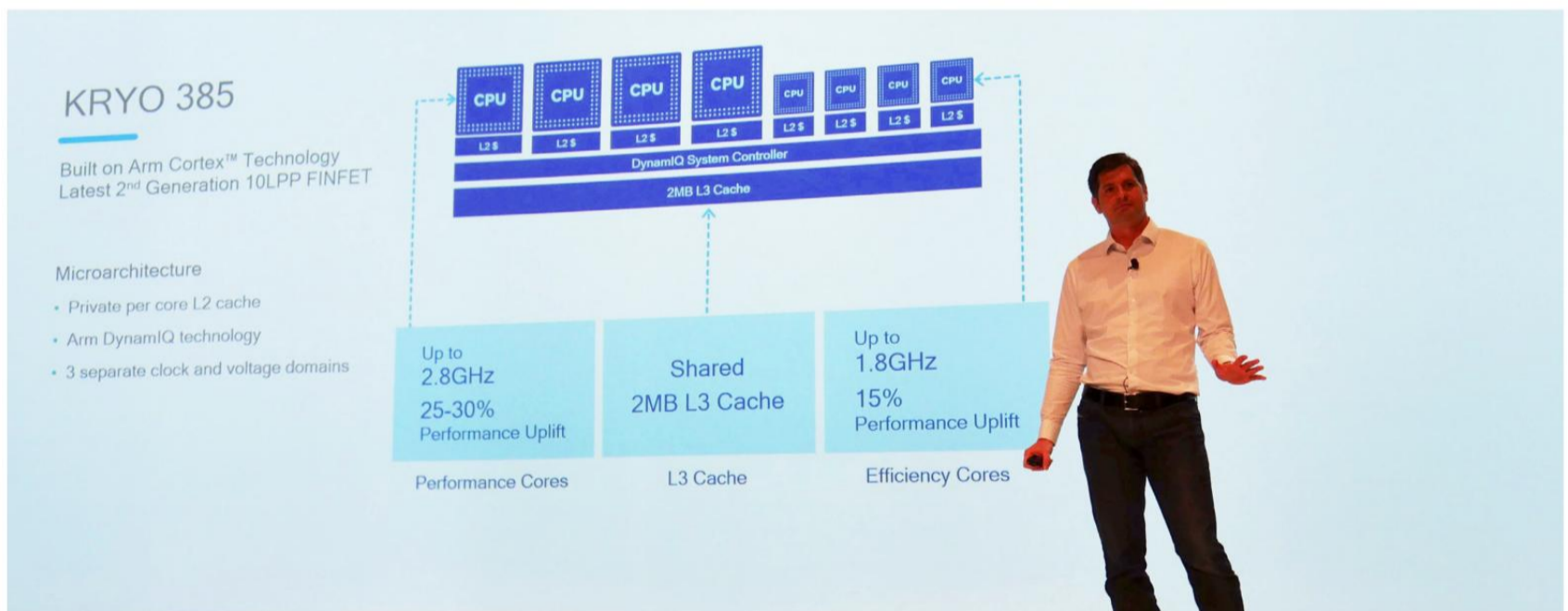
QUALCOMM SNAPDRAGON 845

This little chip is at the heart of the Snapdragon 845 experience. Unlike with PC CPUs, the Snapdragon 845 isn't a single powerful processor. Instead, it's a complex system of different components for different tasks, all joined together.



WHAT'S INSIDE

Qualcomm upgraded several of the components from its Snapdragon 835. The X20 modem now lets wireless carriers hit gigabit LTE with a much more flexible combination of frequencies, making it more likely that you'll see gigabit LTE near you. The Adreno GPU is 30 percent faster. The new image signal processor captures 4K HDR video with very broad colors.



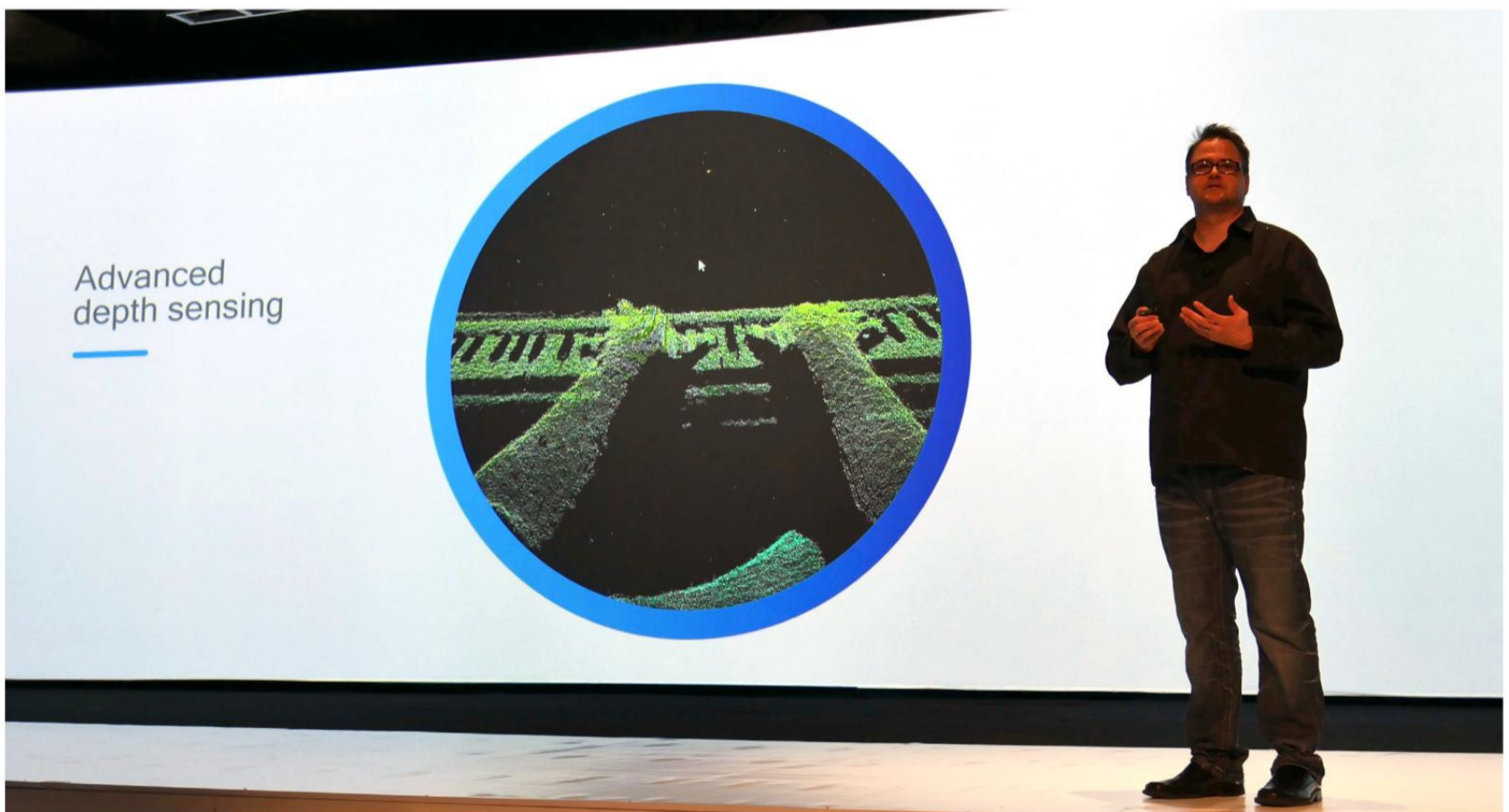
THE KRYO 385 CPU

The Kryo 385 CPU is based on ARM's Cortex-A75 and A55 cores, but Qualcomm says it has done significant customization, most notably in terms of adding a shared L3 cache across all of the cores to smooth performance in multi-core workloads. Qualcomm CDMA Technologies president Cristiano Amon told us that much of the chip's processing load is handled by DSPs and the GPU, however.



ULTRAHD PREMIUM

The Snapdragon 845 is the first mobile chip to record in “Ultra HD Premium,” which combines 4K, HDR, and the broad Rec 2020 color space for stunning photos and videos. It also supports the more common HDR10 format.



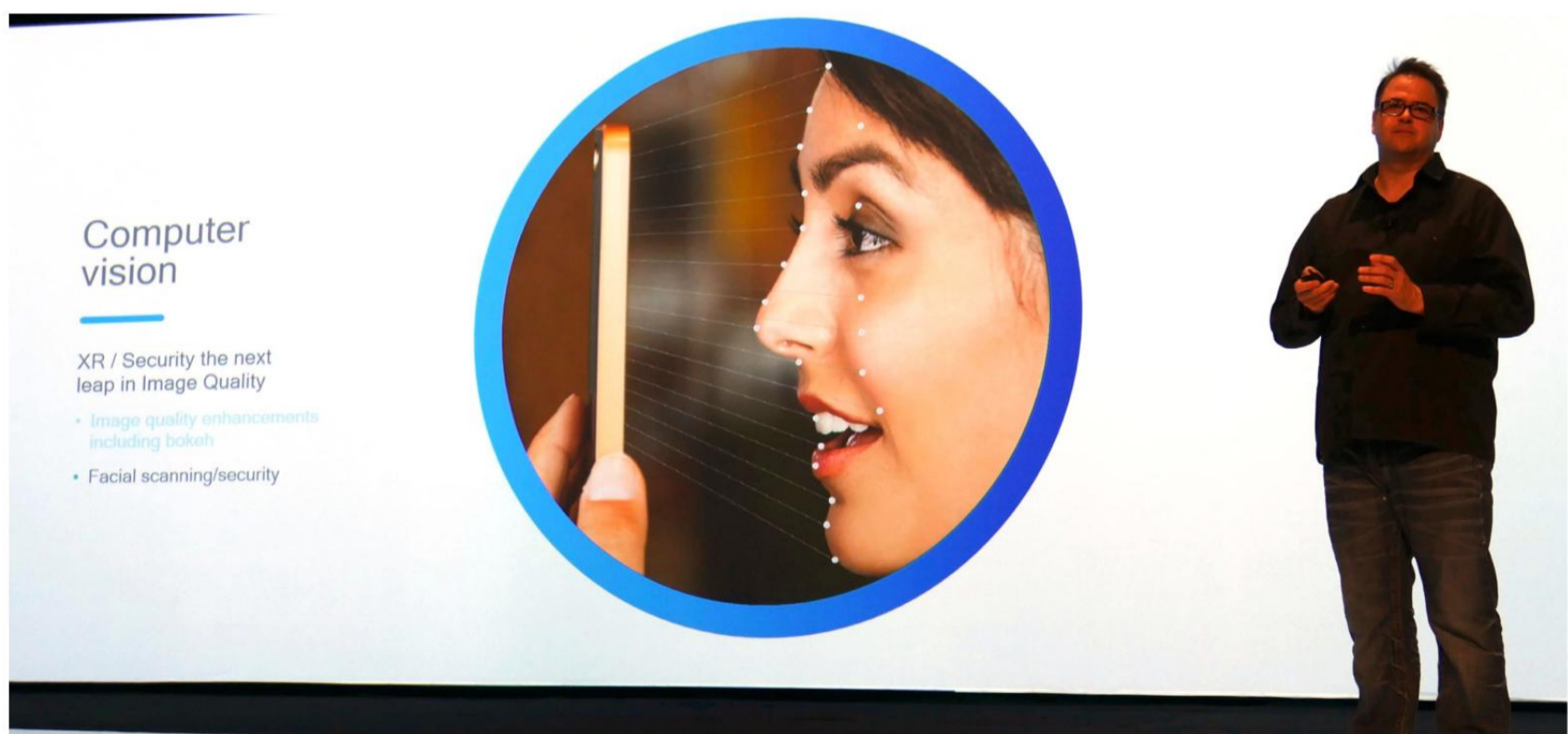
ACTIVE DEPTH SENSING

The Snapdragon 845 has a lot of features for augmented and virtual reality. One of the keys is active depth sensing, using an infrared camera to take a live, 3D map of what’s in front of you. Phone makers will need to install the infrared cameras on their phones, though.



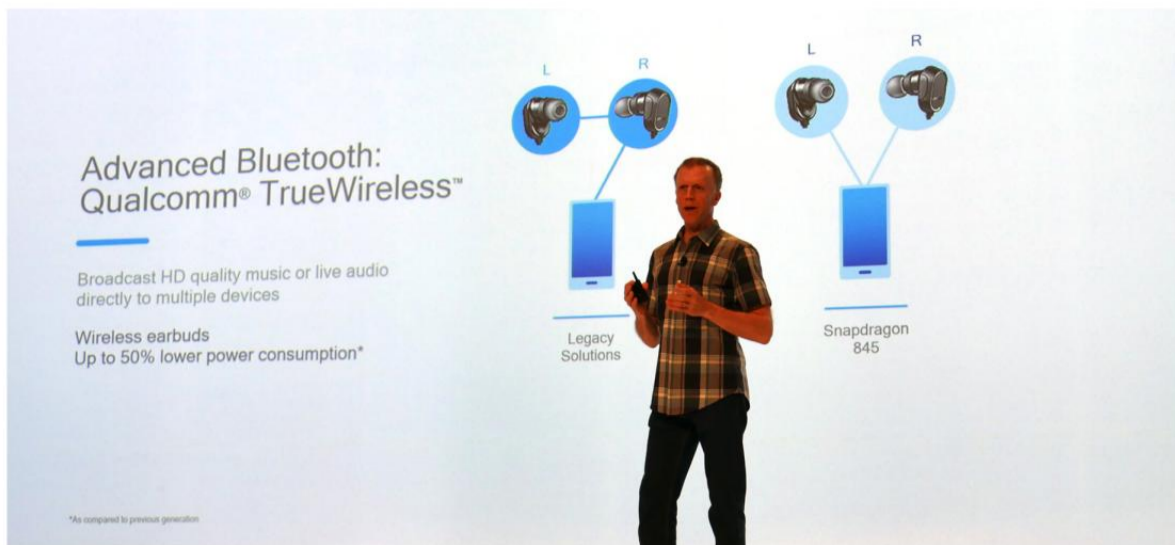
SUPER-FAST WI-FI

We've been hearing about 802.11ad for three years now. Also called WiGig, it's a way to transmit data at extremely fast speeds over short distances, basically within the same room. You'd use it to share a gigabit connection, whether as a client or as a hotspot. There are a few 802.11ad routers out there. Snapdragon 845 phones will support 802.11ad with two sets of antennas, so if your hand is covering one, the other one can still transmit.



FACIAL RECOGNITION

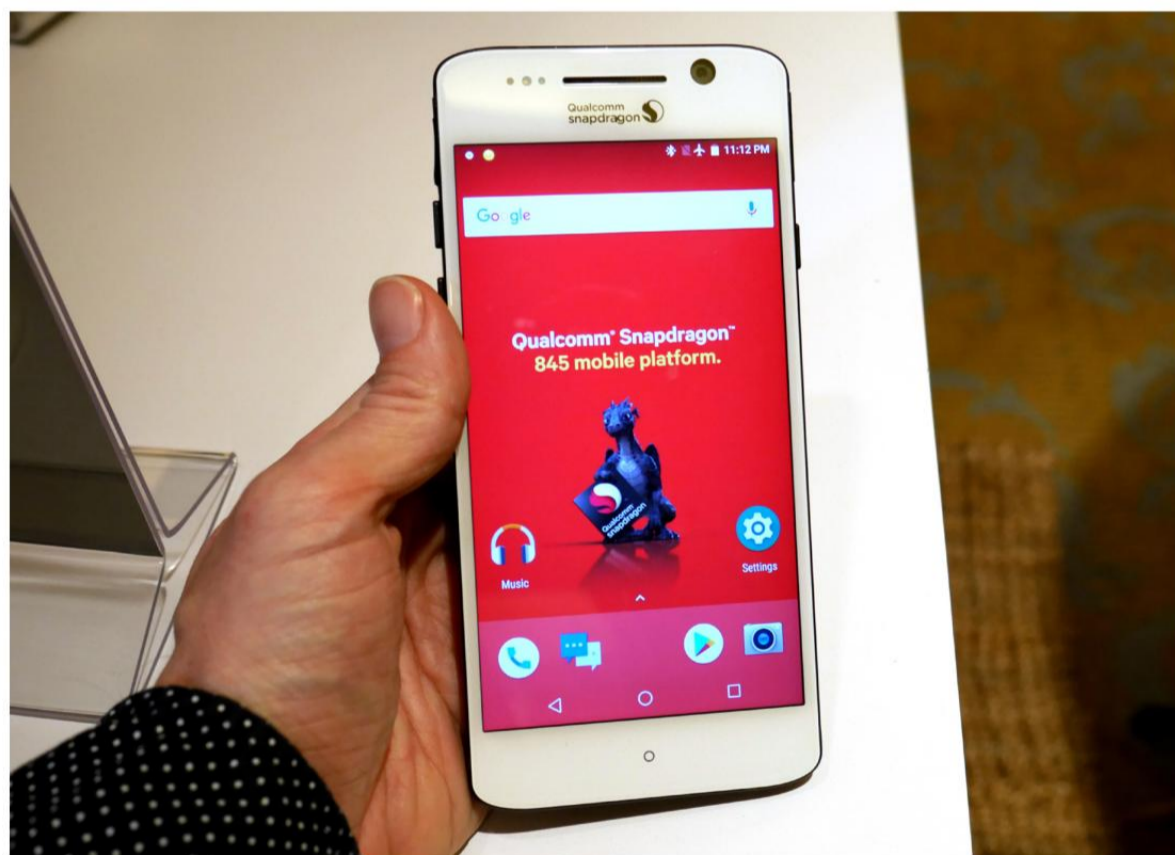
Of course, the Snapdragon 845 does secure facial scanning.



IMPROVING BLUETOOTH BATTERY LIFE

I really liked this feature. Qualcomm is able to split stereo Bluetooth transmissions into separate left and right streams and beam them to true wireless earbuds separately. That means the earbuds only have to receive (right now, one earbud needs to transmit to the other, which consumes a lot of battery power). This will make for much longer battery life for true wireless earbuds, although the trick won't work with existing earbuds.

“
You aren't going to be able to get this phone at retail, but it gave us a feel of the Snapdragon 845 experience.
 ”



QUALCOMM 845 PHONE

Here's the Snapdragon 845 reference phone. You aren't going to be able to get this phone at retail, but it gave us a feel of what the Snapdragon 845 experience will be like in real life.



PLAYING LINEAGE II

I played Lineage II: Revolution on the Snapdragon 845 reference phone. It looked great and played smoothly, with lots of lighting effects. The 845 supports 4K screens at 60fps as well as 2K phone screens at 120fps.



FASTEST LTE SPEED EVER

The new X20 modem is capable of 1.2Gbps speeds, which is the fastest we've seen in a production LTE modem. But more important, it gives wireless carriers lots of flexibility in building gigabit LTE networks from disparate chunks of spectrum, supporting up to five-carrier aggregation.



VR EXPERIENCE WITH HAND TRACKING

This standalone VR headset let me walk around a room and use my hands as controllers. The experience didn't work very well—there was some visual tearing and my hands often felt out of place—but, obviously, it wasn't production software. The 845 promises AR and VR experiences with full-room and object mapping, not the lousy, horizontal-surface-only mapping we've seen so far in ARKit and ARCore.



The 845's audio chip is very good at separating your voice from surrounding music and noise.



QUALCOMM SMART SPEAKER

The 845's audio chip is very good at separating your voice from surrounding music and noise, as we saw in a demo with this smart speaker. The chip is probably too expensive for mainstream speakers, but Qualcomm is driving the 845's audio capabilities down into cheaper chipsets that don't have the 845's video capabilities.

How Technology and Fashion Intersect



Fast Forward is a series of conversations with tech leaders hosted by Dan Costa, PCMag's Editor-in-Chief. He spoke recently with Liza Kindred, the founder of Third Wave Fashion, a consultancy that helped create and define the fashion technology industry.

Dan Costa: So Fashion Week wrapped up here in New York not long ago, but it seems like it was longer than a week.

Liza Kindred: Yes, Fashion Week is actually a month long. It goes between cities—it goes to Milan, it goes to Paris. But in New York, where we believe we live in the center of the universe—or at least we behave like that sometimes—Fashion Week is finished.

We cover fashion technology at PCMag.... when it's Fashion Week, and we send people to the show. This year it seemed a little disappointing, from a technology perspective.

Yes, that's interesting. Disappointing. So one of the main things that changed this year as opposed to some of the most recent years, is that there's no longer a partnership happening between the CFDA, which is the Council of Fashion Designers of America, who puts on the official Fashion Week. Their partnership with Intel is not happening anymore.

And coincidentally, a little less technology this year.

Exactly. In fact, Intel has dissolved their fashion group and kind of absorbed them into some of the other groups, so that partnership isn't going on anymore. We're not seeing that big push that's at the forefront. But I would say that technology has completely upended Fashion Week. Even though we weren't necessarily seeing things as much on the runways, the entirety of Fashion Week and [the event] in general has changed because of technology.

The fashion industry is in this, some would say crisis, because of this idea that's called "see now, buy now"—which basically means that people are buying what's being shown on the runways as opposed to waiting six months or [more] for whatever is on the runway to actually come into a store... When we show something on the runway, everyone posts it on Instagram, all these influencers maybe get samples of the items. By the time it's in the store six months later, there is so much fatigue in seeing our cool new designs that people don't want to buy [them] anymore. So a lot of designers are trying to figure out when to actually be shipping the clothes that they're showing on the runway.



Even though we weren't necessarily seeing things as much on the runways, Fashion Week has changed because of technology.



That's really interesting. Because the whole fashion industry was generally around a print cycle, and you'd have the fall line and the spring line, and there'd be months between when these things would be shown and then when they would actually be shipped.

Right, right. So long.

And now, you're saying that whole thing has collapsed, and people want to buy now. And if they don't build it and ship it now, somebody's going to copy it and ship their version of it.

Always. The fast fashion, the Zaras and the Forever 21s and H&Ms of the world, they knock off stuff from the higher-end designers and even from indie designers. And they have it in the stores in two weeks—an insane time to market. They won't see something, it'll be like a completely blank slate, and in two weeks they'll have it in stores, which is an incredible thing to do on the back end. But that's another technological advance, if you will, that is pushing the fashion industry out of its comfort zone and having to change things entirely.

Can you talk a little bit about that, the rapid manufacturing model that's gotten transformed? Rapid prototyping, but rapid prototyping at scale, where they'll build thousands of garments and send them all over the country.

Yes, [it happens] very quickly. And so some of the most interesting innovations in fashion are actually happening on the back end, behind the scenes in ways that consumers won't see. I think a lot of times when we think of fashion tech, we think of either wearables or maybe a dress that lights up on the runway.

Technology elements—and I think it's interesting that Intel may have had something to do with this—incorporating technology into the runways seemed a little forced a lot of times.

Right, absolutely.

Why are we shooting this with drones when we're surrounded by photographers?

Why not? Because drones are there. And I think that there's been an interesting thing that's happened with fashion and with technology in that for a long time, the brands that people wanted and the money that, let's say teenagers, were spending was going into fashion. I myself, when I was spending money as a teenager, I was spending it on certain brands of clothing. I wanted some Pepe jeans and an Asprey bag. I'm sure anyone else that was born in 1978 is like, "Yes, I wanted that, too." But right now, my daughter who is a teenager is not at all interested in fashion brands. She is interested in expressing herself, how she looks, and trends, but she could give a care about what the brands are. She's more interested in making sure that she has the latest gadgets.

Because it enables her lifestyle in a way that clothing may or may not.

And she's able to have expression as well. So, whereas before we might be expressing ourselves through our clothing, now she is very expressive on Snapchat, you know or through these other platforms. Dollars are moving from being spent on fashion to being spent on technology. So that's something that fashion is really trying to grapple with—how do we compete with this, how do we embrace this? And so we have a lot of these slacked on partnerships where you find drones on the runway, or your dress lights up. And that's not necessarily something that consumers are demanding, it's marketing.

Google Glass made its epic debut during Fashion Week and it turned out to be a disaster. I wish somebody had asked me in advance whether or not this was a good idea. This was never going to belong on the runway. And by forcing it up there, it really highlighted all of the device's weaknesses and none of its strengths.

You know, it's interesting. I know the people that worked on that partnership and made that decision, and they don't see it as an epic fail. I learned by asking how they felt about their epic fail! But they see it as, they wanted to test the market, and they tested the market, and they see it as a successful test.

See a video of the full interview and many more at pcmag.com/podcasts/fast-forward.

What We Love Most This Month

BY PCMAG STAFF



ZENDURE X6 POWER BANK

This relatively diminutive power bank comes with a whopping 20,000 mAh capacity, USB-C input and output, no fewer than five USB outputs, and an X-Charge low-power charging mode as well as full-speed charging, so it's able to handle quite a range of devices. And its UPS function lets it deliver the maximum possible output for charging any given device.

Early bird price, \$59; www.indiegogo.com



DYGMA RAISE GAMING KEYBOARD

Gamers get the coolest devices. This mechanical split keyboard is designed to improve your posture and take some stress off wrists and shoulders as you play (it can also be snapped together for normal typing). The Raise is very customizable, letting you create multiple layouts that you can toggle among. All keys are remappable and can be configured as macros. And the RGB LED lighting schemes can be programmed to change as you change layouts.

On Kickstarter soon; www.dygma.com

MOON BY 1-RING

This gravity-defying smart home security camera has loads of features, including compatibility with Bluetooth Low Energy (BLE), ZigBee, and Z-Wave; wireless charging; an IR blaster; sound direction detection; and sensors for temperature, carbon dioxide, humidity, and light. The Moon by 1-Ring's Presence Simulation tool randomly turns your lights on and off when you're not home, to make bad guys think you're there.

Early bird price, \$224; www.indiegogo.com



Could You Form an Emotional Bond With a Self-Driving Car?

One of the greatest fears among automotive enthusiasts is that when vehicles become autonomous, the joy of driving will disappear, and we'll lose any emotional connection to cars. Even if you're not a hardcore motorhead and hate your daily commute, you can probably imagine missing, say, the sensation of hitting the gas to get around a slowpoke or the visceral feeling that comes from controlling a multi-ton machine.

Several companies are working on ways to ensure humans feel comfortable in self-driving cars—despite a perceived loss of control or fear of hurling from motion sickness. But a project developed by Hyundai and the Los Angeles County Museum of Art goes a step further to explore how to improve the relationship between people and autonomous vehicles.

Titled The Roadable Synapse, the project centers around a prototype car that's based on a Hyundai Ioniq, created by artist Jonathon Keats with the help of Hyundai engineer Ryan Ayler. Though the vehicle is piloted by a person, the goal is to learn how to engage humans in the operation of an autonomous vehicle rather than having them become passive passengers.



Car tech expert Doug Newcomb has written for *Popular Mechanics*, *Road & Track*, and other publications, and is the author of *Car Audio for Dummies*.

First, Keats and Ayler developed an interface that allows the driver to better perceive the car's actions, whether punching the accelerator to pass or carving a hard turn, by controlling music playback. The music speeds up along with the car to give those inside a sense of being in sync with the vehicle.

“What we're doing is using data from the car's computer to modulate the signal, so the driver experiences what the car is experiencing,” Keats told *Wired* magazine. “The faster tempo arouses you emotionally, which alters your perception.”

Keats points to smartphones, which “became a sort of cognitive and emotional extension of ourselves. They've become part of us—we get anxious when we're separated from our devices,” he said. So Keats and Ayler are “applying neuroscientific research to merge the human and the machine in a more organic way. It's the car-as-wearable,” he told *Wired*.

One example of this is a seatbelt attachment that Keats and Ayler put together called a “hunger undulator.” It uses vibrating motors to mimic stomach contractions so passengers feel hungry as the car starts to get low on fuel. Keats also came up with the idea of a power seat with settings that raise the occupant's stress level when the car needs servicing. “I'm tapping into hormones,” Keats said.

At the core of Keats's approach is that despite the prevailing wisdom, he's not convinced that autonomous cars will completely decouple us from the experience we know today as driving. According to Keats, you could become even closer to your car in the future—even if you're not in control.

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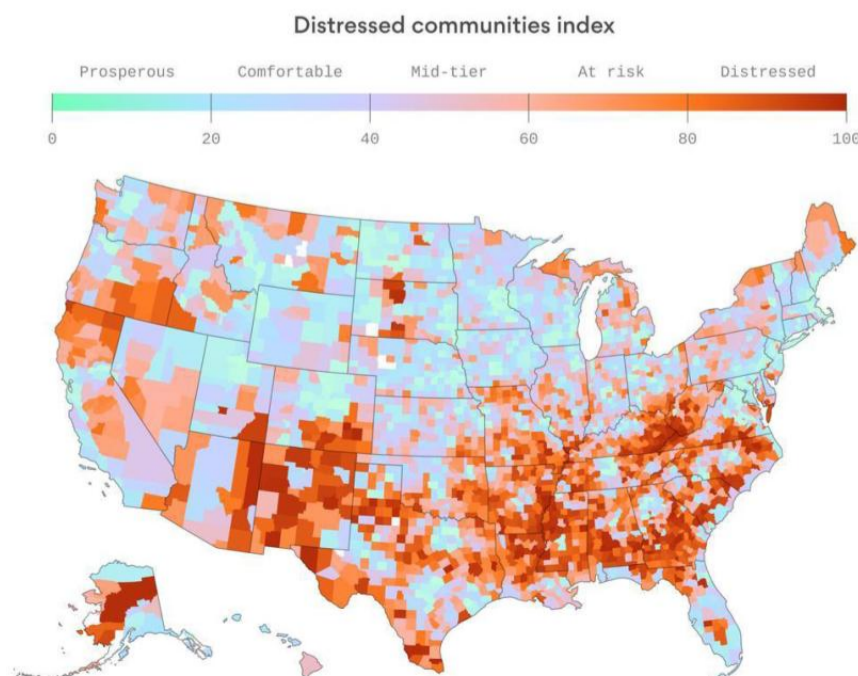
The Tech World Needs to Get Serious About the Wage Gap

Recently, I wrote about the spate of unfortunate headlines coming out of Silicon Valley, from social networks accepting Russian ad dollars to corporate tax issues. But I see the growing wage gap as one of the biggest problems for the region, as well as for tech hubs such as Seattle, San Jose, and Austin. It's especially pronounced in the Midwest, the Rust Belt, and the south, where many people feel left behind by the rise of automation, jobs moving offshore, and a shift in markets. It's no wonder so many look at the excesses of Silicon Valley in a negative light these days.

The chart below from the Economic Innovation Group Communities Index, which shows just how distressed many communities are in the US, should be very troubling to tech leaders and government officials.



Tim Bajarin is the president of Creative Strategies and a consultant, analyst, and futurist covering personal computers and consumer technology.



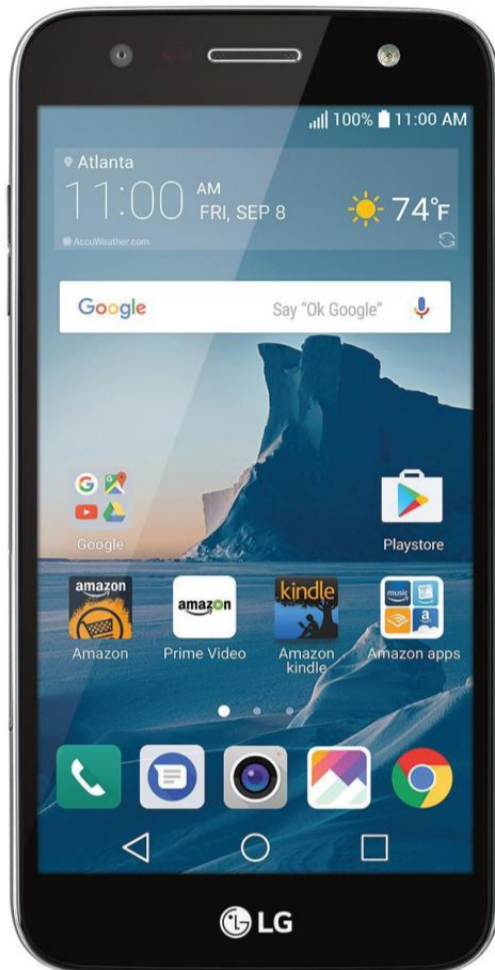
With the exception of a few years abroad and a stint in Illinois, I've lived in San Jose and worked in the tech industry all of my life. But I've been aware of the wage discrepancy issue for a long time; I heard rumblings of a Silicon Valley backlash at least five years ago. Now, in the wake of the 2016 election and the Russian influence controversy, we're even hearing calls for tech companies to be regulated or broken up.

At the heart of this is an age-old question about sharing the wealth, which is often at odds in a capitalist society. As a child, I was pushed to excel and do my best and was told that what I earned was mine. For most workers, that is still their mantra. But when they see bankers, tech leaders, and some politicians making millions or billions of dollars, sometimes at workers' expense, it's hard not to question the system.

I will let others debate capitalism versus socialism versus communism. But the tech world does need to become more sensitive to the fact that our earning potential has grown while many in the US have seen their wages stagnating and have little hope of getting a better, higher-paid gig. We're on the fast track to greater wage disparity, and at some point, those who are struggling will rebel—at the ballot box or in the streets.

The tech world needs to take this seriously. I don't have specific answers, but I do think Silicon Valley needs to use its innovative spirit to help their fellow citizen as much as their bottom line.

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LG X Charge Phone Keeps Going and Going

Modern phones are power-hungry beasts. Instagram, Pokemon Go, Snapchat, Twitter... There's always some app sucking up juice, and even pricey flagships can't promise all-day battery life. That's why it's easy to see the appeal of a phone like the unlocked LG X Charge. With a gargantuan 4,500mAh battery, it can last about twice as long as many phones, so you can keep talking and tweeting. Beyond that, it offers decent performance at a reasonable price. It's a solid deal for anyone that needs as much battery as possible—but you can get more performance for the price if you're willing to sacrifice some juice.

LG X Charge

\$199.99



DESIGN, DISPLAY, AND FEATURES

The LG X Charge is a phone without pretension. It has a simple, textured, gray-plastic back, slick plastic sides, and a large black bezel. The back is nice and grippy, and the polycarbonate build is free of the creakiness you sometimes find on less expensive devices. It doesn't feel cheap, but the comparable Moto G5 Plus offers a nicer, metal build.

The phone measures 6.1 by 3.1 by 0.3 inches (HWD) and weighs 5.8 ounces. That's similar to the G5 Plus (5.9 by 2.9 by 0.3 inches, 5.5 ounces), and a little thinner than the Moto E4 Plus (6.1 by 3.1 by 0.4 inches), which has an even larger battery. The phone's width, along with a large bottom bezel, makes it hard to use with one hand.

Unlike most new LG phones, the buttons are not on the back of the phone. Instead, the X Charge has a power button on the right and a volume rocker on the left. It also has a SIM/microSD card slot on the left that worked fine with a 256GB card. The bottom of the phone has a micro USB charging port and a 3.5mm headphone jack. One notable omission is a fingerprint sensor, a feature we're starting to see on even the most affordable phones.

LG X Charge

PROS Affordable. Sturdy build. Excellent battery life.

CONS Screen could be sharper. No fingerprint sensor. Lackluster camera. Not compatible with Verizon.



The X Charge has a 5.5-inch, 1,280-by-720 TFT LCD. The resolution works out to 267 pixels per inch (ppi), which is a bit soft for the size. The 5.2-inch, 1080p panel on the G5 Plus (424ppi) gives you a much crisper image and has better viewing angles. That said, text and images look sharp enough on the X Charge, and viewing angles are decent, aside from some slight tinting when you view it from the side. Screen brightness isn't very high, so the display can be hard to see in direct sunlight.

NETWORK PERFORMANCE AND CONNECTIVITY

The unlocked X Charge has LTE bands 2/4/5/13 with support for AT&T, Sprint, and T-Mobile, but not Verizon. An Xfinity version of the X Charge uses Verizon towers, but you need to be an Xfinity subscriber to use it. We tested the phone on T-Mobile and saw good network performance in heavily congested midtown Manhattan, with top speeds of 19.6Mbps down and 15Mbps up.

Call quality is decent: Transmissions can sound a bit muddy on outgoing calls, but noise cancellation is very effective at blotting out background sound, and overall volume is good. Earpiece volume is fine, though in a noisier environment it can be a little hard to hear.

Additional connectivity protocols are limited. You get Wi-Fi on the 2.4GHz band and Bluetooth 4.2, both standard fare, though the similarly priced G5 Plus has dual-band Wi-Fi.

PROCESSOR, BATTERY, AND CAMERA

The X Charge is powered by a MediaTek 6750 chipset clocked at 1.5GHz. In the AnTuTu benchmark, which measures overall system performance, the phone scored 39,447, a little higher than the Snapdragon 427-powered Moto E4 Plus (37,606). But it's not nearly as powerful as the G5 Plus, which has a more capable Snapdragon 625 (63,845).

The phone has 2GB of RAM under the hood, giving you a decent ability to multitask, though performance can be sluggish. The phone hangs when you're switching between apps, animations stutter, and it usually takes a few seconds to launch a new app. That said, I never experienced any crashes, and the phone handled key tasks such as browsing and navigation without issue. High-end games are beyond reach, though, as frame rates are too low and latency is too high for most FPS or racing games to be playable.

Battery life is likely the reason you're here. With its 4,500mAh cell, the X Charge clocked an impressive 11 hours 8 minutes on our rundown test, in which we stream video over LTE at full brightness. That's one of the longest results we've seen, handily beating the G5 Plus (7:35) and coming a close second to the 5,000mAh E4 Plus (11:44). The phone lasted for two days of regular use without any difficulty, and in standby mode, it lasted nearly a week. Fast charging is supported, but fully charging the phone's massive battery takes time.

Camera quality is a low point. The 13-megapixel rear camera takes mediocre photos in the best of circumstances. Even on a bright day, the X Charge takes muddy, noisy photos. Colors look undersaturated, with bright blues and whites appearing gray and washed out, making a sunny day look dull and depressing. Low-light shots are (unsurprisingly) not any better. Autofocus misses the mark more often than not and turns out blurry shots, or it simply gives you a grainy mess.

The camera records 1080p video at 30fps. Video tends to be on the soft side and drops frames in lower light, but it's passable. The 5-megapixel selfie camera is simply average.



The X Charge clocked an impressive 11 hours 8 minutes on our rundown test. That's one of the longest results we've seen.



SOFTWARE

The X Charge comes running Android 7.1.1 Nougat. LG's UI layer makes a number of visual changes to the home screen, app icons, notification shade, and menus. By default, apps are splashed across the home screen, and the app drawer is removed, but you can change that in Settings.

We tested the X Charge model subsidized by Amazon advertising, which means ads appear on the lock screen, and a removable widget on the home screen shows you deals, products, and services that may be of interest to you. If you log into your Amazon account, it'll be personalized; otherwise, you get generic offers.

The X Charge comes with no extra frills or features. As for preinstalled apps, you get Amazon's full suite of nine apps, from Audible to Prime Video as well as Facebook, Instagram, and LG SmartWorld. Out of 16GB of total storage, a mere 5.79GB is available, which isn't much if you plan to take lots of photos or download music. You can use an SD card as removable media, but it's not possible to make it integrated storage.

CONCLUSIONS

The LG X Charge offers a reasonable level of performance and tons of battery life for the price. If you're a heavy user or a major traveler, the battery can last you longer than most other midrange phones. But as far as Amazon Prime phones go, you have better options. For a little bit more money, the Moto G5 Plus offers a faster processor, sharper screen, and higher-quality metal build (albeit with less battery life). Even when battery is your primary concern, the Moto E4 Plus lasts longer than the X Charge and costs \$30 less—plus it has a fingerprint sensor and is compatible with all major US carriers.

AJAY KUMAR



RHA MA390 Earphones Outperform Pricier Options



RHA made its name with affordable, good-looking earphones that sound far better than you might expect for the price. After releasing models in recent years that sounded great but were relatively expensive, the RHA MA390

Universal earphones feel like a return to the company's roots, with a stylish design, a solid array of accessories, and a wallet-friendly price. One might suspect that RHA cut corners on audio performance, but the sound quality is excellent, with full-bodied bass that doesn't distort and crisp, detailed high-frequency response. That earns the MA390 our Editors' Choice for affordable earphones.

**RHA MA390
Universal**

\$29.95



DESIGN

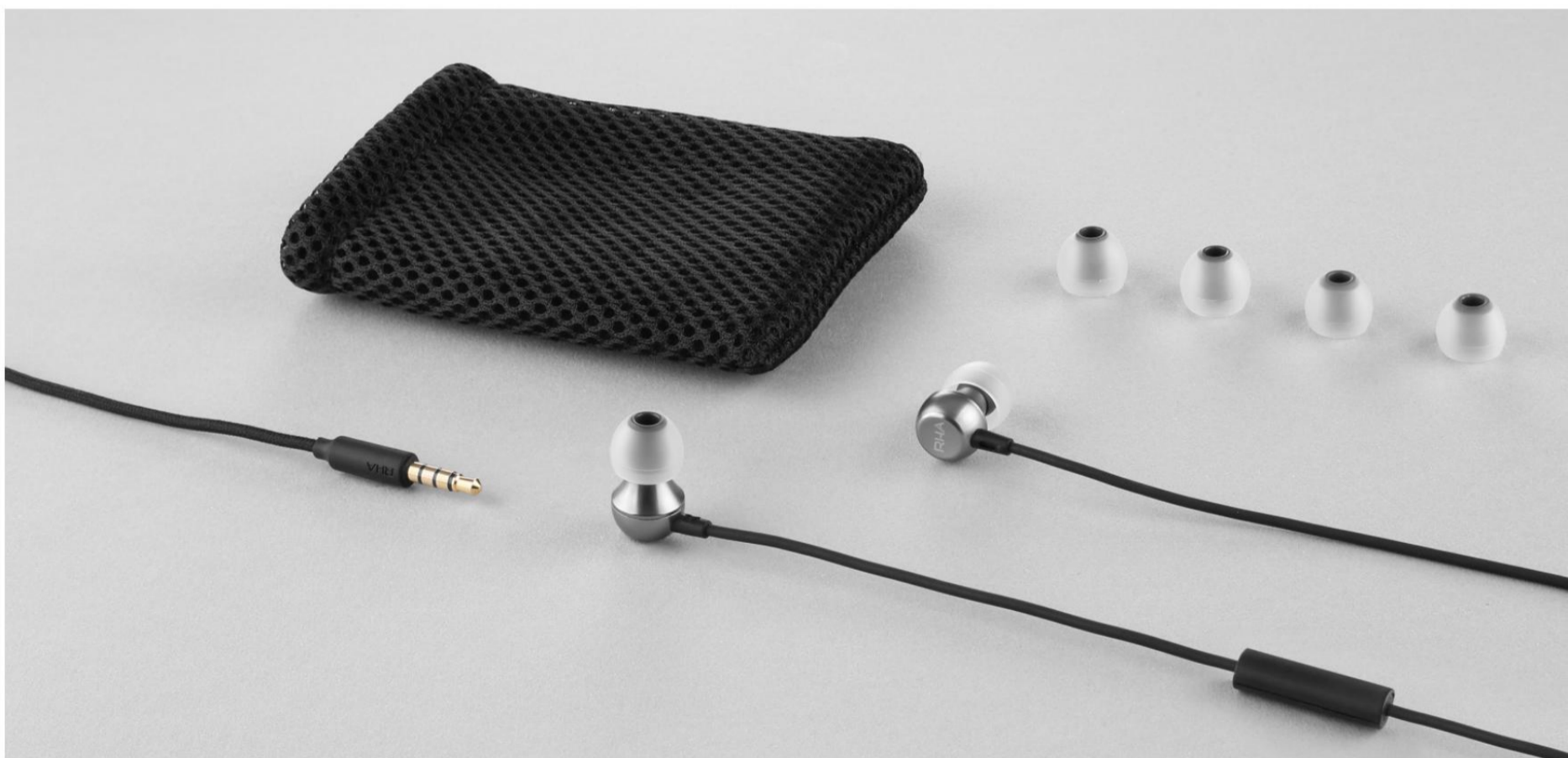
The MA390 Universal's black-and-silver design includes details we often see in more expensive pairs, including aluminum earpieces and cloth-lined cabling. The lightweight earpieces are emblazoned with the RHA logo. They fit securely and comfortably in the ear, sealing off the canal. Internally, dynamic drivers deliver a frequency range that RHA claims to be roughly 16Hz to 22kHz.

An inline remote control runs along the right earpiece's cable, at roughly chin level. It's of the single-button variety, which means you won't be able to adjust volume levels with it. But it controls playback, call management, and track navigation (two taps for forward, three for backward).

RHA MA390 Universal

PROS Affordable. Handsome design with quality materials and a decent array of included accessories. Clear mic intelligibility.

CONS Remote control has single button. Mids are scooped out a bit.



The inline mic offers excellent intelligibility. Using the Voice Memos app on an iPhone 6s, we could understand every word we recorded clearly, and it was a high-quality recording. The mic picks up a decent amount of low-frequency content, and no obvious audio artifacts mucked things up.

The earphones ship with more accessories than most budget pairs. You get a padded drawstring pouch, a shirt clip, and three pairs of silicone eartips. From the use of quality materials to the accessories, RHA has made the MA390 Universal look and feel like a product that costs at least twice as much.

PERFORMANCE

On tracks with intense sub-bass content, like The Knife’s “Silent Shout,” the earphones deliver a powerful low frequency response that will appeal to bass lovers. At top, unwise listening levels, the bass never distorts on this challenging track—an impressive feat for \$30 earphones. At more reasonable listening levels, the sub-bass still packs quite a punch and is balanced out by a solid high-mid and high frequency presence.

Bill Callahan’s “Drover,” a track with far less deep bass in the mix, gives us a better sense of the overall sound signature. The drums on this track can sound overly thunderous on bass-forward in-ears that push the lows too much, but here we get a round, full, rich bass response that isn’t over the top. The high frequency response is also clear, crisp, and detailed—Callahan’s vocals and the attack of the guitar strums stand out and balance things so that the lows don’t overpower the mix. This is undeniably a scooped, sculpted sound, with strong lows and highs, and less low-midrange presence. But for \$30, it’s impressive.



**RHA has
made the
MA390
Universal
look and feel
like a product
that costs at
least twice as
much.**



On Jay-Z and Kanye West's "No Church in the Wild," the kick drum loop gets an ideal amount of high-mid presence, allowing its attack to retain its sharp edge and slice through the layers of the mix. The sub-bass synth hits that punctuate the beat are delivered with gusto. We also hear plenty of the vinyl crackle that is usually relegated to background status—this tells us the high-mids and highs are sculpted and boosted quite a bit, yet the vocals somehow avoid sounding overly sibilant despite some added brightness.

Orchestral tracks, like the opening scene in John Adams' "The Gospel According to the Other Mary," sound excellent through the MA390 Universal. The lower register instrumentation has a full-bodied, rich presence in the mix without sounding overly boosted or unnatural, and the higher register brass, strings, and vocals retain their prominent place in the mix, with excellent high frequency detail and clarity.

CONCLUSIONS

We've tested other standout pairs in this price range over the years, including the JLab Fit 2.0 and the Coloud No. 4. But the RHA MA390 Universal earphones sound good for \$30—and they easily outmatch pairs we've tested that cost twice as much. Audiophiles have very few choices in the budget-friendly realm, and I won't pretend that you're getting high-fidelity, critical-listening audio performance here, but there's lovely bass depth and detailed highs.

If you can spend a little more money, the Klipsch Reference X6i and the 1More Triple-Driver In-Ear Headphones offer excellent audio performance that's an upgrade over the MA390. But if you're wondering which pair of \$30 wired in-ears you should get, and your top priority is audio performance, your search should begin and end with the handsomely designed RHA MA390 Universal.

TIM GIDEON



Beyerdynamic
MMX 300
2nd Generation

\$349.00



Beyerdynamic MMX 300: Superlative Gaming Headphones



Most wired gaming headsets hover in the \$50 to \$150 range, and we've seen very few wireless models break the \$200 mark. The Beyerdynamic MMX 300 is \$349, which makes it more than double the price of the excellent Turtle Beach Elite Pro Tournament Headset and even pricier than the wireless Astro Gaming A50. That's because Beyerdynamic is a high-end headphone company, not a gaming accessory manufacturer, and its pedigree among audiophiles is strong.

The MMX 300 is simply the best-sounding gaming headset we've tested to date, offering an impeccable listening experience with fantastic stereo imaging and a sense of space we haven't heard elsewhere in this category. It's our Editors' Choice, but whether it's the right headset for you depends on whether you can justify the price.

DESIGN

The MMX 300 doesn't look like a gaming headset. It looks like a high-end pair of headphones with a boom mic attached. It's completely black, with large, round plastic earcups mounted on anodized metal arms connected to the headband. The arms let the earcups tilt up and down and pivot slightly left and right for a comfortable fit, but they don't fold inward for storage. The headband is generously padded and covered in leather, and you can remove the padding thanks to hook and loop fasteners that keep it in place. The earpads are also large and plush, and covered in felt. The result is a comfortable, solid fit that you can wear for long periods.

The left earcup holds the boom microphone, a foam-covered capsule on a flexible metal arm. The arm is mounted on the back of the earcup on a plastic disk that can rotate nearly 360 degrees and has firm click stops to set the arm position securely.

Beyerdynamic MMX 300 2nd Generation

PROS Fantastic sound with excellent range, balance, and stereo separation. Solid design with comfortable fit. Two cables, both with inline remotes.

CONS Expensive.





A recessed 3.5mm port on the bottom of the left earcup connects to either of the two included audio cables. This port can be a bit finicky, because the plugs on the two cables are meant to be clicked in securely, deep in the well holding the port. The plugs are surrounded by soft rubber, so the firm pressure needed to click them in feels a bit unnatural. If you don't push the plug in deep enough, you'll still get audio through the earcups, but the microphone won't work; this is an easy fix, but you need to be aware of the issue.

ACCESSORIES AND COMPONENTS

The MMX 300 comes with a shorter cable for connecting the headset to a mobile device or game console (through the headset port on the controller) and a longer cable for connecting to a PC or any other device. The shorter cable is 3.9 feet long and terminates in a four-pole 3.5mm plug. An inline remote sits about a foot down from the earcup and features a volume wheel and microphone mute switch. The longer cable is 8.2 feet long and terminates in two three-pole 3.5mm plugs. It has its own in-line remote, which provides the same function as the shorter cable's remote but works with the separate headphone and microphone connections. This is the first time we've seen an inline remote offered on the longer PC cable. Both cables are thick and sturdy.

Besides the two cables, Beyerdynamic includes a hard-shell zip-up case and a 0.25-inch headphone adapter.

The headset combines hardware and design elements from Beyerdynamic's excellent DT 770 Studio headphones for sound quality, studio microphones for the boom mic, and Aviation headsets for noise isolation. The DT 770 Studio is much less expensive than the MMX 300 at \$180, but the company's gooseneck capsule microphones (like the Classis GM 105) easily retail for at least \$170, and Aviation headsets (like the HS 800) often cost upward of \$800. It's clear that the frame, padding, and microphone account for a big part of the MX 300's price tag.

MUSIC PERFORMANCE

The MMX 300 is very capable at handling music, as you might expect from any headset based on the fantastic DT 770 Studio. It plays The Knife's "Silent Shout," our bass test track, at maximum volume without a hint of distortion.

The synth drumbeat in Erasure's "Chains of Love" sounds powerful and thumpy without overshadowing the lilting vocals or keyboard licks. It's a full, clean sound that lets the dense mix come through without missing any details, a distinct rarity in often bass-heavy gaming headsets.

White Zombie's "More Human Than Human" also demonstrates impressive amounts of power and clarity, with snares popping out with distinct sharpness even over the thunderous bass drums. While Rob Zombie is no Andy Bell, his vocals are also prominent and easy to pick up over the grungy metal sound. On all of these tracks, the MX 300 offers a sense of space and depth that other gaming headsets, even the excellent Turtle Beach Elite Pro Tournament Headset, can't touch.



GAME AND VOICE PERFORMANCE

Star Wars: Battlefront II sounds excellent on the MMX 300. The soundtrack is full and sweeping, and dialogue is clear regardless of how frantic the action is. The different blaster weapons sound distinct, and environmental sounds like forest creatures and crashing spaceships are clean and detailed. While the headset doesn't have any simulated surround tricks, its stereo imaging provides a fantastic sense of horizontal direction.

Forza Motorsport 7 sounds just as impressive. The high-pitched rev of compact car engines comes through clearly against the sound of screeching tires and rain on windshields. The rumble of cars driving over rough terrain sounds deep and imposing, reaching well into the low frequencies to give a good sense of power and friction.

The boom microphone is similarly excellent. Test voice clips came through clear and clean, without any sibilance or fuzziness. It's a high-end mic on a high-end headset, and will serve you well for both team voice chat and podcasts.

CONCLUSIONS

The Beyerdynamic MMX 300 is one of the most impressive-sounding gaming headsets we've ever tested, beating out the Turtle Beach Elite Pro Tournament Headset in build and audio quality. It also eclipses Turtle Beach in terms of price, at a hefty \$350. The headset's aviation and studio pedigree help to justify it, but ultimately this is a luxury headset for users who are both hardcore gamers and dedicated audiophiles. It's a fantastic choice if you don't mind shelling out for it, and our Editors' Choice. If you want a good gaming audio experience but don't want to pay quite as much for it, the Astro Gaming A10 is an excellent wired headset available for a fraction of the price of the MMX 300.

WILL GREENWALD



Dell AIO Has Great 4K display, Speedy AMD Ryzen Processor

Few all-in-one PCs rival the impeccable style of the Apple iMac, but the Dell Inspiron 27 7000 All-in-One comes close. Its star attraction is a 27-inch InfinityEdge 4K display, with bezels that are so thin that the pixels seem to extend off the edge of the computer and go on forever, as the name suggests. Beneath the hood is one of Dell's first high-end consumer PCs with AMD's new Ryzen processors and Radeon graphics cards. Their performance is comparable to their Intel counterparts in the 27-inch iMac. That along with a gorgeous display make the Dell an excellent—even superior—alternative to the iMac, although it's not quite as impressive as the XPS 27, our Editors' Choice for high-end all-in-ones.

Dell Inspiron 27 7000 All-in-One

Starts at \$999,
\$1,799 as tested



A VERY ATTRACTIVE ALL-IN-ONE

Dell has been making good looking all-in-ones for several years, and it upped its game with the XPS 27 and its workstation equivalent, the Precision 5720. These machines each have an array of 10 speakers and glossy 4K touch-enabled displays that make them stand out among their handful of high-end all-in-one competitors, from the Microsoft Surface Studio to the 27-inch Apple iMac. The Inspiron 27 7000's appearance is comparatively staid, though.

The 4K (3,840-by-2,160) display on our review unit has enough pixels to comfortably accommodate two app windows with room to spare, but it's not a touch panel, nor does it have a glossy finish to make blacks deeper and colors more vivid. The silver lining is that the matte finish significantly reduces glare from ambient light in the room, and thanks to the wide viewing angles afforded by in-plane switching (IPS) technology, the Inspiron 27 7000 makes a great kitchen computer. Its 350 nits of brightness are plenty for a matte screen; turned up to 100 percent, it appears similar (in a casual comparison via naked eye) to the glossy screen of the 15-inch MacBook Pro, which has 500 nits of brightness.

Dell Inspiron 27 7000 All-in-One

PROS Speedy AMD Ryzen CPU. Gorgeous 27-inch InfinityEdge display. Loud stereo speakers.

CONS No touch screen option. Enormous power brick.



The Inspiron 27 7000 has two very large caveats to its suitability as a kitchen computer, however. It's pricey for a machine that will mostly display the family calendar and occasionally serve as a Skype platform, and the power needs of the Radeon RX 580 graphics card necessitate a 330-watt AC adapter. The adapter is truly enormous—it's what you might expect from a gaming laptop with a top-of-the-line Nvidia GeForce GTX 1080 GPU, for instance. You'll need to find a place to hide it, since you certainly won't want it taking up counter space in a public area of your house.

The power-thirstiness of the RX 580 is one of its main drawbacks compared with the equivalent card from Nvidia, the GTX 1060. Fulfilling those requirements is necessary if you plan to use the Inspiron 27 7000 for gaming, but if you don't, and space is scarce where you plan to install it, you can configure the PC with a less-powerful and less-power-hungry RX 560, which comes with a more manageable 180-watt AC adapter. (The RX 580 alone requires up to 185 watts of power).

The reason that AC adapters are needed at all is because the Inspiron 27 7000 itself has no internal power supply, making it extraordinarily thin and light for a 27-inch all-in-one PC. It measures just 15.5 by 24.2 by 2.1 inches (HWD) and weighs 22 pounds. The 27-inch iMac, in comparison, is 5 inches taller and more than an inch wider, although it weighs about the same (21 pounds). Both are mere feathers compared with the 37-pound XPS 27, which is weighed down by both an internal power supply and its generous speaker complement. Speaking of which, the stereo speakers and 5W subwoofer on the Inspiron 27 7000 deliver remarkable power at full volume—enough to fill the entire first floor of an average-sized house, although they can't compare with the exquisite highs and earth-shattering bass of the XPS 27's 10 speakers.



Its star attraction is a 27-inch 4K display, with bezels so thin that the pixels seem to extend off the edge of the computer.



Since the Inspiron 27 7000 has no touch screen, it comes with a fixed-height base that allows only tilt adjustments—you can't raise or lower the PC, nor can you orient it completely horizontally. The unsophisticated stand is less of a drawback than it is a reflection of the fact that the Inspiron 27 7000 is not touch-enabled, another downside compared with the XPS 27. That means you'll be interacting with Windows 10 using a plain old keyboard and mouse. That said, the wireless models with our review unit are stylish and comfortable—I particularly admire the mouse's boomerang design.

Like most high-end PCs released in 2017, the Inspiron 27 7000's webcam has built-in IR sensors that let you use it to log in to Windows via face recognition. It's an especially useful feature for a family PC that's likely to have multiple user accounts, and the process worked well on my review unit despite the awkward placement of the camera below—instead of above—the screen. That's because the thin bezels of the InfinityEdge display leave no room for a traditionally placed camera, so be prepared to crouch down slightly when you're Skyping with your relatives. At least the camera's centered; Dell laptops with InfinityEdge displays, like the XPS 13l, have webcams in the lower left-hand corner, which means they mainly get a view of your left knuckles.



The Inspiron 27 7000's webcam has built-in IR sensors that let you use it to log in to Windows via face recognition.



CONFIGURATION OPTIONS

Since this is a Dell, it has a wide range of component options. Memory starts at 8GB and tops out at 32GB. Hard drive options include 1TB spinning drives (at either 5,400RPM or 7,200RPM) or dual configurations with either 128GB or 256GB of solid-state storage along with the 1TB spinning drive. Our review unit is handsomely equipped with 16GB of memory and the 256GB dual-drive configuration. It's definitely worth springing for this storage configuration if you want to future-proof your PC, since it's the only one that includes the faster NVMe SSD interface, resulting in noticeably faster app loading and system startup times. You don't have to worry about future-proofing this system as much as you would with a comparable iMac, however, since the back cover is removable, allowing you to access the drives and memory. The iMac can't be opened—you've got to stick with the components it came with.

The input/output ports are located in three spots on the Inspiron 27 7000. At the easily accessible lower left edge, you'll find an SD card reader, a USB 3.1 port, and a headphone jack. Around back, but equally accessible, are HDMI input and output connectors, in case you want to connect a laptop to the gorgeous display, as well as three more USB 3.1 ports, a USB 3.1 Type C port, and two USB 2.0 ports, one of which will be occupied by the dongle for the wireless keyboard and mouse. Tucked away in a hard-to-reach spot behind the stand are an audio out port, a gigabit Ethernet connector, and the power port. These cables are designed to pass through a hole cut into the stand, since you won't be plugging them in or unplugging them frequently.

You probably won't be plugging in an Ethernet cord at all, actually, thanks to dual-band 802.11ac Wi-Fi and Bluetooth 4.1. The system also comes with a basic one-year warranty, and Dell offers several tiers of optional premium support plans.

RYZEN INSIDE

Because the Inspiron 27 7000 is powered by an AMD Ryzen 7 1700 processor, its performance is told in two very different parts. First is how the system measures up on our theoretical benchmark tests. The Ryzen series of processors are new this year, intended to get AMD back into the mainstream processor market, perhaps on an equal footing with Intel, which has been the provider of choice for consumer PCs for the better part of the last decade. The Ryzen CPU in the Inspiron 27 7000 has eight cores and runs at 3GHz—impressive,

especially when you compare it with its chief competition, the four-core Intel Core i7-7700K. All those cores result in markedly fast performance when it comes to specialized tasks such as video transcoding and 3D rendering.

The Inspiron 27 7000 finished our Handbrake video-transcoding test in just 40 seconds, lightning-quick compared with similar machines. The same is true of the Cinebench 3D rendering simulation, on which the Inspiron 27 7000 scored 1,396, nearly twice the score of the next-highest HP Envy (714). But the general-purpose PCMark 8 test, which measures web browsing, word processing, and other common tasks, tells a different tale. The Inspiron 27 7000 scored lower on this test (2,948) than both the Dell Optiplex 7450 All-in-One (3,059, with a Core i5) and the HP Envy (3,415, with a Core i7). In other words, the Ryzen is great for multimedia content creators but merely average when it comes to everyday performance.

The second part of the Inspiron 27 7000's performance story is how it performs in real-world conditions. Over the course of a full workday, with a dozen or more browser tabs open, frequently streaming videos or music while typing in Google Docs or Microsoft Office at the same time, I never once noticed the system to freeze or hesitate. Of course, you should expect this kind of flawless performance on common tasks from a \$1,800 computer. The upshot is that the Ryzen processor gives the Inspiron 27 7000 a clear advantage when it comes to multimedia content creation, but most consumers who buy this system won't notice a difference in performance when they compare it with the iMac, the HP Envy, or the XPS 27.



In back are HDMI input and output connectors in case you want to connect a laptop to the gorgeous display, as well as three more USB 3.1 ports, a USB 3.1 Type C port, and two USB 2.0 ports.



The Radeon RX 580 graphics card makes it a great choice for casual gamers not interested in an ostentatious gaming rig.



Since this is not a gaming PC, I'll simply say that the Radeon RX 580 graphics card makes it a great choice for casual gamers who aren't interested in an ostentatious gaming rig. It aced all of our gaming benchmarks, posting frame rates around 60 frames per second on our Heaven and Valley game simulations at maximum quality and full HD (1080p resolution). That's markedly better than the results posted by its competition, which have lesser Radeon cards. One caveat: Frame rates around 15fps at 4K resolution indicate that it's not great for 4K gaming—you'll need an Nvidia GTX 1080 or Radeon RX Vega 64 for that.

AN EXCELLENT AIO

The Dell Inspiron 27 7000 is not as flashy or as feature-rich as its big brother, the XPS 27, but it offers a compelling set of features at a much lower price. And that price happens to be the same one at which Apple is offering the 27-inch iMac. As a general-purpose PC, the Inspiron meets or exceeds the iMac's computing performance, and it is much better at gaming as long as you stay away from 4K. If you can make use of the Ryzen processor's multimedia editing chops, the Inspiron 27 7000 is a clear winner over the iMac.

TOM BRANT



Acer Chromebook Spin 11: Tough Enough for Kids



Read our reviews of Lenovo ThinkPads and HP EliteBooks, and you'll see boasts of MIL-SPEC 810G compliance—meeting military standards for resisting shock, vibration, extreme temperatures, and other portable PC perils, to reassure buyers concerned about the bumps and bruises of business travel. But who really needs MIL-SPEC 810G hardware? Little kids, who'd as soon drop a chromebook as look at one. The Acer Chromebook Spin 11 carries the certification into the hostile environment of the grade-school classroom. It's a 2-in-1 convertible built to shrug off 132 pounds (a child standing on the lid) or 11 ounces (of water spilled on the keyboard) or 48 inches (the distance it fell from being knocked off a desk), and is our new Editors' Choice for student chromebooks.

Acer
Chromebook
Spin 11

\$399.99



GOOD-LOOKING IN A TOYISH WAY

The Spin 11 is made of white polycarbonate plastic with a rubberized beige bumper around its bottom half, giving it a rugged look clearly meant for kids' clumsy hands. Black keys match the large black bezel around the glossy screen. The touch panel that covers the display is antimicrobial Corning Gorilla Glass, designed to resist not only knocks and scratches but also passing germs from small fingers to classmates and teachers. At 0.82 by 11.7 by 8.1 inches, it's the same size as the Lenovo Flex 11 Chromebook and a fraction smaller than the Dell Chromebook 3189 Education 2-in-1 (0.82 by 12 by 8.2 inches) and falls between them in weight, with a couple of ounces on each side, at 3.09 pounds.



This tough device flips and folds through the four modes familiar to users of Lenovo YOGAs and workalikes like the Asus Chromebook Flip C302CA: regular Laptop mode; an easel-style Stand mode, with the keyboard face down and screen tilted back; Tent mode, with the system propped up like an A-frame for poking at touch apps; and Tablet mode, with the display and keyboard back to back.

Acer Chromebook Spin 11

PROS Rugged enough for school use. Wacom stylus included. Two USB-C and two USB 3.0 ports. Two cameras. Snappy keyboard.

CONS Small, low-res screen. Easy-to-lose stylus. Imperfect Android compatibility.

The Acer is more expensive than the Dell Chromebook 3189 and the Lenovo Flex 11, partly because of its ruggedized construction and partly because it comes with a Wacom stylus for scribbling or sketching on the screen in Tablet mode. The bad news is that it has no hole or niche for storing the stylus, so kids are guaranteed to lose it. The good news is that the batteryless pen works with good precision and palm rejection. You'll see a little lag when you whip the stylus across the screen at top speed, but in normal use, we found it a capable input tool for apps such as Google Keep and Autodesk SketchBook. It even responded with thin and thick lines to gentler and harder pressure in the latter.

Like the Dell and Lenovo chromebooks, the Spin 11 has an 11.6-inch IPS touch screen with 1,366-by-768 resolution (compared with the Asus Flip's 12.5-inch and 1,920-by-1,080). Like many touch screens, the panel is plagued by reflections, so the bezel and dark areas are like looking at a mirror. But the 360-degree hinges let you tilt the display back as far as it takes to minimize the effect. Otherwise, the screen is attractive, with ample brightness and vivid colors. Neither it nor any other display with this resolution offers razor-sharp details, but contrast is excellent, and the screen, like the keyboard deck, is free of flimsy flex.

The 1,280-by-720-pixel webcam above the screen captures averagely sharp and not terribly bright images. A second camera centered above the keyboard takes pretty good 2,592-by-1,944-pixel snapshots in Tablet mode, using the screen as a viewfinder, though it's awkward to hold the Spin in one hand while tapping the shutter button with the other. Bottom-mounted speakers produce decent sound—distorted when volume is cranked to the max, but rich and realistic, albeit short on booming bass, at sane volume levels.



Who really needs MIL-SPEC 810G hardware? Little kids, who'd as soon drop a chromebook as look at one.



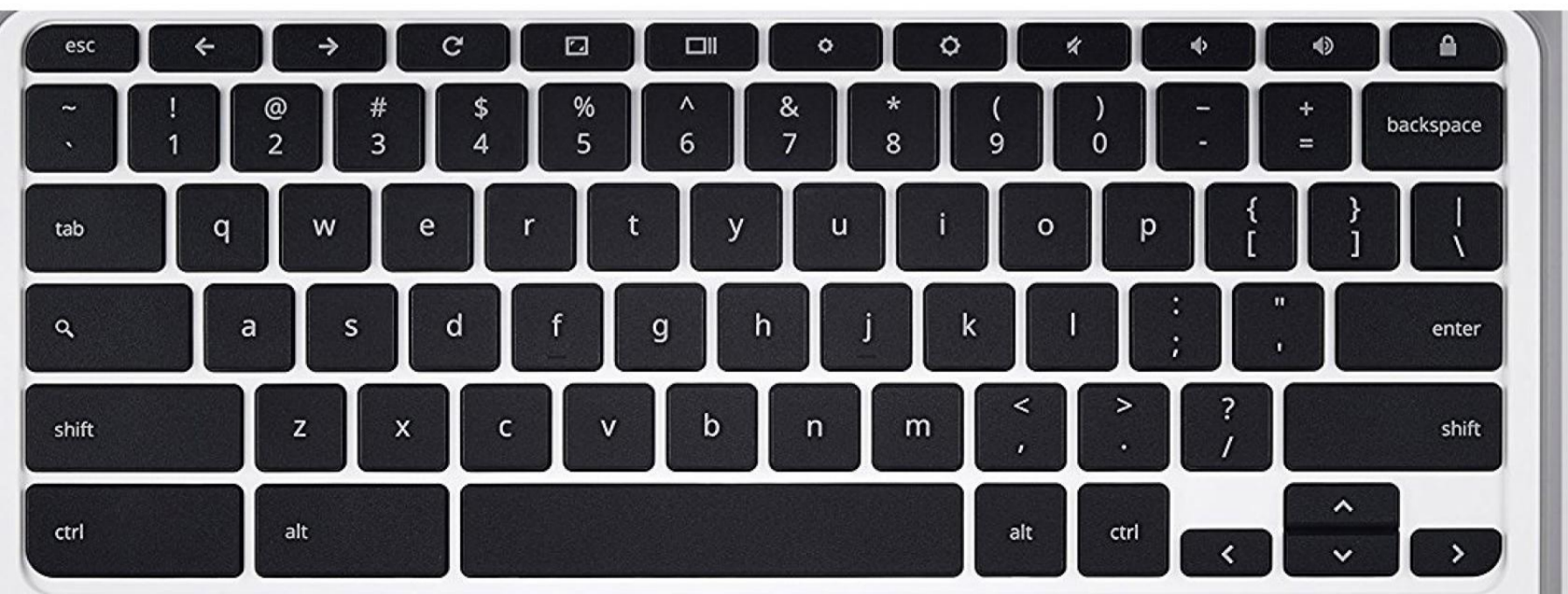
The flush-fitting power button is on the laptop's left side, along with a USB 3.0 port, a USB-C port, an audio jack, and a microSD card slot. On the right is another USB 3.0 port, another USB-C port, a cable lock slot, and a volume rocker for use in Tablet mode. The supplied AC adapter plugs into either of the USB-C ports. Like other chromebooks, the Acer offers 100GB of free Google Drive cloud storage for two years (\$1.99 per month thereafter). A one-year warranty is also included.

The full-size island-style keyboard has shallow travel but a firm, responsive typing feel; we were cruising at close to our maximum speed within minutes, although we can never remember the Chrome OS keystrokes for Page Up/Page Down (Alt+Up/Down) or Home/End (Ctrl+Alt+Up/Down). The keyboard is not backlit. The touchpad has a silky-smooth feel for swipes, taps, and scrolling.

IT TAKES A LICKING

The Chromebook Spin 11 is powered by an Intel Celeron N3350, a 1.1GHz dual-core processor backed here by 4GB of memory and 32GB of eMMC flash storage. It gives the convertible good if not record-setting performance—we opened 10 browser tabs, including a 720p YouTube video and three Android apps, without experiencing noticeable lag.

Speaking of which, the Spin 11, like other current chromebooks, includes beta-test access to the Google Play Store's legions of touch-screen-friendly Android apps in addition to the Chrome Web Store's lineup of mostly browser-based, non-touch apps. Some work flawlessly. Some that didn't work just a couple of weeks before this writing seem cured, thanks to the platform's steady flow of upgrades. And some are still hit-or-miss (Netflix stops when asked to restart a movie), so we still rate Android support as a sometime bonus rather than a key factor when reviewing chromebooks.



A more significant bonus is the Spin 11's battery life: Though it doesn't run our Windows-based performance benchmarks, the system lasted for 12 hours and 48 minutes in our video rundown test (playing a locally stored copy of *The Lord of the Rings* trilogy with screen brightness at 50 percent and volume at 100 percent). A full workday plus an evening of Android games or YouTube viewing will be no problem.

Finally, though we weigh too much to stand on it, we dropped the Acer (both open and closed) from desk height half a dozen times. It ignored the abuse and kept going, so we splashed a glass of water on the keyboard, then (except for wet fingers) continued typing this paragraph as if nothing had happened. We can quibble that kids are more likely to spill juice or soda than plain water, but we can't deny the 2-in-1's toughness.

A PRIME RUGGED ALTERNATIVE

For \$100 more, the Asus Flip C302CA offers a larger, full HD display and faster performance. But the Acer Spin 11 is a first-class alternative for students or anyone seeking a rugged Chrome OS convertible. And as a bonus, it comes packed with all-day battery life. It's our new Editors' Choice for student chromebooks.

ERIC GREVSTAD



Though we weigh too much to stand on it, we dropped the Acer from desk height half a dozen times.





Five Top DNA Testing Kits

Personal DNA testing is more popular than ever before, now that you can do it easily in the comfort of your home at an affordable cost. Even better, you're more likely to get results: In August 2017, AncestryDNA (the genetics-focused arm of Ancestry) surpassed 5 million people in its DNA database, and in April, 23andMe topped 2 million. These large databases mean more opportunities to get matched with distant cousins or to find long-lost or previously unknown relatives.

We looked at five services to evaluate their simplicity, relative-matching features, and the best overall DNA-testing experience. In addition to AncestryDNA and 23andMe, we also explored HomeDNA, MyHeritage DNA, and National Geographic Genographic Project.

HOW DNA KITS WORK

Each of the kits work similarly: You answer a few questions about yourself, order the kit, collect your sample, register the kit (this is very important), send it back, and wait for the results. That said, they differ in the collection process and, to a smaller extent, the cost of shipping.

When we tested 23andMe back in mid-2015, the company was unable to accept DNA samples collected in or sent from New York State, because of local laws (we had to cross the border to New Jersey). The company was also prohibited from shipping DNA kits to Maryland. The shipping issues resulted partly because when the company first launched, it tested for a litany of health issues and genetic markers for disease, raising concerns from the FDA and other agencies. 23andMe stepped back and has been working more closely with governmental agencies as it rolls out more features.

Those restrictive laws are no longer on the books, but as DNA testing companies add more features, including tests related to medical conditions, more laws could surface. Be sure to check a site's terms of service to see whether there are any restrictions in your locality before signing up.

SWAB, SCRAPE, SPIT, AND SEND

HomeDNA has the simplest DNA extraction process; just swipe each cheek twice with a cotton swab, and place the swabs in the included envelope. The National Geographic Genographic Project sent a scraper that you use on each cheek for 45 seconds and then place in a vial with stabilizing liquid; MyHeritage DNA has a similar process. 23andMe and AncestryDNA require that you spit into a tube up to the fill line (harder than it sounds), and ship it back with stabilization liquid. Most of the services said not to eat, drink, or smoke for 30 minutes to an hour prior to testing to get the best possible sample.



The most important part of the DNA-testing process is registering your kit before shipping it. All five services require this, and if you don't do it, you won't be able to access your results. This requirement is to protect your privacy—your name won't appear on the kit or the results—and to easily track your kit as it goes through the process. Of course, when you sign up for an account with these services, your identity is associated with it, but the sample and any reports stored on the service's end have just a unique barcode.

Some services include shipping costs in the cost of the kit; AncestryDNA's \$99 fee includes two-way shipping. National Geographic's Genographic Project ships the kits for free, but you have to purchase postage when you send your kit to their lab. 23andMe tacks on a two-way shipping fee of \$9.95 for the first kit and \$5 for each additional one. HomeDNA includes a prepaid envelope to return your sample and offers three shipping options: \$7 for two-day shipping, \$14 for overnight, and free shipping that takes 7 to 12 business days. Finally, MyHeritage charges \$12 for shipping; if you order two kits, you pay \$6, and if you order three or more, you get free shipping.

Once you've shipped your sample, it's waiting time. All of the services we reviewed confirmed receipt of the sample via email, and most estimated the results would take anywhere from three to eight weeks to process.

DNA RESULTS AND FAMILY TREE FEATURES

Next, you'll receive an email alert that your results are ready, and that's when the fun begins. Your results may not be as dramatic as those portrayed in TV ads, but you may find some surprises.



**HomeDNA has
the simplest
DNA
extraction
process; just
swipe each
cheek twice
with a cotton
swab.**



One important note: Results are different for women and men. Women, who have the XX chromosome, can trace back only their maternal line. Men, having the XY chromosome, can track both their maternal and paternal lines, painting a complete picture. Women with brothers could ask them to take a test and share the results.

AncestryDNA, 23andMe, HomeDNA, and MyHeritage DNA all provide reports of your ethnicity, some showing maps of where your ancestors lived along with information about the particular countries and regions. National Geographic goes further back, pinpointing where in Africa your ancestors came from and tracing migration patterns through to near-present times. Its results are less about your personal genetic makeup and more about who your ancestors were and how you're connected to the beginning of civilization.

On all platforms except National Geographic, you can initiate a search for relatives, though some services let you upload your National Geographic results for further analysis. The software continues to search for DNA matches as more people share their results. This feature may be useful for those who are building a family tree or looking for relatives they've never met; if not, it may be more of a nuisance. You can opt in or out at any time, and the DNA service doesn't share your contact information. Relatives can message you through the software, though. If you already use genealogy software, you may be able to download your results and upload them into your preferred program. Otherwise, AncestryDNA and others featured here have family tree software that you can easily link.



As mentioned, 23andMe started out by testing for genetic markers of diseases and medical conditions before rolling that back in response to the governmental concerns. It has since started slowly adding more health-related features with approval from the FDA. In April, 23andMe got approval to offer risk analysis for ten genetically linked diseases. The company now offers two options: Health + Ancestry (\$199) and Ancestry (\$99). The Health + Ancestry plan includes testing for genetic health risks and carrier status, as well as reports on your genetic weight, hair loss, and other traits.

If you're the family-tree manager for the family and want to track DNA results for other family members, you can do so. In some cases, you may have to create a separate account for each kit that you're managing. You can also share your results as well with other members and connect family trees.

Again, be sure to read through the terms of service and any other agreements before proceeding. Don't agree to anything that makes you feel uncomfortable.

HOW WE TEST DNA SERVICES

We evaluated each kit by ordering one, just like any customer would, and tracking how long it took to arrive at the lab and to get processed. Then we compared the breadth and depth of the results to see what rose to the top. The whole process was a lot of fun, in part because of the anticipation of getting the results.

Most of the kits warn that testing your DNA can lead to surprising—even life-changing—results. Of course, there's also a good chance that you won't be surprised at all, but there's satisfaction in knowing for certain where your ancestors lived and how you came to be who you are.

23andMe

\$199.00

EDITORS' CHOICE



PROS: Thorough ancestry reports. Fun and interesting interactive features.

CONS: Health-related DNA testing doesn't provide a guaranteed vision of your future health.

BOTTOM LINE: 23andMe offers a trove of information about both your personal genetics and your deeper ancestry. It also offers tests for genetic health risks, as well as your carrier status for many conditions.



AncestryDNA

\$99.00



PROS: Easy-to-understand results. Free shipping. Numerous online resources.

CONS: Matching feature can be overwhelming.

BOTTOM LINE: AncestryDNA is an easy-to-use tool for exploring your background. If you have an Ancestry family tree, the service can even find relatives among the 5 million DNA profiles it has already collected.

National Geographic Genographic Project

\$199.95



PROS: Tracks your ancestor's migration patterns back 200,000 years. In-depth information. Interactive features.

CONS: Focuses more on your ancestors' genetic makeup than your personal genetics.

BOTTOM LINE: The Genographic Project is less about you, more about your ancient ancestors and their journey across the world. It's anthropologically fascinating, but look elsewhere for more personal genetic data.





HomeDNA

\$199.00



PROS: Simple sample extraction process. Free shipping available. Detailed look at your ancestors' migration patterns.

CONS: Relatively expensive. Lacks supplemental information about researching your past and understanding DNA results.

BOTTOM LINE: HomeDNA can give an extremely close look at where your ancestors lived, but it doesn't offer much else in the way of researching your past or understanding more about your genetics.

MyHeritage DNA

\$99.00



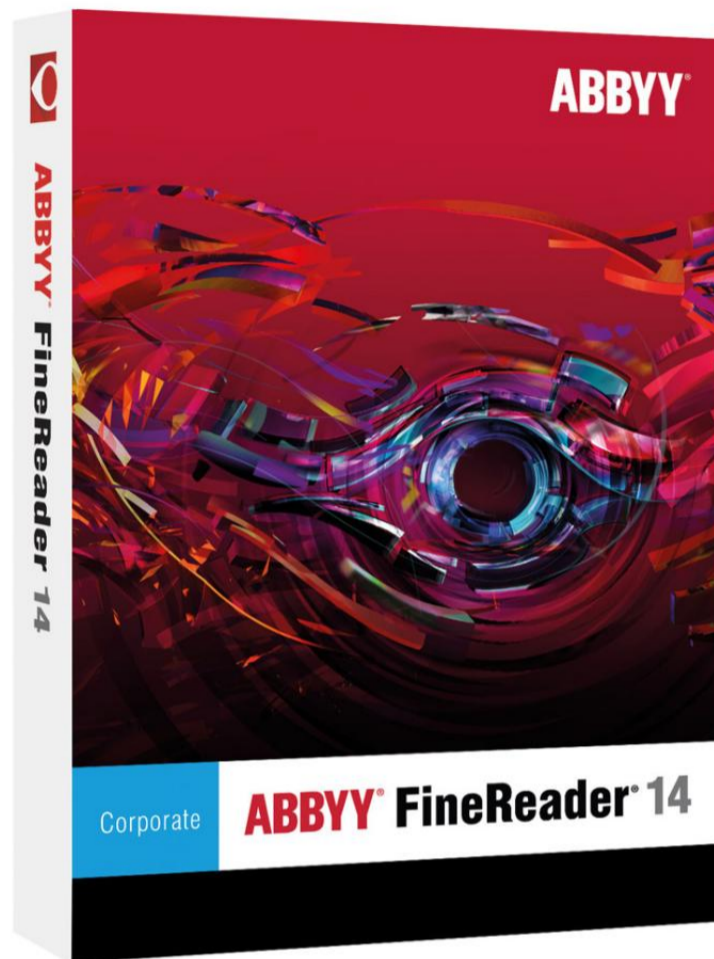
PROS: Easy to understand results. Family tree software and research resources included.

CONS: Collecting sample is tricky. Doesn't give any context to your result.

BOTTOM LINE: MyHeritage DNA offers a basic look at your genetic makeup, but it doesn't include any information to help you interpret the results or learn more about how your ancestors lived.



MOLLY K. MCLAUGHLIN



ABBYY FineReader: Best-in-Class OCR



For years now, our undisputed Editor's Choice for the best-in-class optical character reading software has been FineReader. The revamped latest version, ABBYY FineReader 14, is a top-notch OCR app that adds document-

comparison features that you can't find anywhere else and new PDF-editing features that rival the advanced feature set in Adobe Acrobat DC. FineReader 14 is also the best document-comparison productivity app I've ever seen, with the ability to compare documents in two different formats, so you can compare a Word file to a PDF version of the same file and see which of the two has the latest revisions. It's truly terrific.

**ABBYY
FineReader**

Starts at \$119.99



WHAT YOU'LL PAY

In my writing and editing work, I've relied on ABBYY FineReader for as long as I can remember; one reason I work mostly in Windows and not on a Mac is that ABBYY FineReader Pro for Mac is a lot less powerful than FineReader 14 for Windows. For this review, I tested the FineReader 14 Corporate edition. The Standard version has all the OCR and PDF-editing features of Corporate but lacks the document-compare component and doesn't include the Hot Folder feature that automatically creates PDF files from documents or images saved to the folder.

For most users, the Standard version will be more than enough, but the document-comparison feature alone may be worth the extra price for the Corporate app. The prices, by the way, are perpetual, with no annoying subscription model like Adobe's.

You'll typically use an OCR app to convert scanned images of printed text into either an editable Word document or a searchable PDF file. Now that every smartphone takes high-resolution photos, you don't even need a scanner to create images that you can turn into editable documents or PDFs. However, your OCR software has to be able to work with skewed and otherwise irregular photos in addition to high-quality scans.

FineReader has always excelled at cleaning up imperfect images, but Version 14 seems even more impressive than earlier versions. When I used my phone to take photos of two-page spreads in a book, FineReader effortlessly split the photos into single-page images, unskewed the images so that the text lines were horizontal, and recognized the text with often perfect accuracy.

ABBYY FineReader

PROS Highest-quality OCR on the market. Exceptionally clear interface. Exports to multiple formats. Useful cross-format document-comparison feature.

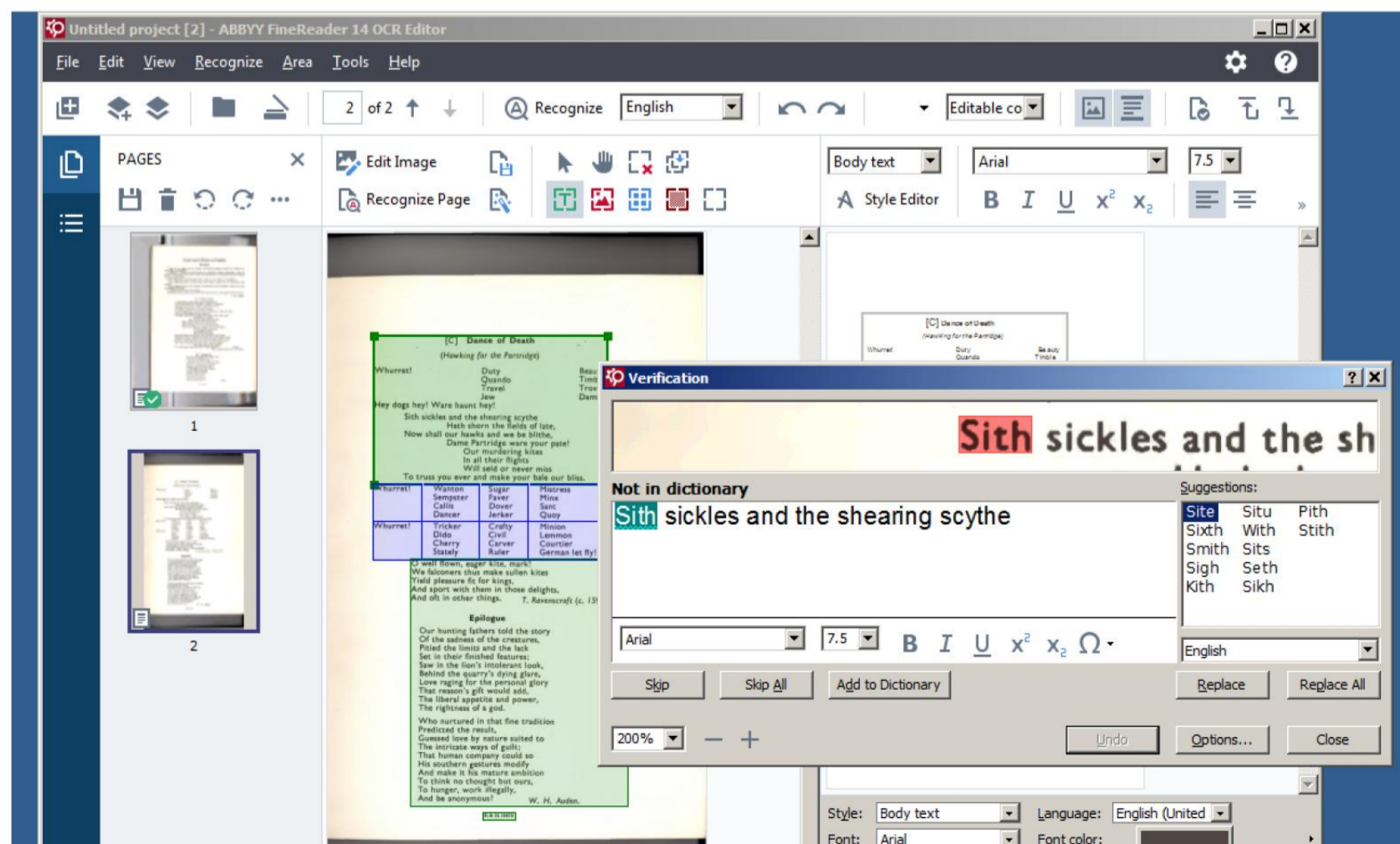
CONS Lacks Acrobat's full-text-indexing feature. Some features only in the more-expensive Corporate edition.

FineReader hides its myriad advanced features behind straightforward beginner-level menus, but the advanced options are easily accessible from a toolbar and menu. When you start up the app, it displays a spacious menu listing a half-dozen tasks: viewing and editing an existing PDF file, performing advanced OCR tasks in a PDF file, and converting standard document formats to PDF, Word, Excel, PowerPoint, or electronic publication formats, such as ePub and DjVu.

Conversion options include the ability to combine multiple files into a single PDF, Word, or Excel file. A second menu lists options to scan to FineReader's OCR Editor or directly to PDF, Word, Excel, or various other image, document, and publishing formats. A third menu opens FineReader's separate compare-documents app. This menu system is more than enough to achieve most standard OCR and file-conversion tasks, and the Windows 10-style interface is among the clearest I've seen.

EDITING MUSCLE

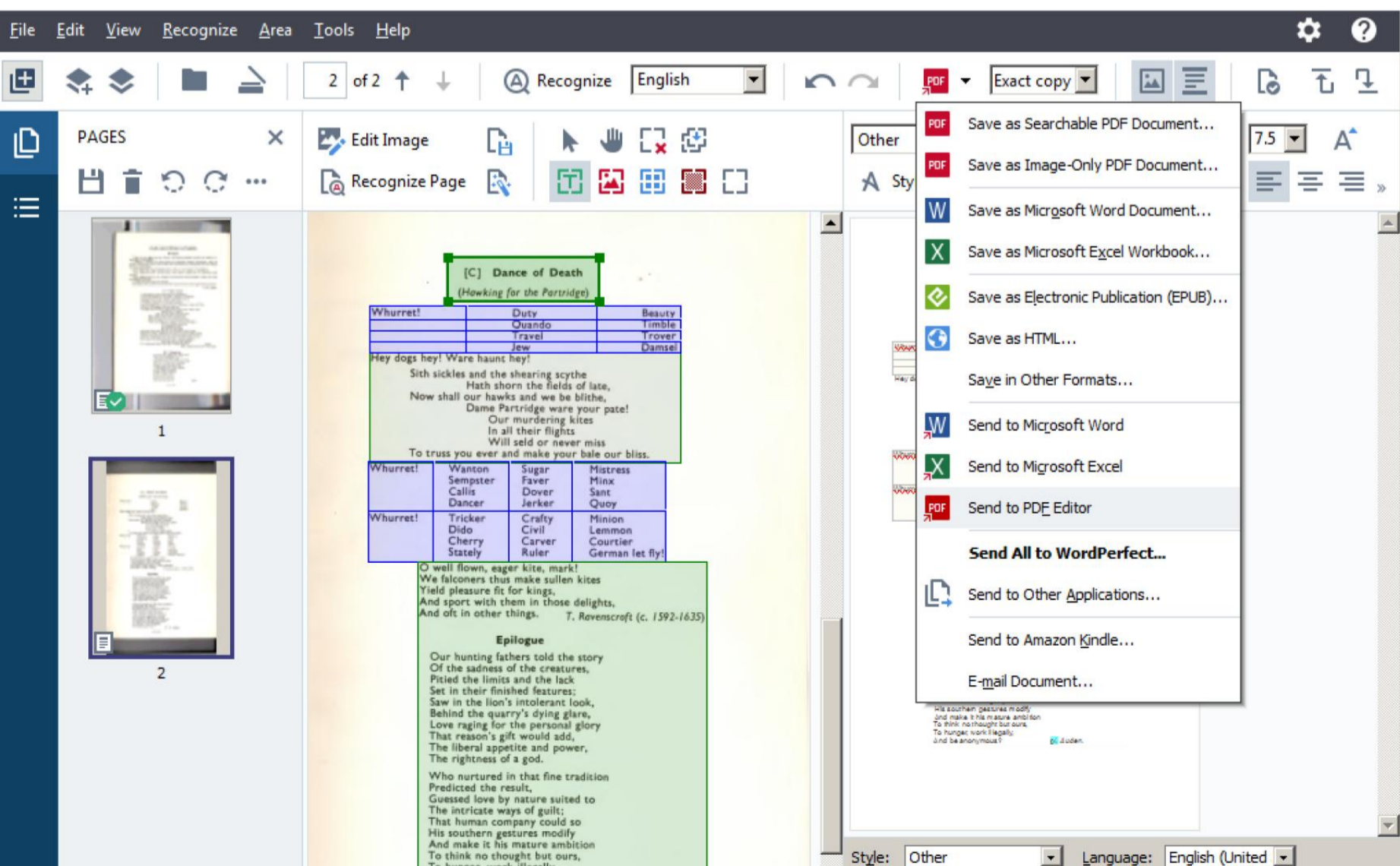
For basic PDF editing, FineReader has a clearer and more modern interface than Adobe Acrobat and makes it easier to perform tasks such as using a developer certificate to sign a document. FineReader's search feature has conveniences that Adobe doesn't match, such as the ability to highlight or underline all instances of a search string. You can also switch on a convenient redaction mode that lets you blank out any text or region in a document simply by selecting a region with a mouse, clicking, and moving on to the next.



On the other hand, FineReader doesn't have Acrobat's full-text indexing feature, which can make searching almost instantaneous in large documents.

FineReader's interface uses the familiar sidebar of thumbnails or bookmarks at the left of a full-size image, but the layout is exceptionally clear, and all icons are labeled. A new background-OCR feature means that you can start editing a PDF before the app has completed its text-recognition operations.

FineReader's unique powers are most evident in its OCR editor, an efficient tool for checking OCR output and correcting recognition errors. Scanned images of old books, crumpled paper, or marked-up pages are almost certain to produce either outright errors or readings where the OCR software can't be certain of the original text and makes a best guess of what was on the page. FineReader's OCR editor works like a high-powered spelling checker in a word processor, quickly trawling through doubtful OCR readings while you confirm or correct each one in turn—and its superb keyboard interface lets you confirm a doubtful reading with one keystroke or correct it with two or three keystrokes, typically selecting the right reading from a list that the program offers. This kind of repetitive work normally strains your hand muscles as you maneuver the mouse, but FineReader's thoughtful design reduces strain to an absolute minimum. One other plus, for many law and government offices that still use WordPerfect for creating documents: FineReader can export OCR output directly to WordPerfect without making you save first in an intermediate format like RTF.



Everything in FineReader seems designed to reduce needless operations. When you install it, FineReader adds a Screenshot Reader app to your taskbar icons. This works like a superpowered version of Windows' built-in Snipping Tool. I use it to capture the text when an on-screen image shows a picture of some text but doesn't let me select the text itself—for example, an image of a page in Google Books or Amazon's Look Inside feature.

I start up the Screenshot Reader app, drag the mouse to frame the text I want to capture, and then wait a second or two while FineReader performs OCR on the image and sends the text to the Clipboard. Options in the app let me select a table or simply capture an image to the Clipboard. They also let me send the output directly to Microsoft Word or some other app instead of to the Clipboard. There's nothing else out there that's remotely as powerful and efficient at capturing text from the screen.

THE BEST OCR

For advanced, high-quality, fine-tuned OCR, FineReader has almost no competition. Adobe Acrobat DC is a PDF-editing powerhouse with strong OCR features built in, but it isn't as accurate as FineReader and doesn't offer anything like FineReader's interactive OCR editor. OmniPage and the enterprise-level OmniPage Professional offer high-powered, automated OCR functions that work well for high-volume operations, but (at least in my limited testing) OmniPage doesn't match FineReader in accuracy or in its OCR-editing interface. The lower-tech ReadIris Pro, bundled with many scanners, doesn't match any of these three in convenience or accuracy.

Acrobat, OmniPage, and FineReader leave all other OCR software in the dust. But FineReader, our Editors' Choice, offers the ultimate in accuracy, convenience, and control.

EDWARD MENDELSON

FEATURES



27 TECH TRENDS THAT WILL CHANGE THE WORLD IN 2018

BY ROB MARVIN

Wondering what's in store for tech in the year to come? We took the crystal-ball question outside of PCMag labs to tech experts in business and research and asked them to opine on the coming evolution of augmented and mixed reality, blockchain, security, and automation and IoT. Our major takeaways: Life will move even faster and become even more interesting in 2018.

AUGMENTED REALITY AND MIXED REALITY



Augmented reality is changing the way we work and play. This year, we've seen an explosion in new AR headsets—even Google Glass made a comeback in the business world—while Microsoft's Windows Mixed Reality ecosystem churned out partner headsets that blend AR and virtual reality (VR) in immersive experiences. At the same time, smartphone-based AR has evolved, thanks to Apple and Google going all in on the technology.

THE SMARTPHONE AR ERA IS HERE

Thanks to the iPhone X and the emergence of more accessible AR development tools such as Apple's ARKit and Google's ARCore, smartphone-based AR experiences are poised to evolve beyond fads like Pokemon Go and become everyday reality for mobile users.

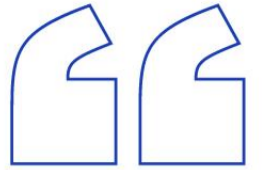
“Over a billion smartphone users will likely create AR content at least once in 2018, with at least 300 million doing so monthly, and tens of millions weekly.”

—*Deloitte’s 2018 Technology, Media, and Telecommunications Predictions Report*

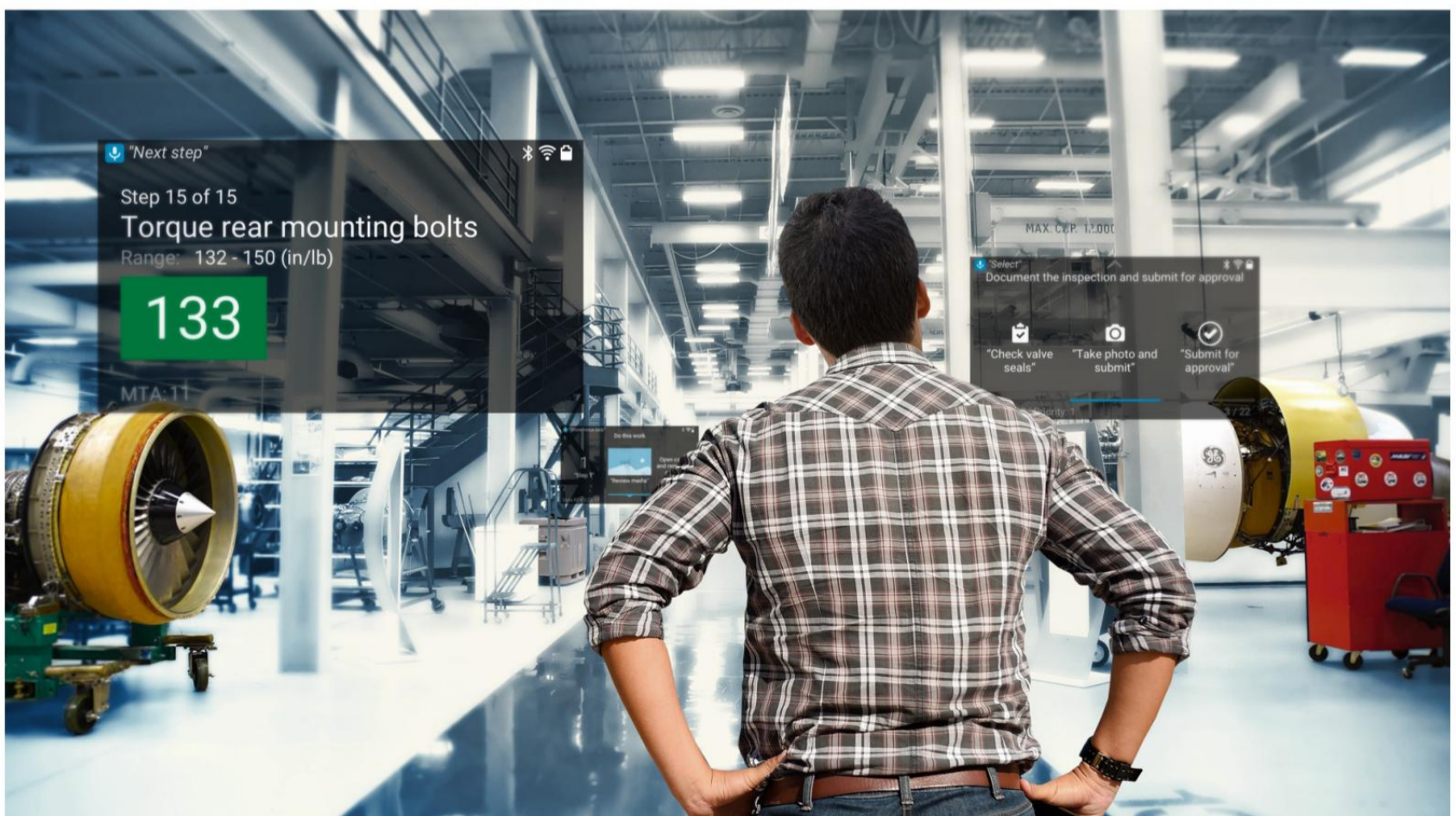
AR WILL REPLACE MANUALS, TIE INTO IOT

“The value of AR will grow exponentially as the IoT [Internet of Things] proliferates. As IoT data continues to grow... so too does the power of AR, as it allows us to leverage and interpret that information. AR serves as the bridge between the physical and digital worlds, opening up our ability to take advantage of the torrent of information and insights produced by billions of smart, connected products worldwide... AR will [also] continue to supplement or replace traditional manuals, brochures, and training documents at an ever-faster pace. By implementing AR technology, companies will see a dramatic positive impact on the productivity and quality of procedures, especially in manufacturing.”

—*PTC CEO Jim Heppelmann*

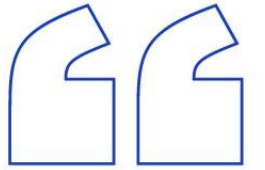


With AR technology, companies will see a dramatic positive impact on the productivity and quality of procedures.



A NEW AGE OF PRODUCT DESIGN

“As teams become more globally distributed, it can sometimes be difficult to get everyone involved to review a product design in a timely manner, collect all the information needed for the review, and capture feedback for future action. Using augmented reality, team members are able to visualize, interact with, and provide feedback on product designs from anywhere in the world. AR makes it possible for stakeholders to interact with a 3D model of the product, such as walking around it and viewing different states of the model—including going inside the model itself. AR also enables users to get a third-party perspective from other teammates.”—*Kevin Wrenn, Divisional General Manager, PLM at PTC*



Team members are able to visualize, interact with, and provide feedback on product designs from anywhere in the world.



AR DEVELOPERS WILL BE IN DEMAND

“In 2018 we’ll see increasing demand for developers that know how to build augmented reality and natural language processing (NLP) based experiences. A short supply of these skills will constrain enterprise efforts, and put pressure on full-stack developers, who will find it hard to stretch their talents from end to end.”
—*Jeffrey Hammond, Vice President, Principal Analyst at Forrester Research*

AR WILL CHANGE THE WAY WE COMMUNICATE

“Much in the same way as the Internet evolved from a forum to share technical report to the robust network it is today, AR presents a new way of engaging with people that will change how we communicate. Because it allows for a remote presence, AR will change customer service and the way that companies interact with and serve customers. AR will also change the way we train employees.”—*PTC CEO Jim Heppelmann*

BLOCKCHAIN



The meteoric rise in Bitcoin’s value has thrust the underlying technology beneath cryptocurrencies into the spotlight, but blockchain’s potential extends far beyond bitcoin. Blockchain’s distributed-network and immutable-ledger technology has the potential to fundamentally reengineer how we interact online, impacting everything from digital identity and healthcare data to insurance, mortgages and land titling, and the supply chain. As giants in the financial and tech sector begin introducing new platforms and tools in the maturing space, we’re already seeing blockchain’s potential to impact areas like cybersecurity and even global foodborne outbreaks.

BLOCKCHAIN WILL DISRUPT MODERN COMMERCE

“Some new technologies are so disruptive they force an instant response. Blockchain is one of these. Blockchain is already transforming the global financial industry, and its impact is being felt elsewhere too—from supply chain efficiency and transparency to transactional trust and security. Already, greater than 2,500 new blockchain-related patents have been filed, while the financial impact is predicted to top 176 billion USD by 2025 [according to Gartner]. In just two years, we expect blockchain to have become the disruptive standard in modern commerce, establishing a new transactional paradigm as financial services providers seek to extract as much value as possible from their value chain. You could even argue that blockchain has achieved this status already, and is beginning to influence other industries just as profoundly: healthcare, retail, the public sector, and more.” —*Amit Zavery, Senior Vice President, Cloud Platform and Middleware at Oracle*

GOVERNMENTS JUMP ON THE BANDWAGON

“IBM believes that 2018 will be the year blockchain becomes an accepted and appreciated innovation for government, a year when the global public sector begins to look closely at this technology, and citizens begin to see its effects on the issues that impact them.

Governments are already testing blockchain as a way to replace current voting systems. More ambitiously, it could formalize identity for every human on the planet, regardless of their residency status or whether or not they have a paper birth certificate. Blockchain can enable new models for providing each person their own truly independent digital identity that no other person, company or government can take away.”—*Jerry Cuomo, VP Blockchain Technology and IBM Fellow, IBM*



IBM believes that 2018 will be the year blockchain becomes an accepted and appreciated innovation for government.



GROWING CRYPTO RESILIENCE

“There will be hacks, but overall, blockchain and crypto robustness will grow. These are ‘resilience technologies’ that have an anti-fragility model. The more cryptocurrencies get attached, the stronger they become. China bans ICOs [initial coin offerings] and hints at hurting Bitcoin exchanges, and the value of Bitcoin goes up. The Ethereum DAO gets attacked, and Ethereum takes hundreds of steps to make itself more robust and secure. It’s not Whack-a-Mole, it’s Block-a-Mole!

—*Don Tapscott, author of “Blockchain Revolution”*

CENTRAL BANKS WILL EMBRACE BLOCKCHAIN

“Blockchain-based payment systems using fiat-backed digital currency will allow central banks to interoperate more easily and partner with retail banks to process cross-border payments with immediate settlement finality. Central banks will begin to embrace digital assets as a means of exchanging value on the blockchain securely and in real-time.”—*Jerry Cuomo, VP Blockchain Technology and IBM Fellow, IBM*

A YEAR OF RECKONING

Forrester predicts we'll see a serious pruning of blockchain projects in 2018. The companies and projects that “failed to translate the headlines into reality will write off their investments and give up,” but the ones that survive the purge and move forward will fall into three categories: pure R&D, applications that provide immediate business benefit, and projects with long-term transformational potential.

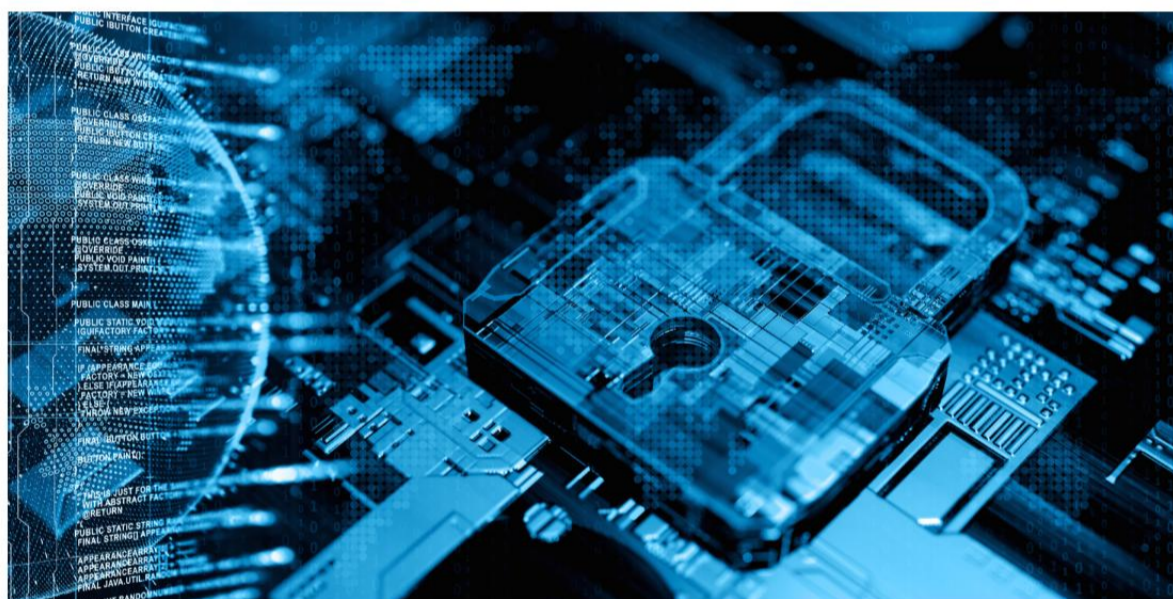
“The visionaries will forge ahead, those hoping for immediate industry and process transformation will give up. This is the answer I usually give when asked for a one-sentence summary of how I see 2018 shaping up in the blockchain technology arena.”—*Martha Bennett, Principal Analyst at Forrester Research*



Central banks will embrace digital assets as a means of exchanging value on the blockchain securely and in real-time.



SECURITY



2017 was a rough year for online security. From the Equifax breach to full-on election hacking by a foreign government, major hacks and breaches touched nearly every industry, institution, and consumer in this country. We spoke to security experts from around the industry and rounded up 10 of the most prevalent security threats and trends you should watch out for in 2018.

THE RISE OF CRYPTOCURRENCY HACKS

“As cryptocurrencies grow in importance, including as a method of extracting revenue from cybercrime, Forcepoint predicts that the systems surrounding such currencies will increasingly come under attack. We expect to see an increasing amount of malware targeting user credentials of cryptocurrency exchanges and that cyber criminals will turn their attention to vulnerabilities in systems relying on blockchain-based technologies.”—*Forcepoint Principal Security Expert Carl Leonard*

EMAIL WILL STILL BE A PRIME TARGET

“According to a recent PSA from the FBI, business email compromise and email compromise is a \$5B industry, yet 80 percent of business IP [intellectual property] is sent via email. Email will continue to be an attractive and lucrative target for cyber criminals while organizations rely on it to communicate sensitive and high-value information and maintain poor digital-hygiene practices, holding communications and records with private information much longer than they are useful. Email is also hard to secure for many reasons, one critical one being the vast opportunity for human error as phishing schemes and social engineering attacks get more sophisticated.”—*Joel Wallenstrom, CEO of Wickr*

DATA AGGREGATORS WILL BE TARGETED

“A data aggregator will be breached in 2018 using a known attack method. The Equifax breach rocked the security industry, and the full impact of this breach has not yet played out. Forcepoint believes that this was the first of what will be many breaches on hosted business applications: those that contain information on a sales force, prospects, and customers, or those that manage global marketing campaigns. Attackers seek the path of least resistance, and if they can find a weak link in a system that already contains the crown jewels of personal data, they will exploit it.”—*Forcepoint Principal Security Expert Carl Leonard*



The Equifax breach rocked the security industry, and the full impact of this breach has not yet played out.





SECURITY AND COMPLIANCE WILL DRIVE CLOUD ADOPTION

“Organizations that have taken a ‘wait and see’ approach to cloud will speed up their adoption rates as they look for help defending against increasingly sophisticated cyberattacks, such as highly-targeted ransomware and phishing campaigns. In addition, as the GDPR goes into effect in May 2018, organizations will recognize that their ability to discover and manage sensitive personal information is made much more possible using cloud services, which will drive a major wave of migrations and investment.”—*Rob Sadowski, Trust and Security Marketing Lead, Google Cloud*

HIGH-END MOBILE MALWARE IS ON THE RISE

“Our assessment is that the total [amount] of mobile malware existing in the wild is likely higher than currently reported, due to shortcomings in telemetry that makes these more difficult to spot and eradicate. We estimate that in 2018, more high-end APT malware for mobile will be discovered, as a result of both an increase in attacks and improvement in security technologies designed to catch them.”—*Kaspersky Lab 2018 Threat Predictions*

DISRUPTION OF THINGS WILL EMERGE

“The wide scale adoption of IoT devices in consumer and business environments, coupled with these devices often being both easy to access and unmonitored, has made them an attractive target for cybercriminals wishing to hold them ransom or obtain a long-term, persistent presence on the network. While ransomware of these connected things is possible, it remains unlikely in 2018. However, a new threat that will emerge is the disruption of things. As the IoT offers access to both disruptive possibilities and massive amounts of critical data, we will see attacks in this area, and may also see the integration of a man-in-the-middle (MITM) attack.”—*Forcepoint Principal Security Expert Carl Leonard*

RANSOMWARE WILL FUEL DIGITAL EXTORTION

“The current success of ransomware campaigns—especially their extortion element—will prompt cybercriminals looking to make generous profits out of targeting populations that will yield the most return possible. Attackers will continue to rely on phishing campaigns where emails with ransomware payload are delivered en masse to ensure a percentage of affected users. They will also go for the bigger buck by targeting a single organization, possibly in an Industrial Internet of Things (IIoT) environment, for a ransomware attack that will disrupt the operations and affect the production line. We already saw this in the fallout from the massive WannaCry and Petya outbreaks, and it won’t be long until it becomes the intended impact of the threat.”—*Trend Micro Paradigm Shifts Report*



SECURITY WILL BE BUILT INTO THE CODE

“Many of the world’s critical systems still aren’t hardened enough—and their surface area is only getting bigger. The steady stream of malware attacks we saw this year will only increase in frequency and as a result, we’ll start to see significantly more financial and development resources allocated for security. Security needs to be built into code development, not added in production. We’ll also see the rise of more financial and development resources allocated for security. Security needs to be built into code development, not added in production. We’ll also see the rise of more intelligent systems, eventually culminating in a series of automatically secured layers.”—*Jason Warner, SVP of Technology at GitHub*



Connected vehicles will generate ever more data about the vehicle, but also about journeys and even personal data.



WATCH OUT FOR CONNECTED CARS

“Connected vehicles will generate and process ever more data about the vehicle, but also about journeys and even personal data on the occupants. This will be of growing appeal to attackers looking to sell the data on the black market or to use it for extortion and blackmail. Car manufacturers are already under pressure from marketing companies eager to get legitimate access to passenger and journey data for real time location-based advertising.—*Kaspersky Lab Automotive Threat Predictions for 2018*

BREACHES WILL ENTER OUR PHYSICAL LIVES

“There is a difference between information and physical security. The breaches that plague organizations today are primarily information security violations. While painful, having credit card information, a social security number, or personal digital information stolen does not result in physical harm to the victim. In 2018, we will see a breach impact our physical, personal lives. It might be a medical device or wearable that is hacked and remotely controlled. Perhaps it will be an industrial IoT device or self-driving car that gets compromised. Or something closer to home, literally. Devices from the garage door to the refrigerator are becoming smarter and more connected. The impact of such an attack will force government, business, and individuals to take a closer look at the security of our infrastructure.”
—*Brendan O’Connor, CTO of ServiceNow*



AUTOMATION AND IOT

Over the past year, everything became more automated, connected, and intelligent. The Internet of Things has swelled to millions upon millions of connected devices in all our consumer and enterprise experiences. We asked experts from Forrester, Google, PTC, Salesforce, and more to predict how connected devices and autonomous systems will evolve in 2018, as companies automate our world, one process at a time.

ROBOTS WILL RESHAPE THE WORKFORCE

“As enterprises become more acclimated with automation, RPA [robotic process automation] will take over low-value repetitive tasks and rote work. In 2018, RPA-based digital workers (that is, bots) will replace or augment 311,000 office and administrative positions and 260,000 sales and related jobs to deliver enhanced customer experiences, according to Forrester. Digital transformation spending will increasingly emphasize automation, and operating models will be reengineered around it.—*Chris Gardner, Senior Analyst at Forrester Research*

POLITICAL BACKLASH TO AUTOMATION

“As people become more and more engaged with customer service automation such as kiosks and robots, there will be hesitation and, in some cases, resentment over change. However, enterprises and political organizations will reexamine change management procedures and reorient PR to navigate these waters. Automation will eventually win out, because its societal and economic benefit will outweigh political resistance.”—*Chris Gardner, Senior Analyst at Forrester Research*

SELECTIVE AUTOMATION

“Large-scale automation right out of the gate is neither smart nor cost-effective. In 2018, service providers will take significant steps to identify repetitive, low-skill IT tasks that could be attractive targets to convert to automated processes. In order to see the greatest ROI with the implementation of automation, businesses will need more precise data around service delivery: exact time to task or project completion, individual employee performance, and service profitability breakdowns, to name a few. Armed with this data, service providers can be selective about what and when to automated, focusing on high-cost tasks that require significant manual oversight from employees.”—*Geeman Yip, CEO and founder of BitTitan*

AN EVOLUTION OF SCALE

“Contrary to popular belief, automation will not mean that we need fewer humans; we’ll just need humans to do different things. In the DevOps industry, our challenge is to build more scalable tools for those people to cope with even bigger levels of complexity and scale. Ten years ago, a typical server-to-sysadmin ratio was measured in the dozens or maybe the low hundreds for a really top notch IT shop. Today, a lot of enterprises that have invested deeply in automation are getting to the point where they can run thousands of servers per human. In 2018, we’ll see more companies go through an evolution of scale and begin to adopt automation tools that can empower them to do that.”
—*Omri Gazitt, Chief Product Officer, Puppet*

IOT-DRIVEN DESIGN

“The market is clamoring for smart, connected products: whether it’s an Amazon Echo, a Nest Thermostat, or a Fitbit. In order to sufficiently meet the expectations of customers, manufacturers need to transform their product development process to understand and leverage data from products in the field. Noting product information on a CAD drawing is no longer going to cut it as products become more complex. Manufacturers will need to become more organized with their product development process. Having a comprehensive PLM [product lifecycle management] system provides a strong foundation to taking full advantage of IoT capabilities by consolidating all product information into a single-view digital product definition.”—*Kevin Wrenn, Divisional General Manager, PLM at PTC*

LOW-CODE ORCHESTRATION

“In 2018, the enterprise will prioritize developing business apps that take advantage of IoT data in real-time. You’ll see companies empowering any employee, regardless of developer skill level, to harness IoT data and drive customer experiences that open new revenue streams—for example, admins at a manufacturing company can build automated workflows that trigger service calls whenever a factory robot issues a component failure alert. Low-code orchestration will be the catalyst for this movement, bringing to IoT the same DIY ethos that transformed enterprise app development: enabling business users and citizen developers to build proactive sales, service, and marketing processes, powered by IoT data, with point-and-click ease.”—*Bo Mangels, Senior Marketing Manager, Salesforce IoT*

RETURN ON IOT INVESTMENTS

“There are a lot of smart things; even a light bulb has an IP address behind it these days. Companies continued to invest in IoT initiatives in 2017, but 2018 will be the year where IoT monetization becomes critical. While it is a good start for enterprises to collect and store IoT data, what is more meaningful is understanding it, analyzing it, and leveraging the insights to improve efficiency. Think saving energy, package-route-delivery optimization, faster pizza deliveries. The focus on location intelligence, predictive analytics and streaming-data-analysis use cases will dramatically increase to drive a return on IoT investments.”

—*Nima Negahban, CTO and co-founder of Kinetica*



Contrary to popular belief, automation will not mean that we need fewer humans; we’ll just need humans to do different things.



FEATURES

♥ 10

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CLEMSON ATHLETICS GOES 'ALL IN' FOR SOCIAL CONTENT

BY JUAN MARTINEZ

💬 12



The blast of cannon fire is unnerving, a martial deviation from an otherwise celebratory medley of passion, pride, tradition, and unbridled youth. Tiny cheerleaders tumble in synchronicity through the 90-degree heat and into the arms of muscular counterparts. The unintelligible sound of synchronized voices exits the wide end of megaphones—the noises blending with and lost among the 81,500 voices in the arena. Here, on the western end zone of Clemson University’s Death Valley Memorial Stadium, the explosion signals the start of what is known as the most exciting 25 seconds in college football—when the reigning NCAA College Football Champion Clemson Tigers run from the top of a hill that sits above the field onto the end zone. The game is about to begin.



As the capacity crowd remains on its feet in anticipation of kickoff, a Clemson student sprints up three flights of steep stairs to deliver an SD card that holds the footage of the hill run to one of his teammates within the Clemson Tigers Creativity Studio. The Studio, a cramped, shadowy room, is managed by Jonathan Gantt, the Clemson Athletic Department’s director of new and creative media. Gantt leads a team of eight creatives—six students and two professionals—who are responsible for creating the social media content that captures the experience of 18 different teams and almost 500 student athletes. For Gantt’s higher ups, the creative team’s main objective isn’t to sell Clemson paraphernalia or amass an army of followers; it’s to show potential athletic recruits what life would be like should they choose to don the orange and white.

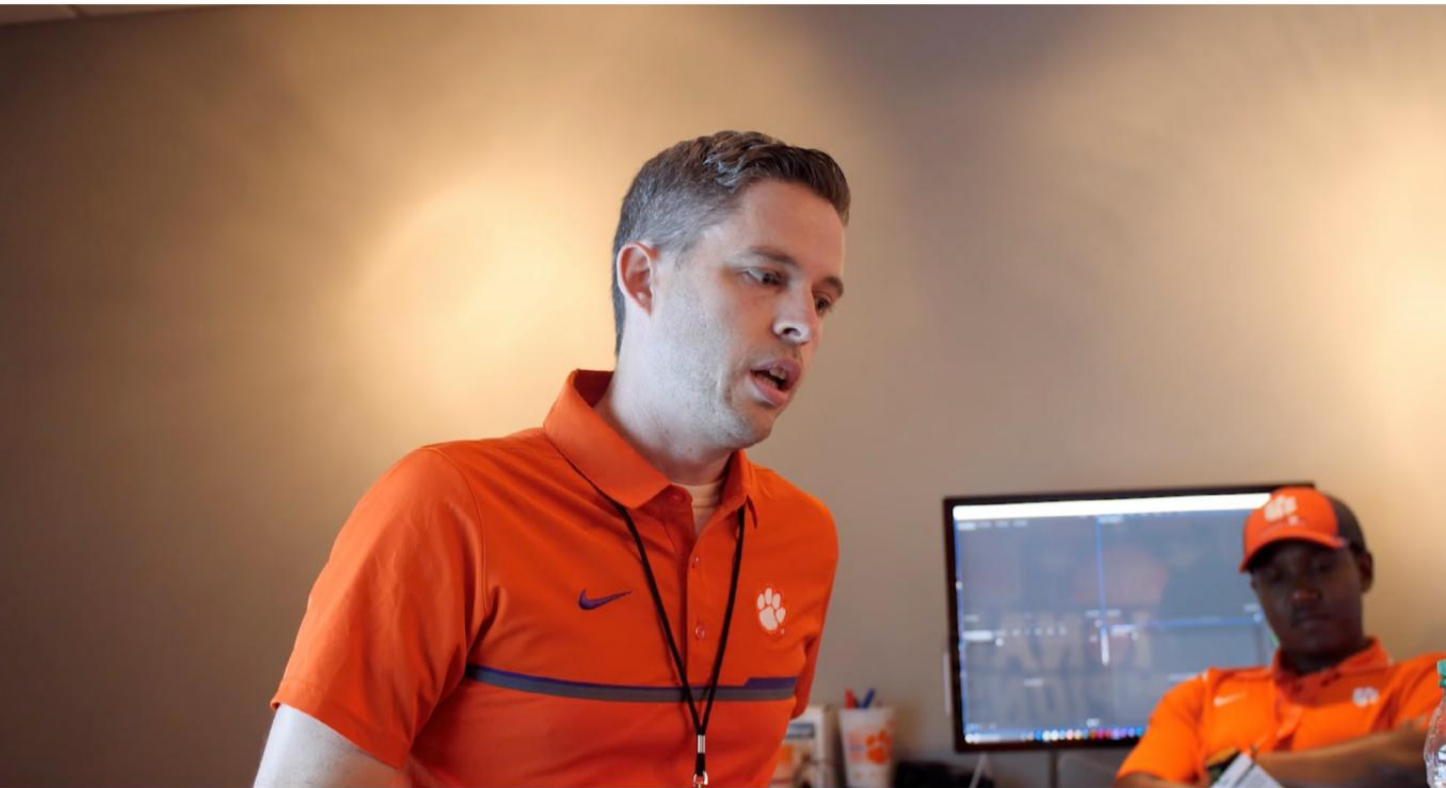
Without the help of a social advertising and marketing agency, Gantt's team has built Clemson University's social media following into one of the best in the nation. Armed with a Nikon D5, Nikon D500, Canon 5D Mark III, Sony FS7, Sony A7s ii, and Sony A6300 for capturing audio and video, along with two Microsoft Surface Studios, two Microsoft Surface Books, an 84-inch Microsoft Surface Hub, and an Adobe Creative Cloud license, Clemson's athletic department is recognized as one of the best social media operations in college sports. The football team's Twitter account has been named the best Twitter account for college football, according to separate rankings by Twitter and *Sports Illustrated*. It has more than 2.5 million followers across all channels (that's the largest of any college football team), averaging about 19 million impressions each week and more than 70 million video views in total.

The creative team combines a mix of short-form video; Facebook, Twitter, and Instagram stills; and Snapchat stories to try to replicate the experience of being a Clemson Tiger. Content includes behind-the-scenes looks into locker-room pep talks, first-person video of practicing with the team, and quick-turnaround video of pre-game ceremonies such as the aforementioned Hill Run. Using its technology arsenal, Gantt's team creates social content that comes close to real-time while still providing expert-level design.

“
**Clemson's
athletic
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college sports.**
”



PCMag was given exclusive access to Gantt's team as well as on-field access to Clemson Tiger pre-game festivities so that we could see exactly how Clemson has become one of the most followed and respected social media content producers in sports.



Clemson's Jonathan Gantt (left)

THE CLEMSON CREATIVITY STUDIO

On Oct. 13th, 2008, Clemson head coach Tommy Bowden, who had been with the team for nine years, was fired. The same day, 38-year-old wide receivers coach Dabo Swinney was offered the interim job and told he could remain on as head coach if he were capable of turning the team around. He met with the team, told them what had happened, and said that the next six weeks would be extremely difficult for everyone involved, but that he would be “all in” to helping return Clemson Football to a place of respectability. He told his team and his coaches he only wanted people who would be “all in” with him. Anyone who wasn't committed to the program, he said, should be absent for the next practice, scheduled for later that day.

The entire team and coaching staff came to the practice.

Today, prior to exiting the locker room before each game, Dabo Swinney and each Clemson football player places a poker chip in a bucket labeled “All In” to renew their commitment to the program. Although Gantt doesn’t run his Creativity Studio with a similar emphasis on tradition, he said he doesn’t choose his staffers and students based on their respective skillsets but rather on the type of person they are and whether they’re committed to going all in for the creative team.

“The number-one criterion for working for us is, you’ve got to be a good person,” said Gantt. “We don’t really care if you can hold a camera or know how to use Photoshop. We can teach you that. Obviously, it helps tremendously if you have some skill and experience, but... we can teach you the rest.”

The first thing you notice when you walk into the Creativity Studio is the 84-inch Microsoft Surface Hub. Then you’ll notice the mess: papers, empty coffee cups, Clemson t-shirts, Clemson hats. You’ll see two Microsoft Surface Studio desktops along the right side of the room, a square table at the center of the room that houses two Microsoft Surface Book laptops, and a coffee bar in the far-left corner featuring a wide variety of sweeteners, creams, coffee flavors, and a bottle of water or two. Because the team needs to follow what Clemson football and its rivals are doing on the field, four large-screen LG televisions are positioned along the back wall.



As proof of his commitment to his staff, Gantt allows any one of his professional or student workers (and even their friends) to access the \$21,999 Surface Hub at any point during the day. The Hub, an 84-inch 4K Windows-based collaboration kiosk, is designed to provide businesses and schools the ability to work in large groups, on multiple screens, and in remote locations. Gantt also allows his team to check out one of the Surface Books to use instead their personal laptops, the staffers told me. The same goes for any of the high-end cameras the team uses down on the field. With access to these expensive devices and the freedom to use them how and when they want, the students feel like professional creatives rather than work-study gophers.

“Any of the people that are on the team can access the Hub on their own and do their own thing,” Gantt explained. “For us, we want them to come to after-hours brainstorming sessions with their peers and to use the Hub and to use that room. My goal is that they would never want to go to the library or go to their apartment to work or to hang out. I want them to come and hang out in here. That’s why we’ve got a coffee bar. There are actually a lot of board games in here. We wanted a mix of your favorite restaurant bar and coffee shop and workplace all in one.”

WHY MICROSOFT?

When Gantt and his boss, Deputy Athletic Director Graham Neff, were approached by Microsoft with an offer to use the Surface suite for content creation, the partnership was a no-brainer, according to Neff. “When it comes to revenue opportunities and brand exposure, it’s really important that we fight above our weight class,” he said. “The Microsoft offerings were comprehensive and allowed us to pull levers in so many different directions [including video and image editing, whiteboarding, and presentations].”



Gantt allows his team to check out one of the Surface Books to use instead their personal laptops.





For Gantt, Microsoft's tools solved a variety of problems his team struggled with prior to the partnership. For example, designing motion graphics, adding written text to video, and game-planning content strategies were easier for the team on the Surface suite's touchscreens. Max Huggins, a fourth-year senior on Gantt's team, is responsible for taking video captured during the team's Tiger Walk (when the team walks from its buses into the stadium alongside a school marching band), locker room speeches, game footage, and crowd reactions, and turning it into a one-minute video that goes live five minutes after the game. Gantt's team uses the Surface Hub's giant display to brainstorm and short-list the footage the team needs to capture for the video. As footage is taken, it's crossed off of the Hub's whiteboard. Footage is transferred via a hand-delivered SD card to Huggins, who puts it onto a Microsoft Surface Studio desktop, and begins to cut the video, which includes adding hand-drawn text as well as audio.

Jordan Salisbury, a sophomore on Gantt's team, touches up and edits photos to ensure maximum quality—simple things like adjusting the color of the team's uniform so that the color is consistent with Clemson's orange, and not, say, Syracuse's orange.

“Footage is transferred via a hand-delivered SD card to Huggins, who puts it onto a Surface Studio desktop.”



When asked if she'd be able to do her job without the Surface Studio, she sighed and said, "It would be a drag to go back from a touchscreen now."

Gantt says synchronicity among Microsoft devices makes his job as group leader much easier. "There's lots of times when we're in a brainstorming session, with me being able to, with one click, look at something I'm looking at on my laptop screen. To be able, with one click, to show it up on the 84-inch screen here and everybody be able to participate, as opposed to, with a MacBook, somebody's got to walk over here and plug in an HDMI cable and then make sure the resolution is working."

Ali Kerns, a senior at Clemson, said the Surface Pens are what she most enjoys, especially when she's tasked with experimenting. Kerns' job requires capturing compelling Clemson gameday content that doesn't necessarily involve the football team. She captures footage of fans swiping their tickets, security guards guiding attendees into the stadium, and the band playing the Clemson fight song, then adds handwritten digital text or drawings to the footage to make it more visually interesting. The Surface Pen lets her switch back and forth between fonts, letter sizes, and color schemes without having to start from scratch when she messes up or goes too far down an experimental rabbit hole.

"I have more control on the Surface Studio than I have on regular paper," Kerns said.

WHAT IS A TOUCHDOWN?

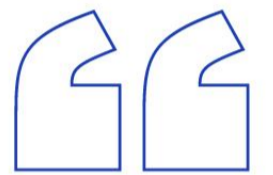
For Microsoft, the partnership means one big thing: trying to get Clemson's 23,000 students and its approximately 5,000 staffers and administrators to try Microsoft products. For Clemson, the partnership is a way to help lure the next top recruit to play football for the Tigers. As mentioned earlier, Clemson's social efforts don't provide a return on investment in a traditional sense: The school doesn't sell hats or jerseys via an e-commerce site on its Facebook page; it isn't using a customer relationship management software (CRM) system to capture leads to send brochures and flyers; and it isn't using a social listening tool to try to drive higher engagement with ads or higher ticket sales. What Clemson and Gantt are trying to accomplish is a pure branding play that lets blue-chip prospects see what playing for Clemson would be like before a top recruit ever steps on campus.



“Our job is to try to take [the] campus to the recruit through content and through social media,” said Gantt. “It’s really important for us to try to tell the stories of our programs, of our university, sometimes of our individual student athletes, to help explain what it’s like to be a Clemson Tiger. Every piece of content tries to answer that question right there, so through videos, photos, motion graphics, articles, whatever it might be, we’re trying to help you understand what’s it like to be a Clemson football player, Clemson volleyball player, whatever.”

Gantt and Neff agree that follower numbers and engagement metrics won’t necessarily determine whether their efforts have been successful, and having all of the nicest Microsoft toys won’t automatically create the best content. But the content has to live up to the success of the football team, which, as of this writing, is arguably the best in the nation.

“Success on the field is the only real driver of significant growth on social channels for a sports team,” said Gantt. “There’s a lot of people who are making great content across the country, but they don’t have a team winning National Championships, and so they’re not seeing the same growth. Now, what I will say is that



We’re trying to help you understand what’s it like to be a Clemson football player, Clemson volleyball player.



when our team did reach those levels in making it to a National Championship and then winning one last year, the staff and students who were doing the work didn't miss that moment. Those numbers certainly would've grown no matter what, but I think they grew more because of the work that the staff and students were doing," said Gantt.

That all sounds well and good. But then, I ask Gantt, if and when Neff calls him into his office and asks him to show and prove the Creativity Studio's value, what will he point to as his proof of ROI? Gantt laughed like a poker player who'd read his opponent's hand. "I've got one for you," he said, "Shaq Smith."

Smith, a Clemson inside linebacker, was a five-star recruit out of Maryland, where he was ranked the state's top prospect. A second-team All American in High School, Smith received scholarship offers from all of the major football programs in the country, including top schools such as Alabama, Penn State, and Ohio State. He visited Clemson in November of 2015, on a night when the team won a crucial victory over powerhouse Florida State, won the Atlantic Division of the ACC, and secured a berth in the conference championship game.

After the game, Gantt said, he and his team were working in the press box into "the wee hours of the night, as we usually do for home games," when he got a call on his cell phone from Clemson's recruiting coordinator for football. "Hey, I want you to talk to somebody real quick," the coordinator said.

"Shaq Smith gets on the line," Gantt said. "I never met Shaq, and I'm going to do a poor impression of him, but he said, 'Hey, is this Jonathan?' I said, 'Yes.' He said 'Hey, I just wanted to tell you, you're doing a great job on social media.'"



**Success on
the field is the
only real
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significant
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social
channels for a
sports team.**



Gantt acknowledges that Smith probably didn't choose Clemson based on the greatness of the school's social content. But might it have had an impact, however small, on his recruiting process? "Yes," said Gantt. "We're just trying to package all the special things that are happening here and make sure that those people who are trying to make a decision about where to go to college understand exactly what Clemson has to offer, and it's important for us to make sure we're telling that story really well."

JUAN MARTINEZ





5

COLLEGES WITH MASTER'S-LEVEL SOCIAL MEDIA CONTENT



BY JUAN MARTINEZ

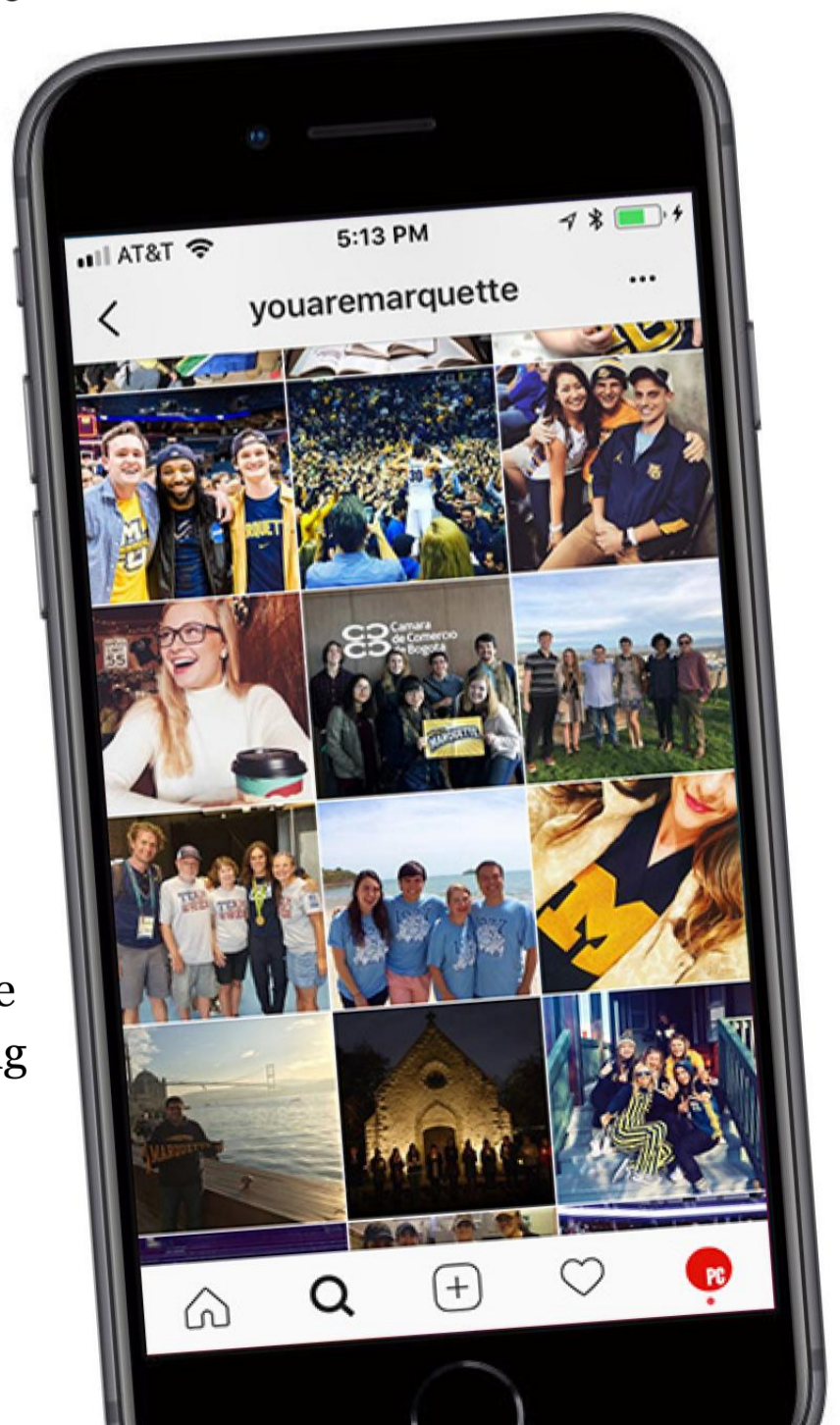


Social media is the new college brochure. Like any business, schools that market themselves effectively on social media and listen to their social audiences have an easier time attracting top recruits than schools that ignore Facebook, Instagram, SnapChat, and Twitter (sorry, LinkedIn, these kids don't need jobs yet).

For this story, I looked for schools that were creating beautiful photo and video content, using social media in new and interesting ways, and posting a diverse array of content, including links, memes, and GIFs. I asked social media experts to nominate colleges and universities, relied on published social media case studies, and did some old-fashioned digging. This list is subjective, incomplete, and totally updateable.

MARQUETTE UNIVERSITY operates more than 75 social profiles, including 44 Twitter accounts, 24 Facebook accounts, and five Instagram accounts. The Milwaukee-based school works with Sprout Social to analyze and study data to determine exactly what students and potential applicants like, dislike, and ignore on social media.

The result, based on what they post, is a snapshot of student life. You'll see photos of the school's mascot (the Golden Eagle) and images from basketball games, but the majority of posts focus on students out in the wild. One of those 75 social profiles, @YouAreMarquette, is almost entirely user-generated and is (based on what I've seen) the best no-frills record of what you'll find walking around a major American college campus.



Perhaps no other major university account toes the line between football insanity and higher education better than the **UNIVERSITY OF GEORGIA** (UGA). Nestled between adorable photos of Uga, the school's rotund, slobbery mascot, and 6-second Georgia Bulldogs football highlight videos are links to stellar research on a wide variety of topics, including plastic waste, STEM-based instruction, and cell therapies for chronic diseases. If you're not into football or bulldogs (God forbid), then stay away from the school's accounts on Saturdays, when it's all Dawgs, all day.

Want to make yourself smarter? Follow **MASSACHUSETTS INSTITUTE OF TECHNOLOGY** on Facebook and Twitter. In addition to posting link after link of stunning new research ("Gravitational waves from a binary black hole merger," as one example), MIT's social feeds know how to have fun. You'll find informative (and comprehensible) GIFs, LEGO caricatures of recent Nobel Prize winners, and copious amounts of robots. As you'd expect, MIT's feeds don't rely as heavily on sports-related content as other college-related social feeds. But it still posts a nice blend of men's and women's athletics coverage, including co-ed club sports such as Shotokan Karate. If you follow PCMag (and our sister sites Geek.com and ExtremeTech), then you'll love following MIT.

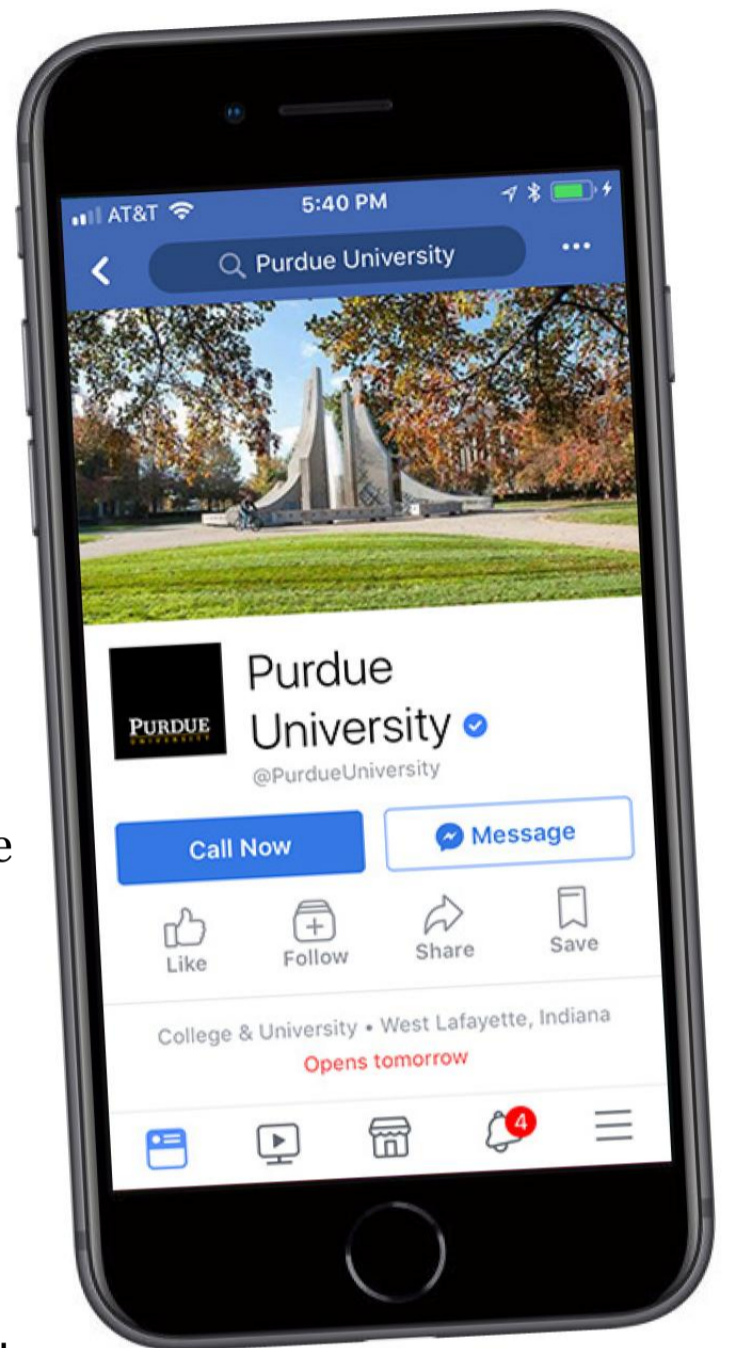
Call me biased, but this New York City boy is partial to **NEW YORK UNIVERSITY'S INSTAGRAM** account. Perhaps the biggest draw for applicants is the Big Apple itself; NYU's Instagram page doubles down on its home-field advantage by serving as a repository of gorgeous cityscapes. Seriously, if you're missing New York City right now, pop over to the school's Instagram page, click on a few photos, close your eyes, and I'll bet you'll be able to smell a Coney Island red hot. NYU's Facebook and SnapChat pages are more traditional, relying heavily on student-lifestyle content, fundraising efforts, and school-related news.




PURDUE UNIVERSITY

Selfies don't have to be selfish. Purdue University raised more than \$28 million in one day thanks to a social media–driven event called “Purdue Day of Giving.” A land-grant public university, Purdue relies heavily on donations to provide tuition assistance for scholarship students, research initiatives, and service learning programs, such as the Priority 4 Paws Mobile Care Unit, which sends veterinary students around the state of Indiana to animal shelters to provide medical care for strays. During the annual fundraising initiative, Purdue and HootSuiteFree at Hootsuite ran several activities across Facebook, Instagram, SnapChat, and Twitter, including a scavenger hunt and a creative selfie competition, to promote awareness for the event and to engage with the community in order to maintain momentum. The school doesn't use its social channels only to give back to its local community—it runs an annual “Boilermaker Wish” campaign, it ran a #BoilerUp4Houston clothing and canned food drive after Hurricane Harvey, and it promotes the Purdue Peace Project, a university-based global political violence prevention initiative.

JUAN MARTINEZ



FEATURES



**CAN ARTIFICIAL
INTELLIGENCE BE
TRULY CREATIVE?**

BY BEN DICKSON

In late May, a small crowd at St. Dunstan's church in East London's Stepney district gathered for two hours of traditional Irish music. But this event was different; the tunes it featured were composed, in part, by an artificial intelligence (AI) algorithm, dubbed folk-rnn, a stark reminder of how cutting-edge AI is gradually permeating every aspect of human life and culture—even creativity.

Developed by researchers at Kingston University and Queen Mary University of London, folk-rnn is one of numerous projects exploring the intersection of artificial intelligence and creative arts. Folk-rnn's performance was met with a mixture of fascination, awe, and consternation at seeing soulless machines conquering something widely considered to be the exclusive domain of human intelligence. But these expeditions are discovering new ways that man and machine can cooperate.

HOW DOES AI CREATE ART?

Like many other AI products, folk-rnn uses machine learning algorithms, a subset of artificial intelligence. Instead of relying on predefined rules, machine learning ingests large data sets and creates mathematical representations of the patterns and correlations it finds, which it then uses to accomplish tasks.

Folk-rnn was trained with a crowd-sourced repertoire of 23,000 Irish music transcripts before starting to crank out its own tunes. Since its inception in 2015, folk-rnn has undergone three iterations and has produced more than 100,000 songs, many of which have been compiled in an 14-volume online compendium.

Flow Machines, a five-year project funded by the European Research Council and coordinated by Sony's Computer Science Labs, also applied AI algorithms to music. Its most notable—and bizarre—achievement is “Daddy's Car,” a song generated by an algorithm that was trained with lead sheets from 40 of The Beatles' hit songs.

WELCOME MISTAKES

Algorithms can mimic the style and feel of a musical genre, but they often make basic mistakes a human composer would not. In fact, most of the pieces played at folk-rnn's debut were tweaked by human musicians.



“Art is not a well-defined problem, because you never know exactly what you want,” says Francois Pachet, who served as the lead researcher at Flow Machines and is now director of Spotify’s Creator Technology Research Lab. But, he adds cheerfully, “it’s good actually that art is not well defined. Otherwise, it would not be art.”

The generated lead sheet for “Daddy’s Car” was also edited by a human musician, and some tracks were added by hand. “There was pretty much a lot of AI in there, but not everything,” Pachet says, “including voice lyrics and structure, and of course the whole mix and production.”

“The real benefit is coming up with sequences that aren’t expected, and that lead to musically interesting ideas,” says Bob Sturm, a lecturer in digital media at Queen Mary, University of London who worked on folk-rnn. “We want the system to create mistakes, but the right kind of mistakes.”

Daren Banarsë, an Irish musician who examined and played some of the tunes generated by folk-rnn, attested to the benefits of interesting mistakes. “There was one reel which intrigued me,” he says. “The melody kept oscillating between major and minor, in a somewhat random fashion. Stylistically, it was incorrect, but it was quirky, something I wouldn’t have thought of myself.”



The real benefit is coming up with sequences that aren’t expected, and that lead to musically interesting ideas.



Pachet explains that these unexpected twists can actually help improve the quality of pop music. “Take the 30 or 50 most popular songs on YouTube. If you look at the melody, the harmony, the rhythm and the structure, they are extremely conventional, which is quite depressing. You have only three or four chords, and they’re always the same. Creative AI is very interesting, not only because it’s fun, but also because it brings hope. I hope that we could change or impact the quality of the most popular songs today.”

NO RIGHT ANSWERS

“The thing that makes art wonderful for humanity is that there is no right answer—it’s entirely subjective,” says Drew Silverstein, CEO and co-founder of Amper Music, an AI startup based in New York. “You and I might listen to the exact same piece of music, and you might like it, and I might hate it, and neither of us is right or wrong. It’s just different.

“The challenge in the modern world is to build an AI that is capable of reflecting that subjectivity,” he adds. “Interestingly, sometimes, neural networks and purely data-driven approaches are not the right answer.”

Oded Ben-Tal, senior lecturer in music technology at Kingston University and a researcher for folk-rnn, points out another challenge AI faces in respect to creating music: Data does not represent everything.

“In some ways, you can say music is information. We listen to a lot of music, and as a composer, I get inspired by what I hear to make new music,” Ben-Tal says. “But the translation into data is a big stumbling block and a big problem in that analogy. Because no data actually captures all the music.”

To put it simply, an AI algorithm’s interpretation and understanding of music and arts is very different from that of humans.

“In the case of our system, it’s far too easy to fall into the trap of saying it’s learning the style or it’s learning aspects of Irish music, when in fact it’s not doing that,” says Sturm. “It’s learning very abstract representations of this kind of music. And these abstract representations have very little to do with how you experience the music, how a composer puts them together in the context of this music within the tradition.



**GOOGLE
DEEPAEAM**
This image was generated by Google's AI computer vision program, which finds and enhances patterns in images.

“Humans are necessary in the pursuit because, at the end of the day, we have to make decisions on whether to incorporate certain things produced by the computer that we curate from this output and create new music,” Sturm says.

In visual arts, the divide between the perception of humans and machines is even more accentuated. For instance, take DeepDream, an inside-out version of Google's super-efficient image-classification algorithm. When you give it a photo, it looks for familiar patterns and modifies the image to look more like the things it has identified. This can be useful to turn rough sketches into more enhanced drawings, but it yields unexpected results when left to its own devices. If you provide DeepDream with an image of your face and it finds a pattern that looks like a dog, it'll turn a part of your face into a dog.

“It's almost like the neural net is hallucinating,” an artist who interned at Google's DeepMind AI lab said about the software in an interview with *Wired* last year. “It sees dogs everywhere!”

But AI-generated art often looks stunning and can rake in thousands of dollars at auctions. At a San Francisco art show held last year, paintings created with the help of Google's DeepDream sold for up to \$8,000.

THE BUSINESS OF CREATIVE AI

While researchers and scientists continue to explore creative AI, a handful of startups have already moved into the space and are offering products that solve specific business use cases. One is Silverstein's Amper Music, which he describes as a “composer, producer, performer that creates unique professional music tailored to any content in a matter of seconds.”

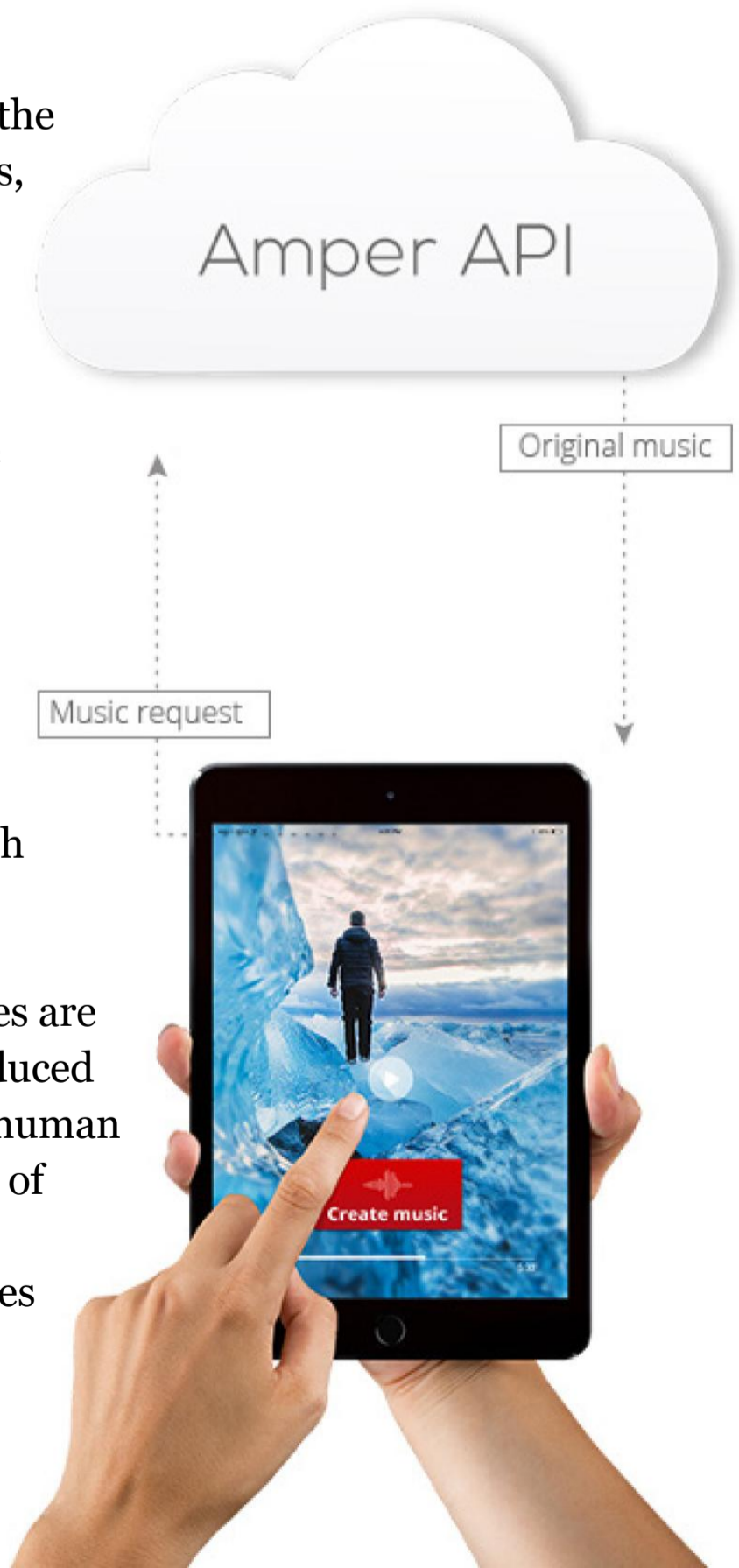
To create music with Amper, you specify the desired mood, length, and genre. The AI produces a basic composition in a few seconds that you can tweak and adjust. Amper also offers an application programming interface (API), so developers can incorporate the platform's creative power into their software.

Jukedeck, a London-based startup created by two former Cambridge University students, provides a similar service. Like Amper, users provide Jukedeck with basic parameters, and it provides them an original musical track.

The main customers of both companies are businesses that require "functional music," the type used in ads, video games, presentations, and YouTube videos. Jukedeck has created more than 500,000 tracks for customers including Coca-Cola, Google, and London's Natural History Museum. Composers are also learning to use the tools to enhance the music they create for their customers.

A third startup, Australia-based Popgun, is building an AI musician that can play music with humans. Named Alice, the AI listens to what you play and then responds instantly with a unique creation that fits with what you played.

In the visual arts industry, business use cases are gradually emerging. Last year, Adobe introduced Sensei, an AI platform aimed at improving human creativity. Sensei assists artists in a number of ways, such as automatically removing the background of photos or finding stock images based on the context of a poster or sketch.





COLLABORATION BETWEEN AI AND HUMAN ARTISTS

Perhaps not surprisingly, these startups are founded and managed by people who have strong backgrounds as artists. Amper's Silverstein studied music composition and theory at Vanderbilt University and composed music for TV, films, and video games. Ed Newton-Rex, founder and CEO of Jukedeck, is also a practiced music composer.

But not everyone is convinced of the positive role of artificial intelligence in arts. Some of the attendees at folk_rnn's event described the AI-generated pieces as lacking in "spirit, emotion and passion." Others expressed concern for the "cultural impact and the loss of the human beauty and understanding of music."

"I haven't met one musician that I've told about this who hasn't reacted with something close to the negative side of things," said Úna Monaghan, a composer and researcher involved in folk_rnn who spoke to Inverse. "Their reaction has been from slightly negative, to outright 'why are you doing this?'"

The developers of creative AI algorithms do not generally share these concerns. "I don't think humans will become redundant in music-making," says Newton-Rex. "For a start, we as listeners care about much more than just the music we're listening to; we care about the artist, and about their story. That will always be the case."

“We think of functional music as music that is valued for its use case and not for the creativity or collaboration that went into making it,” Silverstein says. But artistic music, Silverstein explains, “is much more about the process than the use case. Steven Spielberg and John Williams writing the score of Star Wars, that’s about a human collaboration.”

“The key use-cases we see lie in collaboration with musicians,” says Jack Nolan, co-founder of Popgun. “Artists can use Alice as a source of creative inspiration or to help them come up with melodies and chord progressions in their music. We don’t think people will ever stop wanting to create their own sounds. We think AI will help them do this, rather than replace them.”

Daren Banarsë agrees on the benefits of collaboration. “I always find it daunting when I have to start a large-scale composition. Maybe I could give the computer a few parameters: the number of players, the mood, even the names of some of my favorite composers, and it could generate a basic structure for me,” he says. “I wouldn’t expect it to work out of the box, but it would be a starting point. Or it could output a selection of melodic ideas or chord progressions for me to look through. And somewhere in there, there’s going to be a computer glitch or random quirk, which could take me in a completely unexpected direction.”

Ben-Tal admits that some jobs might be affected. “Working musicians will have to adapt,” he says. “I show this to my students and say, ‘You need to up your game.’ This will mean some of the entry-level jobs into the music industry will not be there in five or ten years, or you’ll need to do things differently or have a different set of skills.”

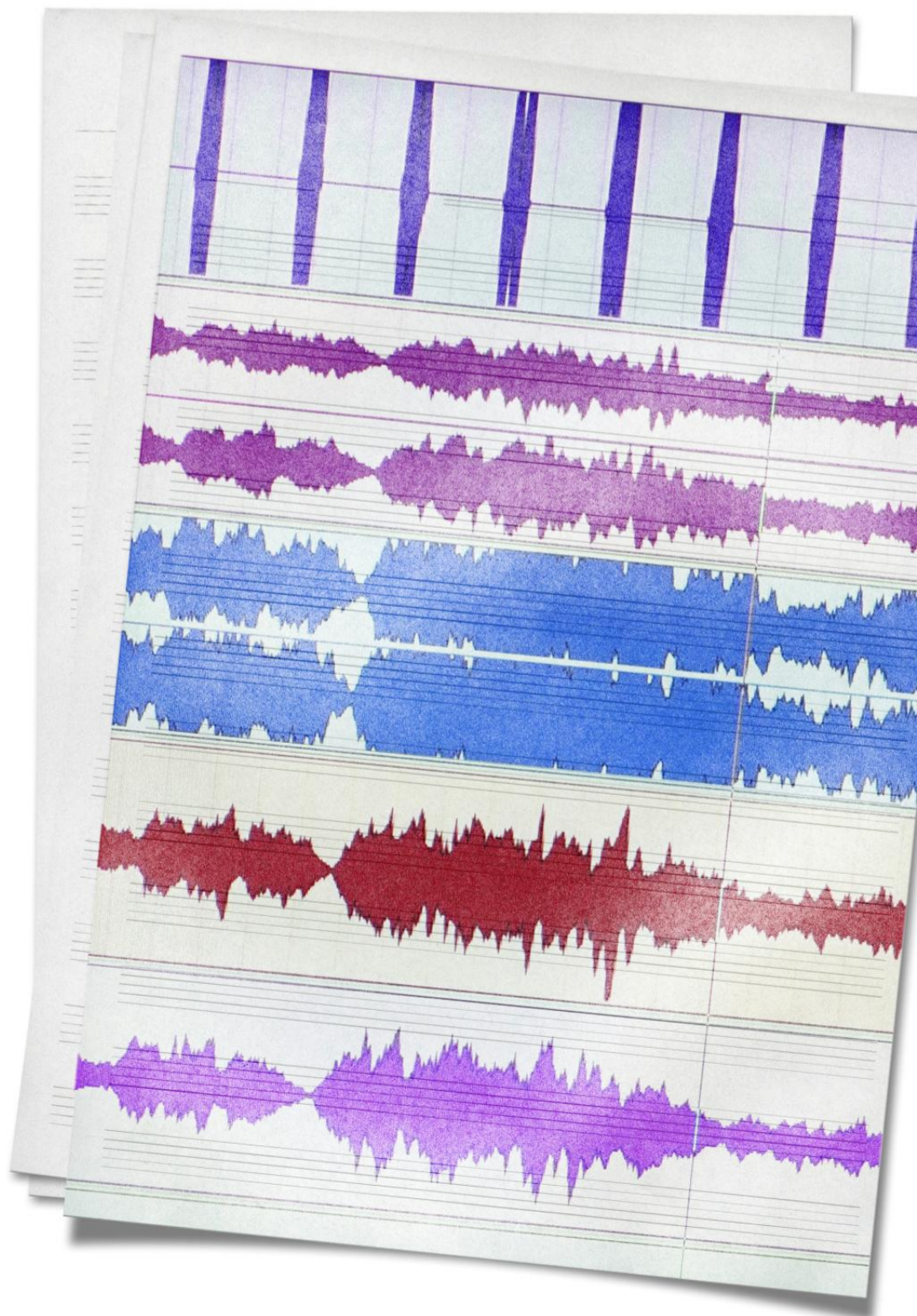
‘DEMOCRATIZING CREATIVITY’

AI creativity can also help people without inherent talent or hard-earned skills express themselves artistically. Take Vincent’s AI drawing platform, which helps transform rough sketches into professional-looking paintings, and the AI music platforms that create decent music with minimal input.

Jukedeck’s Newton-Rex describes this as “democratizing” creativity. “People with less formal musical education can get to grips with the basics of music and use AI to help them make music,” he says.

Pachet concurs. He draws an analogy between recent AI developments and the arrival of the first digital synthesizers in the 80s, followed by digital samplers. At the time, there was a similar fear that musicians would lose their jobs to computers. “But what happened was the exact opposite, in a sense that everyone took these new machines and hardware with them and learned how to use them productively,” he says. “The music industry exploded in some sense.”

“There will be more people doing music, and hopefully more interesting music,” he adds, reflecting back on AI creativity. “I cannot predict the future, but I’m not worried about AI replacing artists. I’m worried about all the other things, the well-defined problems, like automated healthcare and autonomous vehicles. These things are really going to destroy jobs. But for the creative domains, I don’t think it’s going to happen.”



How to Create and Send Animoji on iPhone X

BY LANCE WHITNEY



Among the many cool new features offered by the newest iPhone is an addictive twist on emoji, dubbed Animoji. Apple iPhone X owners can insert any number of animated characters in a text message, thanks to the way the X maps your face. You can say anything you want to convey in the text, and the character speaks in your voice. The phone records your facial expressions at the same time, so the character takes on your mannerisms.

Though you can send an Animoji only from the iPhone X, anyone can receive them on an iOS device, a different type of smartphone, or a Mac. Here's how to create and send an Animoji.

On your iPhone X, launch the Messages app. Start a new message to someone or respond to an existing text and tap in the iMessage field. Tap on the App Store icon (the one with the A) and then tap on the Monkey icon. Select “Tap on to Start.”

View the collection of Animoji by swiping down on the left side. Stop when you find an Animoji you want to send. Look at your iPhone until the message that says “Bring your face into view” goes away. You can now play around with your face, so to speak. Make different expressions and movements with your eyes, eyebrows, mouth, and overall face to see how the Animoji mimics you. Tap on the Up arrow to see your Animoji and the other Animoji full screen. Tap on the Down arrow to exit full-screen mode.

“
**Apple iPhone X
owners can
insert
animated
characters in a
text message,
thanks to the
way the X maps
your face.**
”



To record your speech and your facial expressions through the Animoji, tap on the red Record button. Speak your text. You can talk for up to 10 seconds before you’re cut off, so watch the seconds count down on the timer. To stop recording, tap the red Stop button. Your recording via the Animoji plays back so you can preview it before you send it. Preview it again by tapping on the Repeat button or delete it by tapping on the Trash Can icon. You can also tap on a different Animoji to see it speak the same recording. If you’re happy with the recording and the Animoji, tap on the Blue arrow to send it.

On the other end, your recipient receives the text with the Animoji but with the sound turned off. That person has to tap on the Volume icon to hear your recording. Tapping on the Animoji launches it full screen. The person can pause and replay the Animoji by tapping on the Pause or Play icon at the bottom of the screen.

You can also send a static Animoji with any facial expression. Select an Animoji, then look into your iPhone to place your face inside the frame. Make a face. Hold down the Animoji and drag it into a message to send it.

You can save an Animoji that you send or receive. Hold down the Animoji and swipe up on the screen. (On an iPhone 6 or earlier, an iPad, or an iPod touch, the recipient holds down the Animoji to bring up the menu.) Tap on Save, and the Animoji is saved to your device's Camera Roll. To reuse it in a new text, tap on the Camera icon, and tap on the video clip of the Animoji (or select Photos as the source and then look for and tap on the clip).

From this menu, you can also copy the Animoji to use it in another message or forward it to someone else. Return to your text and tap on the Animoji to view it full screen. Tap on the iOS Share icon to share it via email, Facebook, Google +, or other apps and services.



Essential Tips for WhatsApp Users

BY CHANDRA STEELE



The desire for encrypted communication is no longer limited to spies, informants, and journalists. Amidst news of widespread surveillance, secure messaging apps are growing in popularity. More than 1 billion people now use WhatsApp every day, sending 55 billion messages, 4.5 billion photos, and 1 billion videos.

WhatsApp makes it easy to keep in touch with far-flung friends on the cheap. It's free to text and call as long as you have a Wi-Fi or data connection.

The IM-style service is more popular than the very similar Facebook Messenger, likely because it works on feature phones, which are common outside the US, and because it isn't directly tied to Facebook, despite being owned by the huge social network.

Whatever you're using WhatsApp for, though, you likely don't know everything it can do. Here are our top tips.

FIND ME: If you don't mind being caught in an "I'm five minutes away" fib, you might want to try WhatsApp's Live Location feature. Share your location by opening a chat, clicking on the plus sign, and selecting Location, where you'll see an option to Share Live Location. It's a handy way to find someone in a crowd or to get an idea how long you have to wait before your friend shows up.

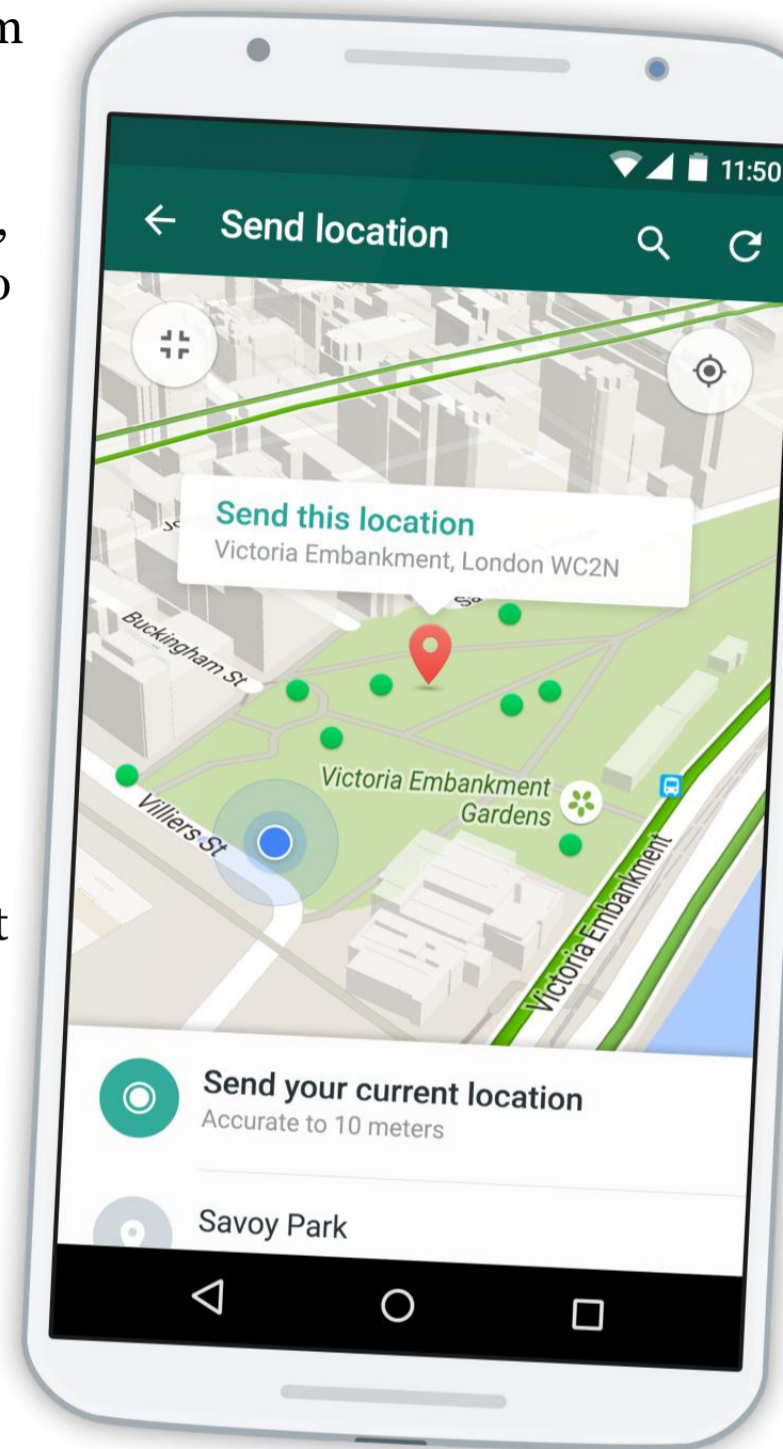
GET PINNED: Put the person you chat with more than anyone at the top of your messages list. Go to the Chats tab and find the chat you want to make a priority. Swipe right and select Pin.

PRYING EYES: Do you want to be friendly but not give too much away on WhatsApp? Then protect your privacy by going to Settings > Account > Privacy. There you can change who can see when you were last active, your profile photo, and status. You can also turn off read receipts, though you will then in turn not be able to see others' read receipts.

BACK IT UP: To save chats, whether you're sentimental or stocking up on blackmail material, you can go to Settings > Chats > Chat Backup > Back Up Now.

YOU'RE A STAR: Have a message you want to save? Star it so it's easily accessible. Tap and hold the message and the Star icon will appear. To unstar it, do the same. The message is now viewable by going to Settings > Starred Messages.

TAKE YOUR FRIENDS WITH YOU: WhatsApp doesn't operate only on your phone; you can use it on

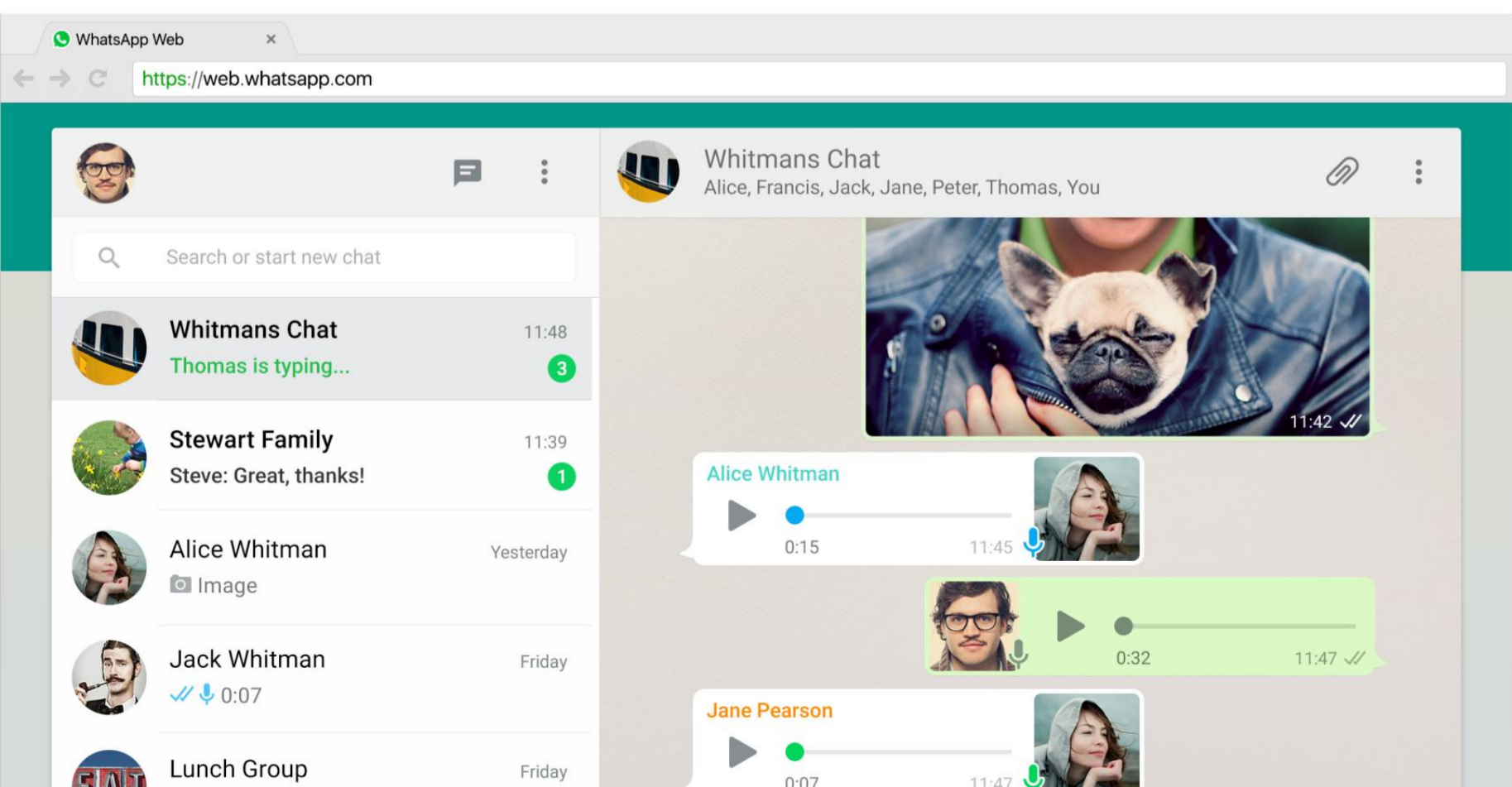


your computer, too. Go to web.whatsapp.com on your computer. On your phone, go to Settings > WhatsApp Web, and scan the QR code on your computer screen with your phone. There are also desktop apps for Windows and Mac.

GROUP THERAPY: If one of your #squadgoals is to never be out of touch one another, then you'll want to start a group chat. Go to the Chats tab and select New Group. Name the group, and select an image, if you want. Tap Next, and add participants either by selecting the plus (+) and adding them from a list or by typing in each name individually. Select Create when you're done.

SHOUT IT OUT: To send a message to multiple people without them realizing they're on a group chat, use the broadcast list feature. You can use this only with those who have you in their contact list. To broadcast, go to Chats > Broadcast Lists and either select an existing list or create a new one by clicking New List and typing in contact names. When recipients reply, it will be only to you and not the rest of the list.

PASSING NOTES: Last year, WhatsApp rolled out the ability to send documents to contacts. To send, tap the plus (+) sign next to the text field (iOS) or the paperclip icon at the top of the screen (Android). On iOS, choose a doc from iCloud Drive or tap More for other options, like Google Drive (above). On Android, select the document you want to send and tap Send in the popup.



JAZZ UP YOUR PHOTOS & CHATS: In October, WhatsApp took a page from Snapchat, Instagram, and Skype, all of which allow the addition of text and doodles to images. On WhatsApp, editing tools appear automatically after you capture a new photo or video or import one saved on the phone. Then you can add text in different colors and fonts. WhatsApp also lets you use flash on the front-facing camera of your phone, so you'll be well lit for selfies. To add GIFs to your chats on iOS, tap the plus (+) button > Photos & Video Library > GIF button on bottom left. On Android, tap the emoji button and select GIF at the bottom of the screen.

STATUS CONSCIOUS: WhatsApp celebrated its eighth birthday by giving users the ability to expand their status updates beyond text. Photos, GIFs, and videos that disappear in 24 hours can now be shared with contacts. First, you're going to want to control who sees your status update: Open WhatsApp and tap the Status icon in the bottom tray, then select Privacy. You'll be able to choose between your contacts, your contacts with the exception of some chosen people, and just contacts that you hand select. To use the feature, tap Status > My Status. It opens to the camera feature, where you can take a photo or record a video. Or select the photo icon, where you'll see your library of photos that you can select from. Also, at the bottom of that screen, you'll be able to tap GIF to search Giphy. Then just tap the send icon, and whoever you chose to see your status will receive it.

PICTURE PERFECT: WhatsApp has stepped up its photo game. When you get four or more photos or videos in a row from one person, they're now be grouped together in a tile-display album within the message. When you tap it, you see a full-screen view of each image or video.



Editing tools appear automatically after you capture a new photo or video or import one from your phone.



HEY MAN, NICE SHOT: Let's face it, filters make for good photos, and you can filter your photos, GIFs, and videos right in a WhatsApp message. Just tap the camera icon and either select an image from your library or take one, and then swipe up to select one of five filters (pop, black and white, cool, chrome, and film).



SEEN AND HEARD: WhatsApp has finally added video calling. To use it, go to Chats, tap the person you'd like to call, and select the phone icon at the top of the screen. Then tap Video call.

DOING THE TWO-STEP: Two-step verification is a must for those concerned about security. To use it on WhatsApp, you'll have to enter a six-digit passcode—but the inconvenience is worth the peace of mind. To enable it, go to Settings > Account > Two-Step Verification > Enable, and you'll be asked to create a passcode. Make sure to enter your email address when prompted, so you can disable the two-step verification if you forget your passcode.

GET A WORD IN: Sure, you can type in the text box like anybody, but there's an alternate way to reply to a message. Just swipe right and start typing your response immediately.

DOCUMENT EVERYTHING: Attach documents to a chat by opening the chat and tapping the plus (+). Click on Document, and choose the source you want to send it from.

PHOTO FINISH: Love them or hate them, you can handle a series of photos you've received in one fell swoop. If you've been sent multiple photos, tap them and hold, and you'll be presented with a choice to forward them all or delete them all.

TAKE IT BACK: There are some things you can never take back. But you can delete a message in WhatsApp. Tap and hold it, and choose Delete, followed by Delete for Everyone.

How to Watch Esports Anywhere

BY JEFFERY L. WILSON



Esports is the title given to the video game industry's competitive-player arm. The term doesn't refer to a few friends getting together on the weekend to down beers and pizza while engaging in smack-talk-filled FIFA or Madden NFL sessions: Esports stokes the competitive fires by adding tournament structures and cash prizes.

Money is generated from players paying tournament entrance fees or purchasing downloadable content and from large companies that sponsor events. Sometimes the prize money is a mix of both. Those pots attract players, with the most talented and dedicated people rising to the top to put on tense, terrific matches. There's also a governing body (the Electronic Sports League, commonly referred to as ESL), drug testing, and professional teams complete with training camps.

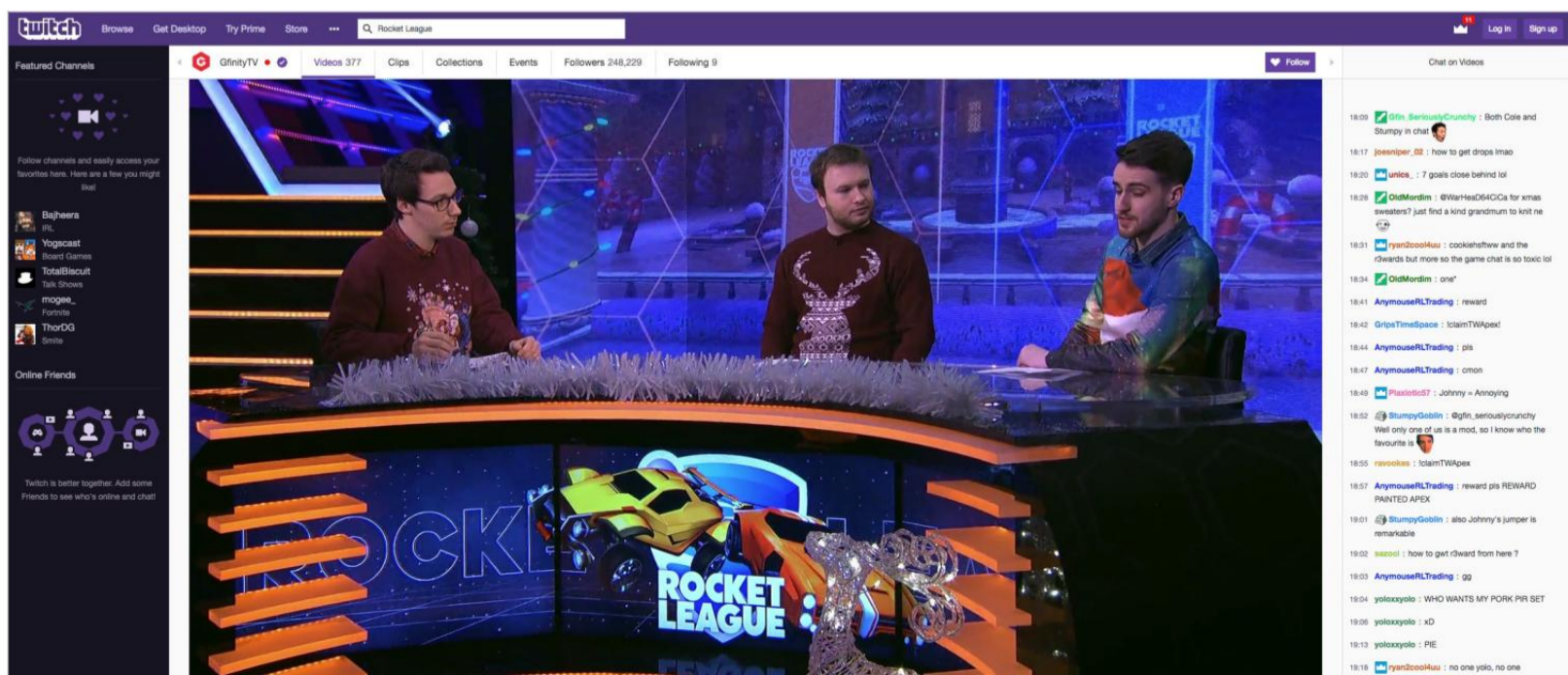
Competitive, professional video gaming is filled with so much drama and memorable moments that it's one of the best sporting events around, ranking up there with the NBA in terms of sheer spectacle and ridiculousness. And considering the faces and heels, cool folks and obnoxious brats, esports is the best reality TV, too.

Thankfully, watching esports is not a difficult task, as there are many esports-friendly games (on console and PC) played on the local, regional, national, and international levels. And you can choose from many ways to view the contests, courtesy of vital online and offline advances.

WATCH ESPORTS ONLINE: Streaming esports via your desktop, laptop, smartphone, or tablet is, without question, one of the most convenient ways to view competitive video game playing. All you need is an internet connection and an app or browser to watch live matches in bed, at work, on your commute, or during a cross-country flight.

Here's how to check out a stream: When you're using a web browser, just point it toward Twitch, Mixer, or YouTube Gaming's home pages. And if apps are more to your liking, all three services offer corresponding free clients for Android and iOS.

Please note that not all streams featured in these apps and websites are esports-related; most streams simply feature people broadcasting their playthroughs and interacting with their viewers. Fortunately, cutting through the muck is relatively simple. You should look for official game channels such as Counter-Strike Global Offensive and Rocket League, as they feature high-profile, big-pot matchups. You'll often find archived matches there, too, so you can catch up after they've aired.



WATCH ESPORTS IN PERSON: The “e” in “esports” could lead you to believe that the only way to watch the contests is via electronic means, but that’s not the case. Esports has always had an “analog” real-world component, dating back to LAN parties and money bets in dank, smoke-filled arcades.

For better or worse, LAN parties and arcades are pretty much things of the past. Nowadays, the two best methods to enjoy live esports is to visit community-run tournaments, such as East Coast Throwdown and Chinatown Beatdown, or massive stadium-filling events such as Brooklyn Beatdown and the Evolution Championship Series. Dedicated esports venues, including Blizzard Arena and Eleague Esports Arena, have popped up around the country in recent years as well. A few traditional sports venues, such as New York’s Barclays Center and Madison Square Garden, host esports events too.

You’ll have to pay for tickets as you would for any other sporting event, but that’s the literal cost of cheering on your favorite player or team with thousands of other rabid fans.



Esports venues, including Blizzard Arena and Eleague Esports Arena, have popped up around the country.



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WATCH ESPORTS ON TV: Esports on television is a relatively new occurrence—for the United States. Years ago, Starcraft got some esports broadcast love in Asia, but video games on American airwaves didn't really become a serious thing until the Disney-owned ESPN 2 partnered with Evolution Championship Series to air the Street Fighter V Grand Finals in conjunction with Twitch streaming it online. In fact, the successful partnership led to the Street Fighter V Grand Finals also airing on Disney XD.

Likewise, TBS has found success airing Eleague's Street Fighter V Invitational round-robin tournament, as well as the Counter-Strike: Global Offensive Premier and Injustice 2 World Championship.



Esports on television is a relatively new occurrence for the United States.





Tech 'Improvements' That Actually Makes Things Worse

Recently Intel announced that support for the “old-fashioned” BIOS-based PC is going by the wayside. It’s being dumped in favor of the Unified Extensible Firmware Interface (UEFI), which seems like BIOS on steroids.

BIOS and UEFI can be thought of as middlemen for the computer, making the hardware able to communicate with the OS and to smooth out operations.

The BIOS was semi-programmable, in that you could upgrade it as necessary. The UEFI is programmable beyond the upgrade, which has two implications. One is abuse by hardware or software companies that want to optimize the UEFI to improve their products’ performance, probably at the expense of other companies. This could easily evolve into sabotage of the competition. There is the possibility that one modification will wreck a different modification, without malicious intent.

Which brings us to the most obvious problem—malware itself. Consider the potential for hijinks. Numerous pieces of malware infect today’s modern browsers, hijacking them for the purposes of posting more advertisements or tracking users to an extreme. The intelligence community must be drooling over the possibilities with the UEFI. The bad actors in the hacker community are, too. It will not be instantaneous, but within the first year, some interesting cracks will appear.

I have a negative attitude about this because I remember when the first few dopey computer viruses were employed, beginning around 1985. Initially, they were designed as pranks and would typically erase your hard disk and send a mocking message to your console.

The computer virus went through several iterations and became generically called malware. Much of its usefulness (to hackers) now involves hijacking your computer to make it part of a “bot army” used en masse to attack targets for denial of service and other sorts of irritations. The purpose is generally to bring down sites or just harass someone or some company.

More recently, we’ve seen malware kind of circle back, with ransomware. As in the early days, when the idea was to erase your hard disk, ransomware promises to permanently encrypt your disk if you do not pay someone money (typically in bitcoins) for a key. Millions of dollars have been made with this scheme.

All along, from the 1980s until the present, computer and OS and chip companies have been trying to make machines better than ever—and more secure. Instead they’ve just made everything more expensive and have generally allowed things to get worse.

Why? Because a lot of the best software and slickest ideas you ever see open the machines up to vulnerabilities, and that’s because people who design the coolest code have no background in security. They are not paranoid enough. They just do things because they’re so cool. It’s so juvenile in many instances.

With the new UEFI, the opportunity to get fancy at a more fundamental level will be irresistible to these same programmers. Once the better tools are available, you’ll begin to see some nifty programs. Then someone with skills and malice will come along, and your life will be ruined.

A handwritten signature in black ink that reads "John Dvorak". The signature is fluid and cursive, with a large initial 'J' and 'D'.

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