PC MAGAZINE

ROBOTS WANT YOUR JOB

DIGITAL EDITION
FEBRUARY 2016

PC MAGAZINE

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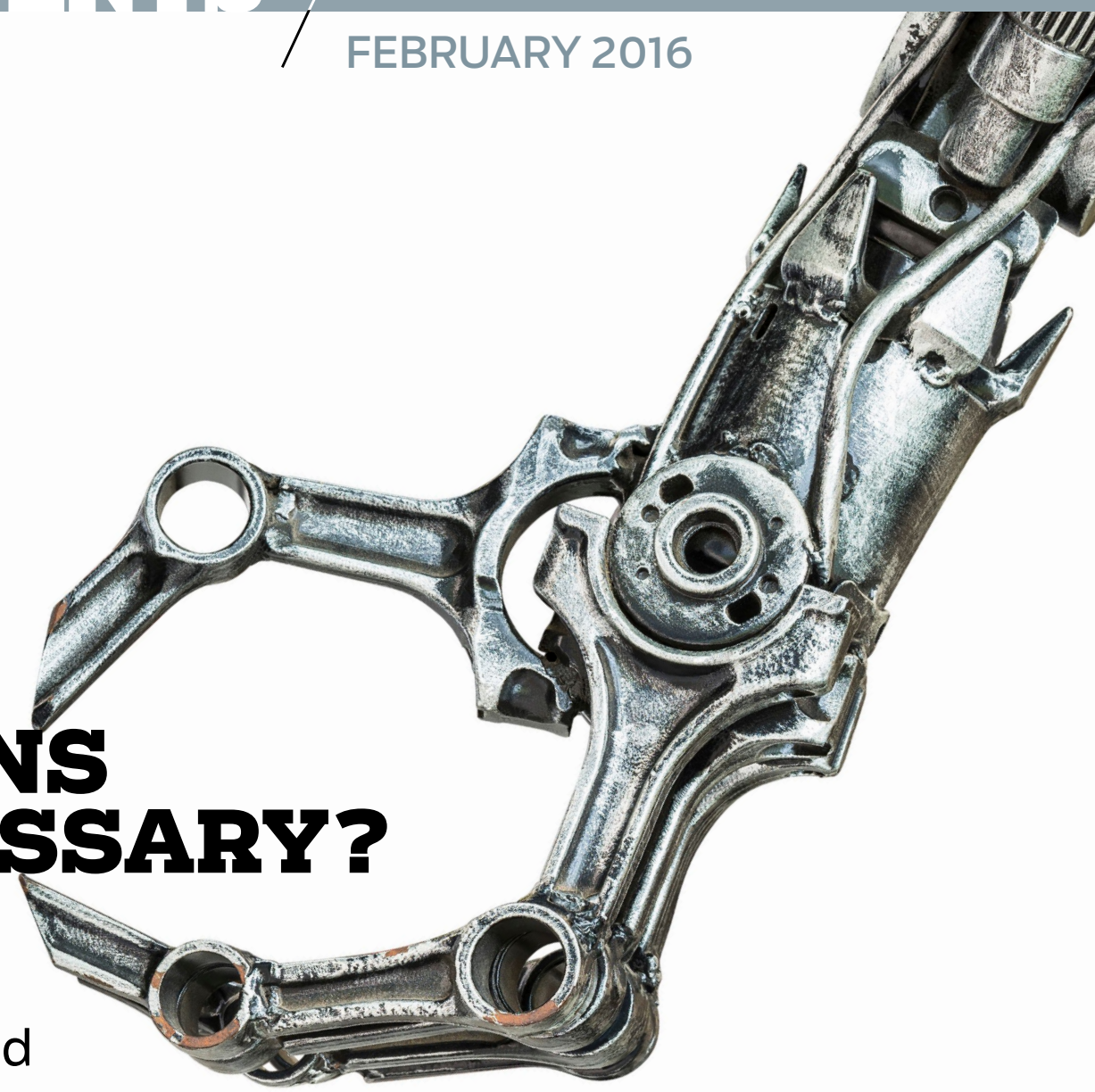

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ARE HUMANS EVEN NECESSARY?

Technology is replacing lots of jobs humans used to do. But this could point the way to a more positive and productive future for all of us.

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9 TRENDS AT CES

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FitBark Dog Activity Monitor

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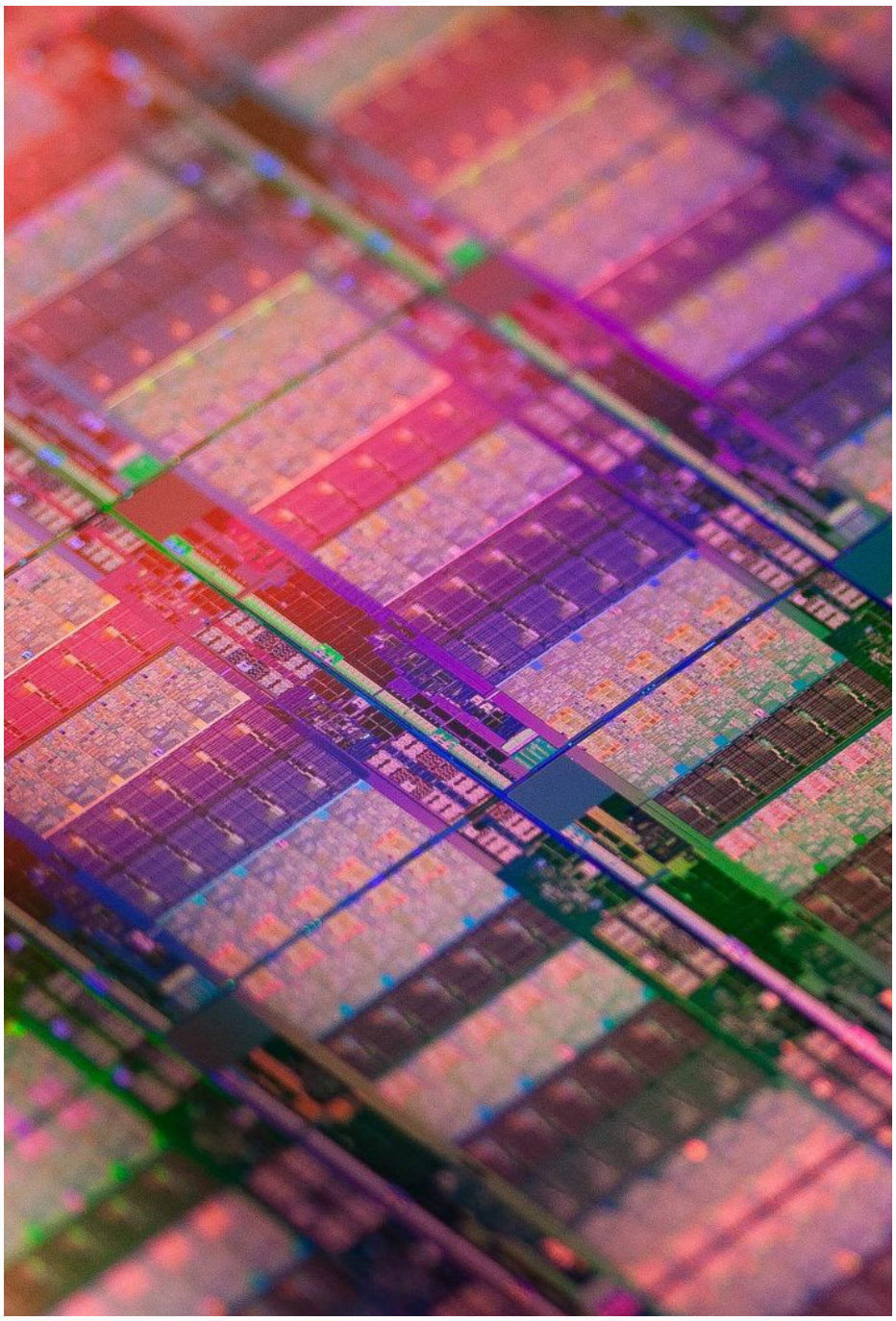

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The chip giant is pursuing revenue and innovation beyond the computer's confines.

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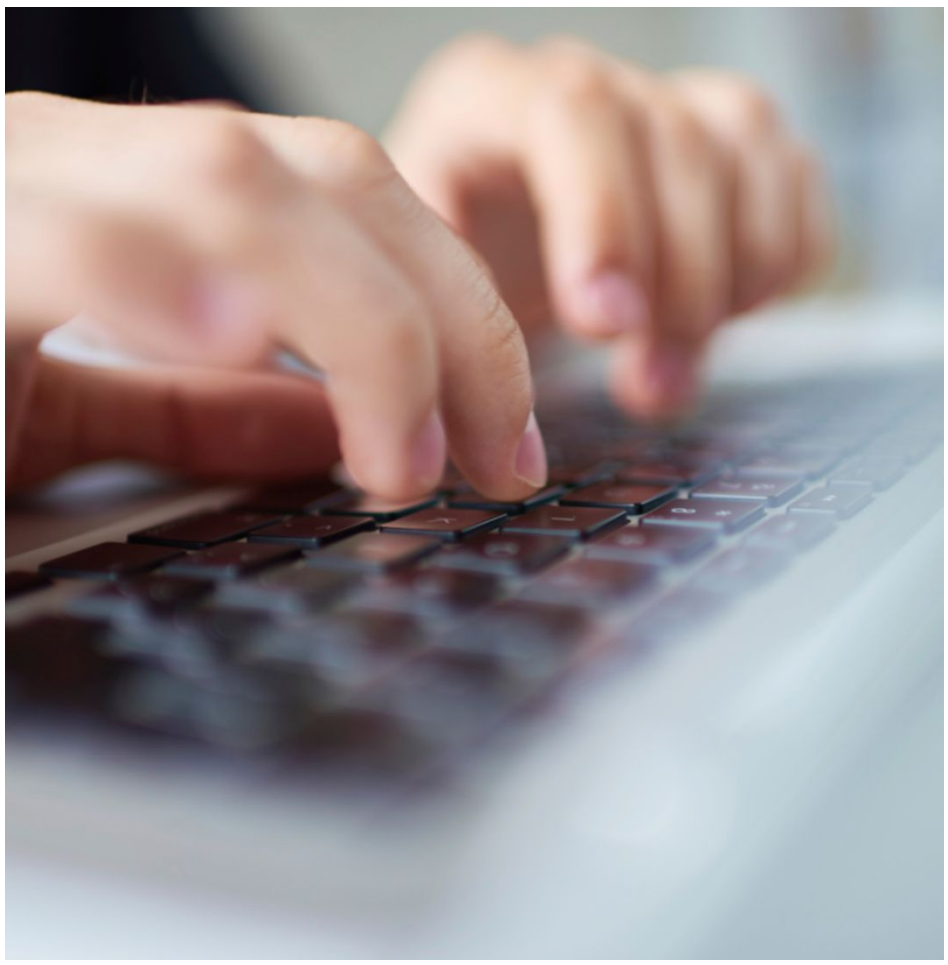

DAN COSTA

Robots Are Coming for Your Job—and Mine

I have a variety of terrible habits, but one of the worst is my tendency to bring up politics in polite company: family dinners, business lunches, Facebook conversations, even the pages of this fine magazine. I'm not trying to convert people to my way of thinking—not always, anyway. As the U.S. presidential election kicks into gear, it seems clear that voters are worried about their jobs. Donald Trump points to unemployed factory workers and blames China. Senator Bernie Sanders points to an unlivable minimum wage and blames Wall Street. I think we have a bigger problem. The freaking robots are coming for our jobs!

Of course, I'm using the term "robot" pretty broadly. Although we do cover robots, this month's cover story addresses technological automation and unemployment of all kinds. The takeaway is clear: Technology is doing a lot of the things we used to hire people to do. And that trend is going to accelerate.

Let's look at just three examples.

The automobile industry is one of the leaders in automation; every assembly line features some form of robotic assistance. The shift has led to significant cost savings. An automated spot welding machine can be operated for $8 per hour, compared with $25 per hour for a human worker. By some estimates, robots will be performing 30 to 40 percent of tasks in the auto industry by 2025. Competition from low-wage countries is a major problem for the U.S. auto-worker, but robots aren't helping either.

Then there's Uber. Love it or hate it, you have to respect how the company transformed the cab industry in just six years. In 2012, Uber had a handful of drivers mostly in San Francisco. Now it has more than 160,000 across the globe. Ironically, Uber is actively working to replace almost all of them with self-driving cars.

"We don't want to be like the taxi guys who came before us—we embrace the future," explained Uber CEO Travis Kalanick at a conference last year. "There's an insane amount of good that comes out of this [technology], which is why so many companies are working on this."

Perhaps you think some jobs could never be automated. My job, for example? Allow me to introduce you to a firm called Narrative Science. The company uses an artificial intelligence engine to analyze groups of facts and then create compelling narratives from them. Those facts could be a company earnings report or the stats from last night's football game. The company claims that the stories are indistinguishable from stories written by humans. Does it work?

Here's the summary from my last Fantasy Football game, generated by a similar company called Automated Insights. (I lost.) You tell me. "Down 0.18 on Sunday night, Vanity as Doreen came back, slipping by The Baldface Criers 94.48 to 90.56. Vanity as Doreen got 22.00 points from the Kansas City Chiefs Defense and 19.70 from Calvin Johnson. The GM of Vanity as Doreen hasn't needed nail clippers all season, biting their nails through two close wins this season. This makes it two in a row for Vanity as Doreen against The Baldface Criers. Their last matchup was a 119.88 to 74.44 shellacking in Week 7."

Not bad for a robot.

The nature of work itself is changing. The robots are coming. We need to figure out a way to make peace with them.

This transition will take some time. In November of 2015, the McKinsey Global Institute published a report saying that 95 percent of jobs will not be jeopardized in the next five years. But even those who keep their jobs will find them fundamentally changed. The report found that across 800 occupations, 45 percent of work activities could be automated. Even at the chief executive level, and estimated 20 percent of tasks can be automated. The change is happening now.

This technological transformation is real and largely beyond the control of our political system. Trump is not going to be able to wave a gold wand and "get Apple to build their damn computers and things in this country instead of in other countries." Senator Sanders could certainly raise the minimum wage, but that won't bring back the thousands of bank teller positions that were replaced by ATMs. The nature of work itself is changing. The robots are coming. We need to figure out a way to make peace with them. Or at least pay our bills.

Evan Dashevsky does a wonderful job of exploring these issues in this month's cover story. Give it a read and let us know what you think by e-mailing letters@pcmag.com.

dan_costa@pcmag.com

Better With a Band

I have a lot of family videos taken with a DV camcorder in 4:3 format that I would like to transfer to DVDs, but in 16:9 format without the black bands on the sides. Recently I have seen TV footage where the side bands are filled with either suitable colors or a fussy image. It seems like a good solution to the problem. Will other effects work? Are there effects standard in video editing software? Can you suggest a package that can do this well?
—Antonis Papanestis

OUR ANSWER:

You can import your 4:3 footage into video editing software such as CyberLink's PowerDirector or Corel's VideoStudio to get the effect you're looking for. Set the project for widescreen and you'll see the black bars at the sides. You can add another video track in the background to fill that side space. You can use any image in the second track. The software comes with background patterns you can use. In VideoStudio, for example, you choose Graphic from the Library panel and then Background from the Gallery drop-down. Then choose the desired background from the Library and drag it to the Video or Overlay track. Drag the edges of the background's entry in your timeline to match the duration of your main video.

Another option would be to use the software to resize the video frame. That means you'll be cutting off the top and bottom of the image.

Finally, PowerDirector can actually stretch your 4:3 content to fit 16:9 widescreen format. Right-click on the clip, choose Aspect Ratio from the context menu, and then choose Stretching Options. Note that this method will result in some distortion of your video content, but one of the stretching options is CyberLink Pano Vision, which attempts to minimize the distortion.
—Michael Muchmore, Lead Software Analyst

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.

What's New Now

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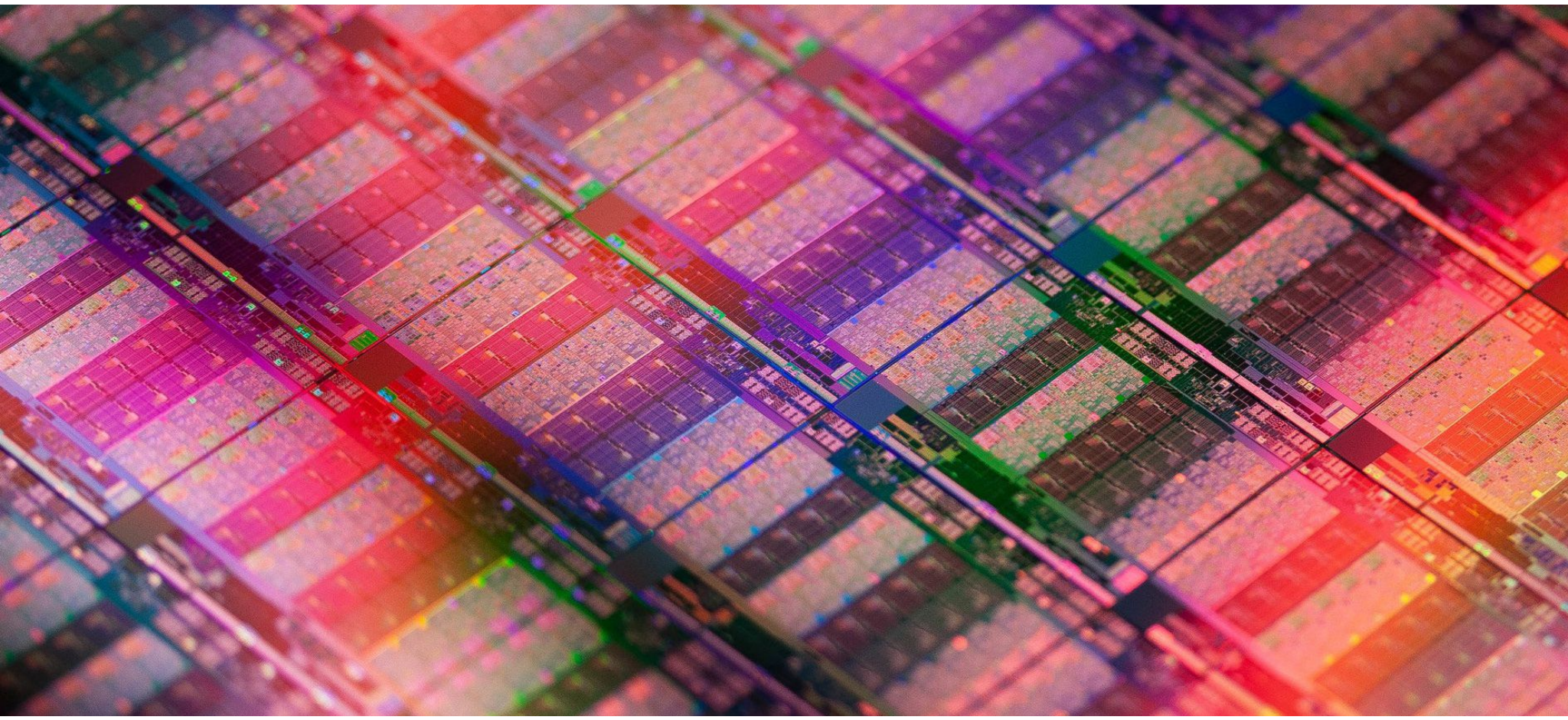
TOP GEAR

Intel Pursues Growth Beyond PC Markets

BY JOEL HRUSKA



For decades, Intel has been known first and foremost as a provider of CPUs. From the "Intel Inside" jingle to the company's preferred position as an enthusiast and gaming platform, Intel built its business on selling consumer processors for both desktops and laptops. The company has no plans to stop selling CPUs, but made it clear during its Q4 2015 conference call on January 14 that it's not looking to the PC market to drive growth, either.

"Taken as a whole, 2015 demonstrated the benefits of our strategy, which is designed to capitalize on the growing need for the infrastructure powering the smart and connected world," Intel CEO Brian Krzanich said on the call. "That strategy is also resulting and the evolution of our business model to focus on three keys areas of growth: the data center, the Internet of Things, and Memory. Our results reflect that evolution."

Those results are the relative growth and revenue of Intel's various business segments. The Client Computing Group fell 8 percent year-over-year, despite sequential growth in Q3 and Q4, and all-time-high volume shipments of both

ON THE ROADMAP At CES, Intel CEO Brian Krzanich explained how the company's full product base (beyond processors) will be "conflict free" in 2016.

Photo credit:Intel Corporation/Walden Kirsch

Core i7 and enthusiast K-class SKUs. Meanwhile, security revenue rose 6 percent, Internet of Things (IoT) revenue was up 7 percent, and data center revenue rose 11 percent. Intel's client PC business is still its largest segment, but company CFO Stacey Bright said, "Other businesses now make up about 40 percent of our total revenue, and 2015 marked the first year where these businesses made up the majority of our operating profit."

The question-and-answer portion of the call focused almost entirely on the progress Intel has made integrating field-programmable gate array (FPGA) manufacturer Altera, when it expects to sample combined FPGA+Xeon on a single piece of silicon (starting this year, with production volume by 2017), and a bit about expected sales in 2016 for enterprise customers. Almost nothing was said about Intel's mobile business and its various deals with Rockchip, TSMC, or any future smartphone wins. Its modem business got a brief mention, with Krzanich reiterating that the XMM 7360 4G LTE modem is in production and being validated by some interested customers.

Although not all of the decline in the Client Computing Group's revnue is due to combining mobile reporting into the PC client segment, the size of the drop suggests that Intel has made little progress reducing mobile costs. The fact that the company made no mention of its further plans for tablets and smartphones doesn't mean it's abandoning those segments, but it suggests they're going to take a back-burner position, at best.

Intel would undoubtedly dispute this argument, and Krzanich did declare that Intel was "very confident" about the XMM 7360 and the designs that come after it, as well as claiming that Intel had hit $1 billion in mobile profitability improvements. The lack of detail on any of these claims, as well as specific figures on shipped hardware, new customer wins, or new partnerships—none of it points to positive news, particularly given that customer wins and partnerships are precisely what Intel needs to demonstrate if it wants to gain

market share in tablets and smartphones without relying on contra revenue to make up the difference.

Mark Hibben of Seeking Alpha recently wrote that "[t]he death of x86 may be painful and protracted, but it looks increasingly certain," because to date, we've seen precious little cross-pollination between software stacks and device compatibility that would functionally enable such migration. The consumer PC market will likely continue to contract until it reaches long-term replacement-level stability, but businesses aren't going to shift from Windows to Android or iOS without guaranteed backward-compatibility and substantially more enterprise features than either firm has offered to date. Windows RT was supposed to be the OS that would make it possible for Android systems to go head-to-head against x86 devices running Windows—and Windows RT died an ignominious death.

The consumer PC market will likely continue to contract until it reaches long-term replacement-level stability.

Where I agree with Higgen, however, is that the x86 market is essentially bifurcating. On one hand, you have power users, workstations, data centers, and gamers—all groups that need access to high-end CPU performance and the solid-state drives, GPUs, and other equipment that come with it. On the other hand, you have businesses and some home users who want a PC either because it's what they're comfortable with, for backward-compatibility, or because desktop PCs in particular tend to offer a better price/performance ratio than comparable laptops. Outside of these areas, Android and iOS continue to present a significant threat.

Given that there are no ARM SoCs even attempting to compete in the 45-watt and higher form factors where x86 dominates both performance and sales, I don't think x86 is in any danger of losing this market. Intel's move to focus on IoT and its memory business, including the 3D XPoint memory it announced last fall, suggests that the company isn't willing to sit on x86 and wait for the sky to fall. If Intel can't dominate the mobile industry, it's going to try its hand at other types of products.

Meet Josh: Jeeves For the 21st Century

BY SOPHIA STUART

NO JOSHING
Can't afford a butler of your own? No worries. The new AI-powered Josh from JStar can answer all your questions and cater to your whims, no matter where you are.

Ready to have a rapport with your residence? Meet Josh, a new AI-powered home management system, with a personality of its own (actually several, but more on that later).

Picture the scene: You've just arrived off a long-haul flight from Hong Kong after another successful business trip. While in the high-speed electric overground transit from the airport, you call home.

It answers.

"Hello."

"Hi. I'm heading home to the apartment in Manhattan."

"ETA in 25 minutes?"

"Sounds about right. Thanks for checking the traffic."

"Sure thing, boss. So, at 05:13 hours, transitioning temperature in the library to 72 degrees, master bedroom to 71, lights to 'attractively dimmed,' audio

JSTAR STARS
Tim Gill (left) and Alex Capecelatro bring experience with natural language processing and smart apps to their work on Josh at their company, JStar.

streaming to Coltrane, assessing filtration levels for a hot shower in ensuite bathroom and powering on ice cube maker."

"Thank you."

"You're most welcome. Please let me know if there's any other way I may be of assistance."

It sounds like a scene from *Her*. And in fact, Josh's creators, Alex Capecelatro and Tim Gill, did name one of their beta test home systems Theodore Twombly in homage to director Spike Jonze's 2013 utopian-dystopian film. *PC Magazine* went to Beverly Hills to meet Capecelatro and Gill at Beta 1, a home outfitted with the Josh system.

Gill made his fortune with Quark, the content automation platform he founded in 1981. He's since been busy with natural language processing, artificial intelligence systems, and other deep mathematical geek conundrums.

Capecelatro, meanwhile, has never known life before AI (or the Internet, for that matter). A two-time software start-up founder himself, he launched smart social network app At The Pool, which became cool place finder Yeti; he sold both before the age of 28. Prior to that, he did stints as a research scientist at the Naval Research Lab and worked on the Karma concept car at Fisker Automotive.

The two met when Gill became an advisor to Capecelatro's last company. They started talking about the potential for true AI and JStar was born, with Capecelatro as CEO and Gill as CTO.

"My initial motivation was to have something to do," Gill said, laughing. "I've been playing with natural language systems and voice response systems since high school. I cannot be away from computer programming for very long, and Josh has kept me occupied for 50 to 60 hours a week for the past two years."

The time is right for sophisticated automation: We now have natural language processing, text-to-speech, and the Internet of Things (IoT), with many available smart-home-based devices like Nest, Sonos, and Lutron, all of which work with Josh. This stuff is no longer vaporware. But there's a catch.

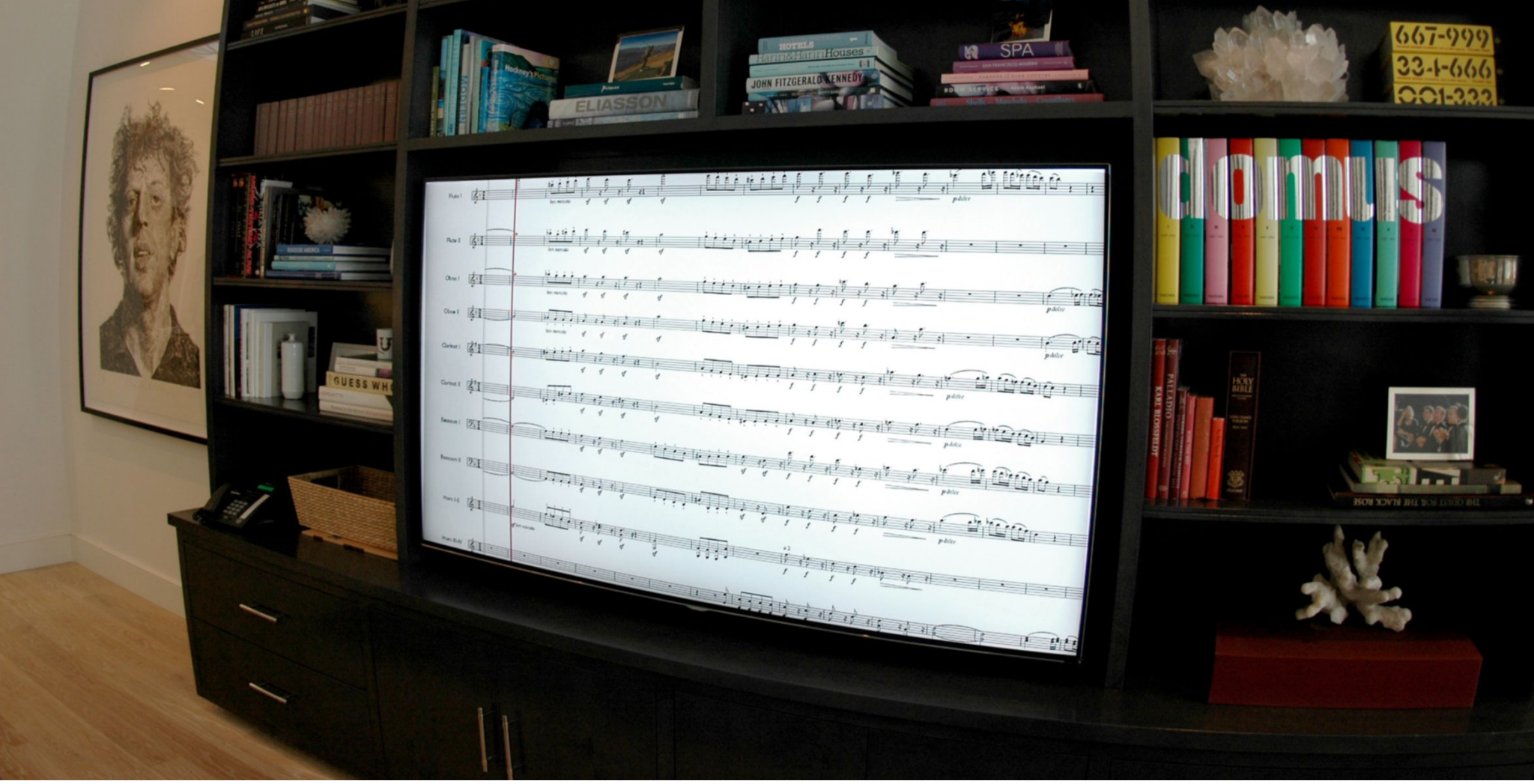
"Each of those devices we support—and we want to be device agnostic—is unique unto itself," Gill said. "There are no actual standards for IoT. That's what we wanted to build."

"Right now," added Capecelatro, "you'd either have to spend hundreds of thousands on a custom integrated system to connect them together, or you'd have 20 different apps to manage them. We thought there was a better way. What if you could just talk to your house?"

To accomplish that, Capecelatro paired his expertise in recommendation engines with AI-based pattern recognition. Basically, Josh learns more about its owner over time to become smarter.

It was time to see it in action. Capecelatro spoke conversationally into his phone. He selected the male voice (the aforementioned Theodore), but there are a variety of options (such as a female voice from India) so international customers can customize their Josh as they wish.

WARM FRIENDSHIP
The Nest Learning Thermostat (below) is one of the many smart home devices that works with Josh.



After a few runtime scenarios—asking about the temperature in different rooms, turning lights on and off again, then revealing the hidden cameras in the room—Capecelatro said, “Play Nina Simone.”

“Playing Nina Simone’s ‘I Put a Spell on You’ from Spotify,” Josh responded.

The sound system was sublime. The entire ground floor of the house filled with the soaring string section.

So how does it work?

Josh runs on J++ (not to be confused with Microsoft’s Visual J++), the software language Gill created by extensively modifying bits of C++ and building in self-diagnostics. This means your house can tell you not only that the thermostat in the bathroom upstairs is malfunctioning, but it can request a software upgrade patch and a hard restart to the heating system while you’re out of town. Clever stuff.

Josh exists both in the cloud and locally within your home network. If your Internet connection goes down, Josh can still work, though cloud-based individual components, such as Nest, will not.

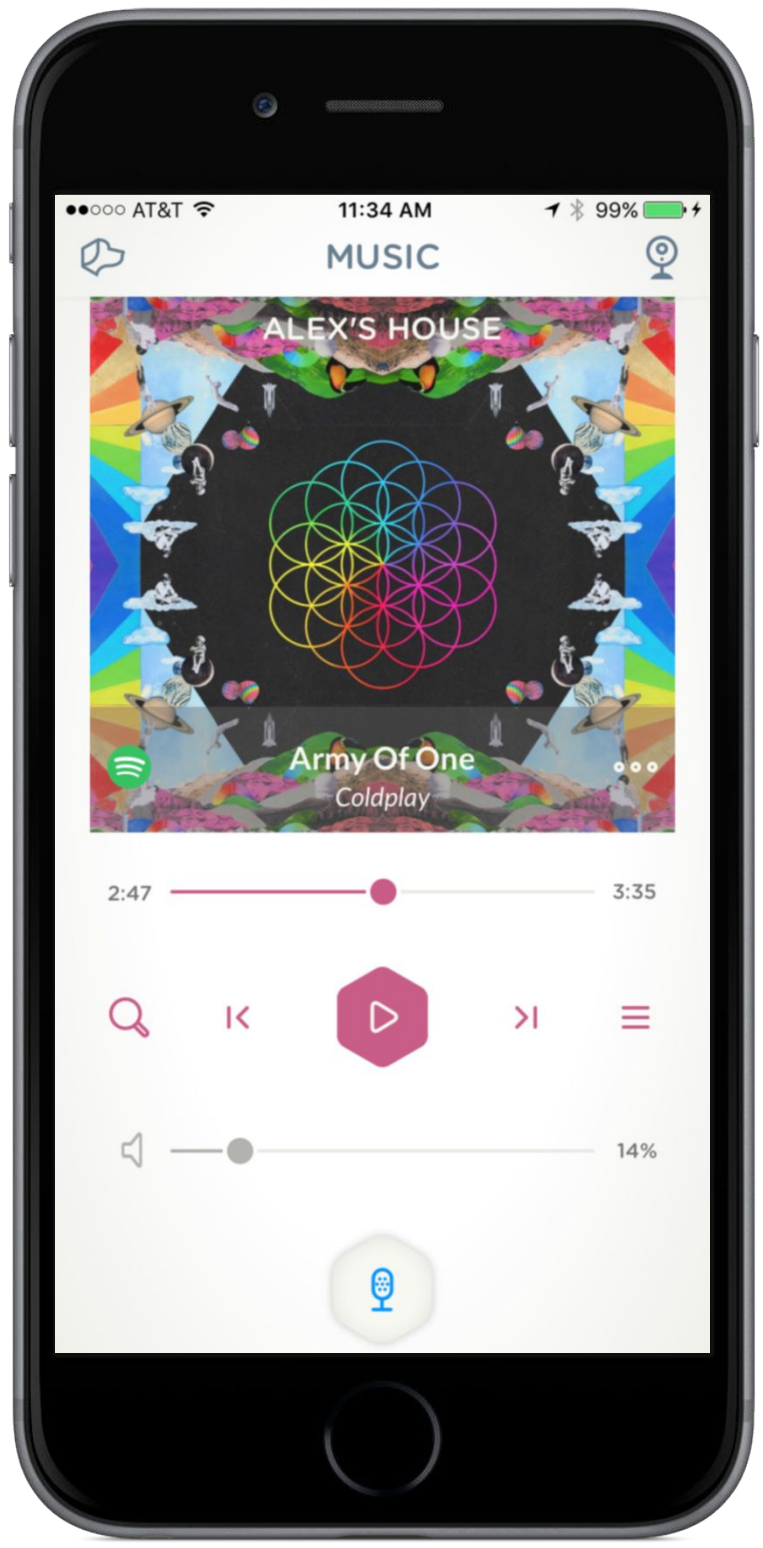
There is significant investment in security and an override for every device that has one. Switches will still turn lights on and off. But don’t lose your front door key, just in case, and obviously reconsider tricking out your house upstate with any pod bay doors that don’t have manual locks.

JStar is committed to staying nimble during this early stage. The entire company is less than a year old and Gill and Capecelatro want to get it right rather than go mass-market instantly. Installation starts at $10,000, with a

$5,000 deposit. That includes a dedicated Josh server that plugs into the Wi-Fi router and an electrical outlet, full customization of your house, as well as apps to control and monitor things at home and remotely.

"The plan is to be very controlled with the rollout," confirmed Capecelatro. "We have 285 people signed up to be beta testers, but we don't want to build out more than five a month, which is why we're only focused in the U.S.A. right now. We need to be able to get to the home easily, set it up, test, debug, and so on."

"Every home is different," said Gill. "For example, we're sitting here in Beta 1, which has Sonos Play:3 speakers, but we just went into a home that had the latest version and we needed to write new components for the Sonos Playbar to control them via Josh."



So what about plans for the future once smart houses, like the smartphone, become standard-issue? JStar is keen on opening up Josh to third-party developers.

"Quark was made successful for a variety of reasons," Gill said. "But one was because it was a platform that third-party developers could write for. It's incredibly important to do the same here. We've made Josh open so that we can support that. Theoretically, someone could write a translation program into French. If someone can make the platform do more, that's great, because we'll sell more Josh servers in the end as a result."

Of course, the IoT isn't just about what's inside the home. It will also be about responsive infrastructure in cities and a host of other scenarios.

"We want Josh to be able to talk to everything," Capecelatro said.

"And we want you to be able to use whatever you want to talk back to Josh—a phone, tablet, TV—I don't really care," agreed Gill. "Essentially, we're building Josh to be an OS for the entire IoT universe."

In Going Global, Netflix Curbs Proxy Use

BY ANGELA MOSCARITOLO

Using a proxy to watch movies and TV on Netflix that aren't available in your geographic region? You'd better binge on that content while you can, because it probably won't be available for much longer.

Netflix in mid January announced a new effort to crack down on proxies or "unblockers," like VPN services, which help users fool the company's systems into thinking they're in a different country and thus access additional content not available where they live or are traveling.

"In coming weeks, those using proxies and unblockers will only be able to access the service in the country where they currently are," Netflix's Vice President of Content Delivery Architecture, David Fullagar, wrote in a blog post. "We are confident this change won't impact members not using proxies."

The change comes after Netflix announced a huge international expansion that makes the streaming service almost global. Netflix is now available in 190 countries, but the service has a long way to go before it offers the same films and TV series everywhere.

The company currently licenses content by geographic territories, meaning the TV shows and movies available on the service differ, to varying degrees, by region.

“We look forward to offering all of our content everywhere and to consumers being able to enjoy all of Netflix without using a proxy,” Fullagar wrote. “That’s the goal we will keep pushing towards.” But for now, the company will “continue to respect and enforce content licensing by geographic location.”

The news comes about a year after reports that Netflix was cracking down on those who used VPN services to bypass content restrictions for their geographical locations. Netflix, however, said that was nothing new. “We use industry standard methods to block VPNs. Always have and always will,” a Netflix spokesman said at the time.

In 2013, though, Sony Pictures Television executive Steve Mosko said Netflix does “not closely monitor where some of their subscribers are registering from and don’t take steps to counter circumvention websites that allow people in.”

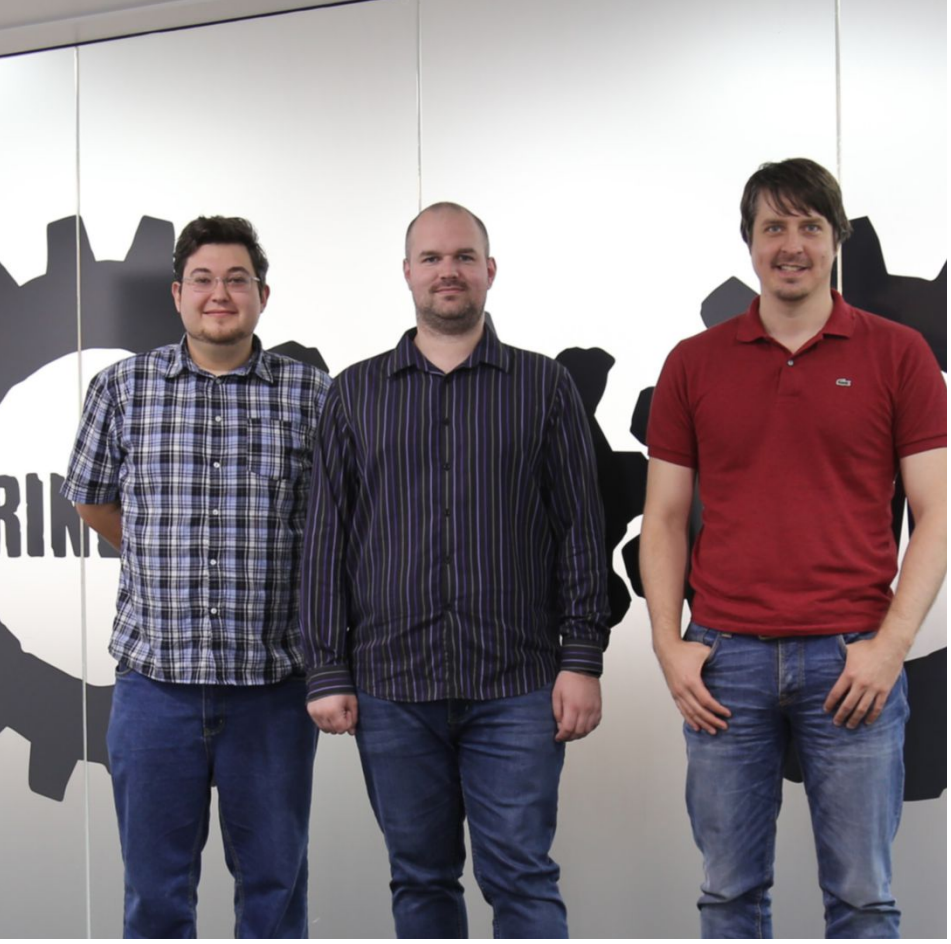
Pressure from studio heads likely influenced Netflix’s most recent decision. Those studios are likely less inclined to license their content to Netflix if the company cannot ensure that geographic restrictions will be enforced.

Path of Exile's Path to Indie Success

BY CHARLES BATTERSBY

Back in the 1990s, PC gamers couldn't throw a rock in a Software Etc. store without hitting a shelf of Diablo clones. By the mid 2000s, the Diablo-style action RPG (ARPG) had gone out of fashion for most players, and Diablo III wouldn't arrive until 2012. During those in-between years, a group of ARPG fans took matters into their own hands and made the game they wanted to play. This group eventually became the indie studio Grinding Gear Games. The company's game, Path of Exile, has just celebrated its third anniversary online—where it is completely free, no strings attached—and is slated to release its fourth expansion pack, Ascendancy, early this year.

We spoke with Managing Director Chris Wilson about what's made Grinding Gear Games successful, and why Path of Exile is different than every other game in its genre—including the title that inspired it.



GRINDING GEAR GUYS
Grinding Gear Games coworkers Chris Wilson (above left, center), Jonathan Rogers (left) and Erik Olofsson founded their company in New Zealand. Their first release: the free action ARPG Path of Exile.

"We literally started out in my garage, with the three of us in New Zealand," said Wilson about the team in its infancy. "We felt that there was a big gap in the action RPG genre. Titan Quest had come out [in 2006]; it was fun, but it didn't have online servers. It had been a long time since there had been talk of anything Diablo-related from [developer] Blizzard. We thought, 'There's a gap here.' There were a lot of people who enjoyed playing games like Diablo II, who had nowhere to play apart from Diablo II. That was getting on to six years old at the time."

The irony behind Path of Exile's development is that Blizzard was actually hard at work on its Diablo sequel at the same time, and Diablo III launched while Path of Exile was still in alpha testing. "I remember the moment, watching the announcement," said Wilson about Diablo III's unveiling. "It was an interesting moment for me personally, because as a big Diablo II player I was very interested to see where they would go with Diablo III.... But also I had a slight amount of disappointment personally from the announcement day because it wasn't [what] I was personally hoping for as a gamer. And that helped us double down on trying to make the action RPG that we wanted to, and one of the reasons that it ended up being very different from what Blizzard did.

"Path of Exile is a game that is very much about character customization in a way where there's a lot of depth in how you can combine your various skills and items," Wilson explained. "So we have a passive skill tree that contains 1,400

nodes on a gigantic web. Your choices on this tree, which are both semi-firmly locked in and very versatile, enable you to create a character that's going to be different than everybody else."

Wilson explained how one key difference between Diablo III and Path of Exile is that the former lets players easily change their characters' skills, with few limitations on when they can "respec." He elaborated on the consequences this can have for players: "If you and I are playing through [Diablo] together, and you're playing a barbarian and you've got a cool character build, if I like that I can press a few buttons and have exactly the same character build in seconds. Completely discarding everything that I've done for my own build before… The ability to trivially respec from one thing to another takes away the ownership of your character, prevents it from feeling like yours. It's the kind of thing where you Google 'how to make a monk' and then make that. That shortcuts a lot of the emergent gameplay that you get by playing through and working out how to make the best character of your own."

The designers of Path of Exile try to cater both to old-time ARPG fans and to people who have never tried Diablo. "We want the game, at face value, to be fun," Wilson said. "You can run around, click on the monsters, fight them, and it's hopefully relatively easy to play. That's because the bulk of our new players come from the League of Legends generation: people [who are] in their early 20s now, and haven't necessarily played a lot of Diablo II. We have a core of hard-core players who have sought refuge from modern games in our game, and they're the people who take the character builds to the next level, and create spreadsheets and try to work out the perfect way of building a certain character. We generally find that the new players will often adapt into the becoming the experienced hard-core players over time."

When asked about players taking refuge from modern games, Wilson cited how many RPGs target a mainstream audience, making their potential player base larger, whereas Path of Exile "has a few barbs in it. There are some places where our game is a little more hard-core."

There is, however, also Path of Exile's free-to-play business model, and the pitfalls that many such games fall into. "It's very possible in most [free-to-play] games to buy some form of advantage with money," Wilson said. "For a lot of our older generation of players who are used to a game being competitive, and their progress mattering because they put the effort in, it's important to them that you can't purchase such progress."

Path of Exile's microtransactions are based on cosmetic additions, rather than anything that tangibly affects gameplay, Wilson said. "You can dress up your character to look really cool, buy armor sets, get pets. But none of these do anything to make you stronger—they just make you feel a lot more cool and show off to other players. On the other level, we sell Supporter Packs, which contain the credits that you use to buy these microtransactions, and the Supporter Packs contain as much interesting stuff as we can throw in. So there's physical merchandise, physical comic books, T-shirts, art packs. We include the ability in the more expensive ones for players to contribute designs to the game that are used to add items to the game—and they don't get these items, because that would be an advantage. But everyone else can find them."

What We Love Most This Month

BY STEPHANIE MLOT

JUNE

Just because you're not prancing around the beach in shorts and flip-flops doesn't mean your skin can't be damaged by the sun's rays. This year, spoil your health-conscious sweetie with a wearable beauty coach that helps fight premature aging from UV exposure. The wraparound June bracelet notifies the wearer before a sunburn appears, and reminds about reapplying sunscreen and putting on a hat. Available in platinum, gold, or gunmetal, the smart accessory syncs with a free iOS app.

$129 junebynetatmo.com

What We Love Most This Month

BY STEPHANIE MLOT

FOSSIL Q FOUNDER

Can't afford that Apple Watch your beau has been craving? Timepiece maker Fossil recently debuted its Q Founder smartwatch, with customization, notifications, and activity tracking to fit any man's style. Powered by Android Wear (but also compatible with iOS) and engineered with Intel Innovation, the device boasts an estimated 24-hour battery life, Bluetooth capabilities, and a slew of applications. Choose between the brown leather or stainless steel bands to match his personality.

$275-$295 fossil.com

What We Love Most This Month

BY STEPHANIE MLOT

VIDDY

Couples who DIY together stay together. The Viddy build-it-yourself pinhole camera from Photojojo promises before-and-after fun. Pop out the screen-printed pieces and assemble them in about half an hour. Then load the cardboard creation with standard 35mm or medium-format 120mm film, point, and shoot. Capture your favorite moments together, create a photo-based scavenger hunt, or just prop the camera on a shelf for vintage-inspired decor. Download the Pop-up Pinhole Exposure Calculator app to learn more about manual shutter speeds.

$40 photojojo.com



What We Love Most This Month

BY STEPHANIE MLOT

AXIS VIDIUS DRONE

Size does matter—especially for the world's smallest first-person-view drone. The Axis Vidius Drone can soar up to 100 feet away, performing 360-degree rolls while recording and streaming live video. Control the machine from an Android or Apple device, or the included 2.4GHz controller; the live video feed is transmitted to your phone or tablet over Wi-Fi. Learn tricks to impress friends, tease the family pet, or just live out your daredevil fantasies without leaving the couch.

$95 axisdrones.com

What We Love Most This Month

BY STEPHANIE MLOT

PLANTLINK

Nothing says "relationship goals" like keeping a potted plant alive. You don't need a green thumb to keep up with PlantLink—just stick the two-pronged device into soil indoors or out, and the system automatically learns the watering needs of your vegetation. Users can set up watering alerts via email, text, or push notification. And you'll never have to wonder whether the neighbors topped up your Venus flytrap while you're away: The app can remind others to water your plants for you..

$79 (additional Links cost $35 each) myplantlink.com

Opinions

SASCHA SEGAN

TIM BAJARIN

WILLIAM FENTON

The Android feature phone movement isn't new, but now might be its time.

SASCHA SEGAN

IS ANDROID THE FUTURE OF FEATURE PHONES?

Is Android the Future of Feature Phones?

Feature phones are about to be reborn.

The $270 Kyocera Dura XE for AT&T looks and works just like flip phones have for 15 years or so. It flips open, it has relatively fixed functions, and it has no app store. But under the hood there's a strange amount of power for an easy-to-use flip phone: a Snapdragon 210 processor, 1GB of RAM, and... Android.

The Android feature phone movement isn't new, but now might be its time. The strategy has been used to implement push-to-talk before in 2011's Motorola i886, and to run music apps on 2012's ZTE Chorus. More recently, Sonim built a high-end corporate Android feature phone in the XP5. But a big wave may come soon because Android-compatible chipsets are much cheaper than they used to be, and the wireless carriers are demanding a truly non-feature-phone-compatible feature: Voice over LTE (VoLTE).

VoLTE is huge for the U.S. wireless carriers. LTE is much more efficient than older cellular technologies, and switching customers to VoLTE lets carriers shift their spectrum away from older technologies and accommodate more customers. VoLTE, which can include "high-definition" voice and rich calling services such as IM and video calling, will eventually replace standard voice calling on all four major networks, executives have said at various times.

Sascha Segan is the lead mobile analyst for *PC Magazine*. His commentary has appeared on Fox News, CNBC, CNN, and on radio stations and in newspapers around the world.

And VoLTE is definitely the future. AT&T, T-Mobile, and Verizon have all launched it, and Sprint CEO Marcelo Claure says his carrier intends to do so as well.

Kyocera representatives have said that for the DuraXE, AT&T wanted its "enhanced push-to-talk" capability and VoLTE, and those aren't available on the older feature phone operating systems. I've been unable to find any feature phones that support VoLTE, even globally.

Kyocera isn't the only company working on this. I've heard from several other manufacturers who want to remain unnamed that they're working on Android-based feature phones.

FEATURE PHONES HAVE A FUTURE

The CTIA, a wireless trade organization, estimates that about 22 percent of the 355 million total "connections" in the U.S. are feature or messaging phones—that's 78 million devices. That number jibes with what I've heard informally from Verizon, where various people have told me that 20 to 30 million dumbphones remain on their network.

Ian Chapman-Banks, the CEO of Japanese manufacturer Freetel, sees an ongoing market for flip phones. His solution to consumers demanding feature phone form factors, for now, is the Musashi, a powerful dual-flip Android phone with a $249 list price.

"We make feature phones; even in Japan, they buy feature phones," Chapman-Banks said. "If you reach a certain age, you don't want to change, and why should you?"

Kyocera is protected by the Dura XE's corporate focus, which lets it sell its rugged feature phone for $270—far more than, say, the $20 Blu is charging for its Tank II phone.

MediaTek supplies many of the chipsets for those existing feature phones, and according to company president C.J. Hsieh, it's still tough to supply Android-compatible hardware, which gets down to the prices most people expect from feature phones.

"It's still not easy to move [feature phone customers] to the Android platform," Hsieh said. "They don't like it; it's too complicated, and the cost is a little big because of the footprint of the Android platform."

There may be a way to slim down Android, MediaTek's general manager Finbarr Moynihan points out: Get rid of the Google services, which add a lot of weight to the package. "There are very different cost structures for software and memory," he said. "Closing that gap isn't so easy because it's not just Android, it's Android plus GMS."

Moynihan and Hsieh also point out that there's still a large market for super-inexpensive and basic 2G phones in the developing world, even if U.S. and Japanese carriers are starting to push hard to get away from 2G devices.

> **There may be a way to slim down Android.**

CAN APPS FIT IN?

The main danger here is a missed opportunity.

Although the manufacturers I've spoken to are working with Google to get some sort of stamp of approval for their feature phones, I haven't heard about any sort of consortium or coordination to allow for consistent interfaces or app compatibility across manufacturers' devices.

There's precedent for that, too. Back in 2008, a bunch of manufacturers tried to create a Linux-based middleware platform for semi-smartphones called LiMo, which ended up being folded into the Tizen OS. Of course, LiMo and

Tizen both failed as standards (Tizen ended up becoming a Samsung-only project), which doesn't speak well for mobile OS standards formed by consortia. Maybe there are just too many cooks in the kitchen that way.

Some sort of consistency in the platform would allow for third-party developers to create apps and games for these budding feature phone platforms. Don't necessarily think of Candy Crush here; think of corporate GPS, asset tracking, line-of-business, and fleet-tracking apps for business feature phones, for instance. The need for those kinds of apps has been driving longtime rugged feature phone maker Sonim toward smartphones.

A common platform would also make the phones cheaper, more reliable, and quicker to come to market, as they'd be able to run common code for "apps" like VoLTE, push-to-talk, and carriers' account management apps.

Over the holidays, I had a long chat with my in-laws about how they want to upgrade their Verizon flip phones, but don't have a lot of available options. (They need world phones, and Verizon has only two world feature phones out right now.) From what I'm hearing, they—and the millions of other feature phone users who may need new phones, but want quality phones that aren't big touchscreen slabs—may only have a year or so to wait.

"A common platform would also make the phones cheaper, more reliable, and quicker to come to market."

sascha_segan@pcmag.com

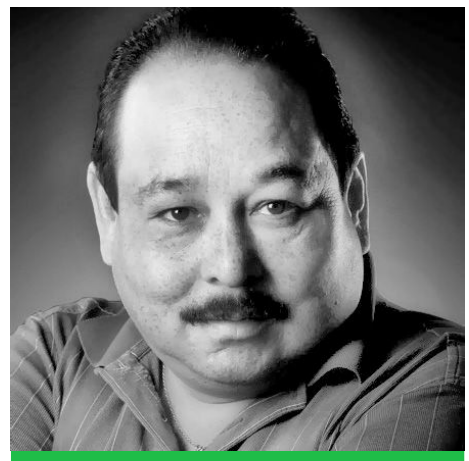
Why I'm Warming to Two-in-Ones

Ever since two-in-ones were introduced about five years ago, I've been skeptical of the form factor.

The idea of marrying a tablet and a keyboard was a disconnect for me. Part of the reason is that I am a diehard laptop user. My love affair with laptops goes back to the early 1980s, when I used a pseudo laptop, the Tandy TRS 80, as a portable word processor. Then in 1984, I was asked to work with IBM's research group on what became its first full-fledged laptop. Ever since then, a laptop has been my go-to computing device. I have used desktops from time to time, but because I travel so much, a laptop has long been my primary computing tool.

My first foray into the two-in-one concept was with Lenovo's Yoga. The screen did not detach, so I used it as a traditional laptop—never as a tablet. My first real experience with a tablet-keyboard combo came through Microsoft's first Surface product, and that experience was so bad that it put me off this type of device for a couple of years. I have to admit that I did use a Bluetooth keyboard with an iPad from day one and liked the mobile flexibility it gave me for things like email and notetaking. But it never replaced my laptop; I could never do the kind of heavy lifting with it that a true laptop delivers.

But over the last two years, the technology to deliver a more robust two-in-one experience has



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

gotten much better. In fact, there are two products I think might be pointing us to the next major shift in portable computing. Microsoft's Surface Pro and Apple's new iPad Pro are at the moment the best of breed in two-in-ones.

The design and the keyboard on my Surface Pro 3, coupled with Windows 10, make this two-in-one a good mobile computer. It delivers the power of Windows and, even given its lack of a large pool of touch-based apps, I can see how it could be a laptop replacement for some people. But I still struggle with its layout and smaller fonts, and am not convinced that it could replace my Yoga or my Dell XPS 13 as my full-time portable computer. Call me old-school when it comes to the Windows platform, but these traditional laptops still seem a better fit for my needs.

As for the iPad Pro, at first I really struggled with such a large iPad and its keyboard case. Although I'm a power user on the Mac OS platform, I spend most of my mobile digital time on an iPad Air and am more proficient with iOS. But I was not a big fan of Apple's keyboard case and could never become comfortable using its keyboard. And because I am artistically challenged, even the Pencil was of little use to me. I did try to take notes using the pen, but considering that I can't read my own handwriting, that was not a big draw, either.

But by using my favorite Bluetooth keyboard, the iPad Pro started to live up to its potential for me. The 13-inch screen is equal to those on my Dell and Lenovo laptops, and because I use iOS so much, using touch to navigate was very easy.

When Tim Cook announced the iPad Pro, he said it could do as much as 80 to 90 percent of

what anyone could do on a traditional laptop. On a recent trip, I decided to try out that theory. I only took my iPad Pro with me and used it the way I would my MacBook or a Windows laptop. I found that, in general, Cook was right. I did email and text messages, took notes, wrote and edited my columns, and used it for video, movies, music, and Skype videos with clients. My only problem with the iPad Pro is that it's not as easy to cut and paste in iOS as it is in Windows 10 or Mac OS X, but that was minor compared to its actual ability.

Intel and Microsoft have a goal to make two-in-ones and convertibles, or products like the Yoga, as much as 50 percent of the overall laptops shipped by the latter part of this decade. They are convinced that the flexibility a tablet-laptop combo gives a person is so valuable that they, along with their OEM partners, are working hard to make these devices sleeker, more innovative, and flexible.

Although I was skeptical of this goal at first, I am starting to come around. The jury is still out on how successful Microsoft, Intel, and their partners will be in getting the majority of laptop users to move to these new mobile computing form factors, but it's no longer a foreign concept to me, at least.

“The jury is still out on how successful Microsoft, Intel, and their partners will be in getting the majority of laptop users to move to these new mobile computing form factors.”

Turning the Page on Library Digitization

Most of the recent coverage of the New York Public Library has tended to focus on the 187,000 high-resolution digital images now available to visitors, and with good reason. Patrons near and far can download high-quality versions of everything from medieval illuminated manuscripts to the correspondence of Alexander Hamilton. NYPL not only allows users to make wall-sized prints, animated GIFs, and digital wallpapers, it also encourages and kindles experimentation through a Remix Residency program. Staff even added a public data snapshot on GitHub to enable scholars to perform bulk analysis.

What was lost in the hubbub, though, is that the electronic content we praise today was developed—and in some instances made available—some time ago. That is, the NYPL news is less the apogee than the continuation of carefully coordinated efforts of dozens of library staff across various groups and subgroups of a vast institution.

In many respects, the NYPL's announcement was two decades in the making. In fact, archivists might suggest the process began still earlier, when librarians determined which assets to keep. In terms of digitization, however, the process began when vendors began to digitize holdings in the late 1990s. At the fulcrum of that process is NYPL Labs, which effectively project manages the

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digitalization of images and metadata. Josh Hadro, the Labs' deputy director, explained to me the process behind the process.

Digitization begins, but by no means ends, with scanning items. An atlas might travel from the maps division to the digital imaging unit, where photographers capture the highest-quality electronic representation. Then staff members catalog, process, and physically relocate the item. The metadata services unit helps connect that data to the digital asset and to ensure the connections to the original cataloging record remain intact. Concurrently, the copyright and information policy group evaluates the atlas and attaches copyright information using something called a rights statement.

All that information—the digital asset, metadata, and copyright—travels to the applications development team, which creates the infrastructure that enables data to flow into an open-source repository called Fedora. That information is represented in the library's Archives portal as well as the Digital Collections platform. In the past, Digital Collections served images suitable for the Web. Over the past several years, however, the applications development team built custom software that cut derivative images and served archival images (TIFF files) for any item with a public domain rights statement. Finally, alongside the coordination of the all of these groups and subgroups, NYPL Labs product R&D group developed projects to showcase materials.

All of this back-end work means that patrons need not possess a library science degree to locate print-quality images. Items available in the public domain are tagged "Free to use without restriction" and available for download in highest

possible resolution. That imagery is generous: I downloaded one image upwards of 240MB. When images are not available in public domain, users are directed to the appropriate library division. For example, items in the Merce Cunningham Archive direct users to visit the Library for the Performing Arts.

Just as the public domain announcement relied upon dozens of staff working hand in glove, that cumulative undertaking demanded carefully cultivated tools and platforms that culminated in the establishment of the wide-ranging Digital Collections in 2013. The NYPL's announcement is less the culmination than a milestone in the maturation of the Digital Collections platform. The 187,000 items tagged for public domain represent less than one-third of the items in the digital collection, and that collection comprises only a fraction of the NYPL's voluminous print holdings. Thankfully, as an ongoing and open-ended process, public domain assets will be automatically made available to patrons.

The NYPL's iterative approach to digital projects places emphasis where it belongs: on how patrons use holdings. This approach aligns with NYPL Labs' investment in crowdsourcing digital innovation. Although I find the term "remix" somewhat glib, the underlying philosophy is meaningful. By encouraging visitors to repurpose holdings, librarians collapse the distance between visitor and curator, exhibit and patron, research and play. In addition to driving interest in its collections, NYPL's public domain venture models how a library can operate as both a research laboratory and a digital sandbox.

"The NYPL's iterative approach to digital projects places emphasis where it belongs: on how patrons use holdings."

Reviews

CONSUMER ELECTRONICS

FitBark Dog Activity Monitor

HARDWARE

Dell Inspiron 15 7000 Series (7559)

Velocity Micro Vector Z35

Digital Storm Slade Pro

Intel Compute Stick STK1AW32SC

Seagate Backup Plus Portable Drive (4TB)

Netgear ReadyNAS 202

SOFTWARE & APPS

Adobe Photoshop Elements 14

LastPass 4.0

Our Favorite Apps for February

Monitor Your Dog's Activity As Easily As Your Own

Fitness trackers for pets might sound like a sketch out of *Portlandia*, but an active lifestyle is every bit as healthy for your furry friends as it is for you. True to its name, the FitBark Dog Activity Monitor is an unobtrusive fitness tracker for canines of all sizes that syncs with clever software on your phone or computer to check in on your dog's activity levels. It's easy to use and offers a unique social aspect, though the Whistle is a slightly more attractive option thanks to its lower price and built-in Wi-Fi.

FitBark Dog Activity Monitor

$99.95

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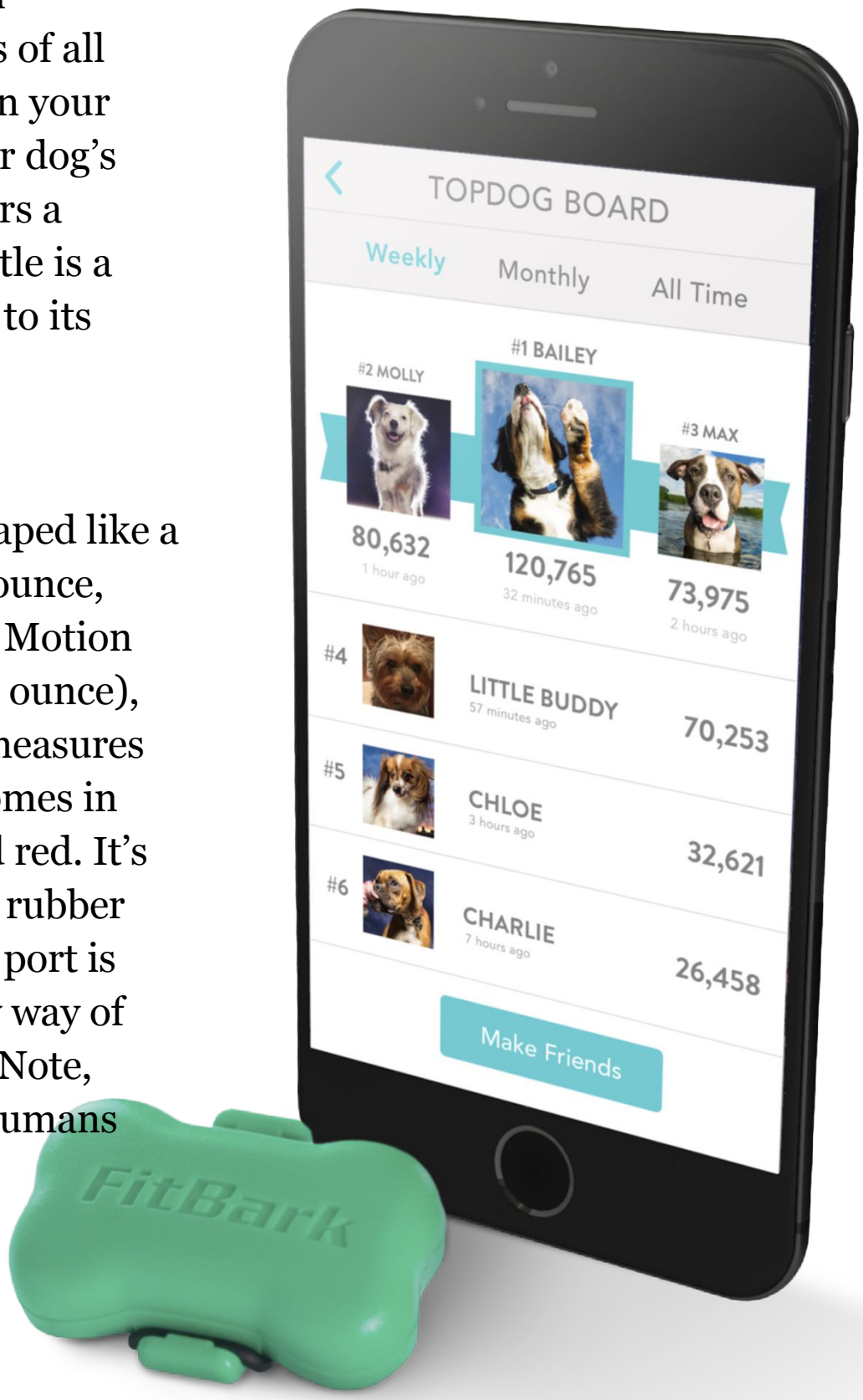

DESIGN AND FEATURES

The FitBark device is a plastic unit, shaped like a dog bone treat, that weighs only 0.28 ounce, which is comparable with the Tractive Motion (the lightest tracker we've seen at 0.25 ounce), and half the weight of the Whistle. It measures 1.1 by 1.6 by 0.4 inches (HWD), and comes in five colors: blue, gray, green, pink, and red. It's waterproof (rated IPX7) as long as the rubber plug covering the micro USB charging port is tightly sealed. The FitBark operates by way of the three-axis accelerometer inside it. Note, though, that it's not really for cats or humans because the software behind it isn't intended for those species; that said, the FitBark could probably track a feline with a modicum of accuracy.

The size and shape of the FitBark put it at both an advantage and disadvantage compared with the Whistle. The latter's heavier, larger form factor also fits on a collar, but it's big enough that it won't work for toy breeds. But there's a good reason for its size: The Whistle has built-in Bluetooth and Wi-Fi, so it can communicate activity data directly to a smartphone app, sending it to your home router and over the Internet. So even when they're not home, Whistle users can get their dog's activity info.

With FitBark, you only get Bluetooth, unless you pony up an additional $79.95 for the FitBark Wi-Fi Base Station. It's a cute plastic dog house you plug in via micro USB, connect to the FitBark smartphone app, then let run near your router to relay the FitBark's data to your account online.

Things are better in the battery department. The FitBark uses a micro USB connection to charge its lithium ion battery (battery life is quoted at ten to 14 days, depending on use). That's a big step up from the proprietary chargers used by other trackers like the Whistle and PetPace (and even most Fitbits, for that matter).

Maybe the most surprising thing out of the box is how the FitBark attaches to your dog's collar. It's doesn't use a clip like the Tractive or a strap like the Whistle. It simply uses a heavy-duty rubber band that clips into a couple of slots on either side of the tracker. Thankfully, it ships with extra bands. The design of FitBark is such that you should be able to take off your dog's collar and bend it back to charge the device; that may depend on the collar, however.

FitBark Dog Activity Monitor

PROS Easy-to-understand activity information. Very light, unobtrusive. Attaches to any collar, harness. Long battery life. Waterproof. Web-based dashboard. Social aspect helps compare canines.

CONS Separate base station required for off-site monitoring.

PERFORMANCE AND APP

Any dog activity tracker is good at one thing especially: making humans feel really bad about the lack of activity in their pet's life. I attached one to my 10-year-old mutt,

Madison, and assigned her a 7,000 BarkPoint goal per day—that's a middle-of-the-road active lifestyle for a dog of her size and age. FitBark claims the average pup with my dog's stats gets 5,400 BarkPoints daily, whereas a canine Olympian racks up 9,600 BarkPoints each day. It can go up or down depending on the dog. Imagine my horror when I realized that, without my making a point of going on a long walk, poor ol' Maddie barely broke 4,000 points per day.

How does FitBark calculate BarkPoints? According to the company, it uses a proprietary algorithm that attempts to quantify "total physical activity in line with the best veterinary practices." But from my observations, if your dog is moving or playing, it earns points. It's not about steps, per se, the way it is with a human using a Fitbit.

The FitBark app is available for Android or iOS, plus there's a Web-based dashboard, all in keeping in line with what Whistle offers. After setting up an account, you can invite people (such as your dog walker) to track your dog, or get invites from other FitBark users.

The app shows you a battery indicator and a quick rundown of the dog(s) on your account (The Home

FitBark claims the average pup with my dog's stats gets 4,500 BarkPoints daily, whereas a canine Olympian racks up 9,600 BarkPoints each day.

Pack), with a display of BarkPoints earned for that day. Each dog gets a count of the time spent at Play (moving a lot), Active (moving at all), and Rest. Tap the central number and you get a close look at when Activity/Play is taking place; tap each quadrant of the central circle graph to get more detail on how active your dog is per hour.

FitBark has also a unique social/competition aspect to its service. You can compare your dog's BarkPoints rating with that of other dogs, especially of the same breed. A TopDog Board was recently added, so any dogs you track—whether they belong to you or friends using FitBark—can be instantly ranked. FitBark Explore is a public, interactive map showing doggie health in all 54 countries where FitBark devices are currently at work.

CONCLUSIONS

If you're a serious dog lover, and have concerns about your four-legged companion getting enough activity to stay healthy, you should certainly invest in a canine fitness tracker. The FitBark is a fine example; it's a lightweight, attractive device with an intuitive companion app and a neat social aspect. For the price, though, it just can't beat the Whistle, which includes built-in Wi-Fi, so you can check in on your pet no matter where you are.

ERIC GRIFFITH

PRESS PAWS
The FitBark app provides plenty of detail about both your dog's activity levels and how he or she rates against other pets using the service.

This Entry-Level Gaming Laptop Doesn't Play Like One

Dell Inspiron 15 7000 Series (7559)

$799.99 (as tested)

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PC MAGAZINE EDITORS' CHOICE

The Dell Inspiron 15 7000 Series is an entry-level gaming laptop that offers solid performance at a very reasonable price. It's powerful enough to provide a smooth gaming experience on all but the highest settings with its full-HD display and discrete video card, and it can efficiently perform daily work and media tasks when you're not playing.

DESIGN AND FEATURES

The 7000 Series is hefty, and seems larger than its 15-inch size, perhaps due to its angular design. It's not the

most portable system, but feels sturdy and well built at 0.98 by 15 by 10.4 inches (HWD) and 5.88 pounds. The exterior is almost entirely black plastic, with red flourishes on the Dell logo on the lid, the trim around the touchpad, the speaker, the fan vents, and the rubber feet. The top lid and the keyboard deck are rubberized, which feels nice, and the bottom of the laptop and the bezel are hard plastic.

The 1,920-by-1,080-pixel 15.6-inch display (now basically a minimum for gaming systems) has an antiglare coating that drastically cuts down on reflections. Although some of the more expensive machines out there now have 3K or higher displays, full HD still works well for an entry-level system, as the hardware would have a difficult time delivering smooth gameplay at high quality settings on a higher-resolution screen.

The keyboard has white backlighting, which is not something that all systems in this price range include. The keys themselves are of good quality, if with slightly short travel. The touchpad feels very smooth and sturdy. The speakers provide decent sound quality, though they sound a bit tinny at maximum volume.

There are two USB 3.0 ports and a headphone jack on the left of the laptop, and the right side holds another USB 3.0 port, an HDMI port, a two-in-one SD card reader, an Ethernet port, and a Kensington lock slot. For storage, there's a 5,400rpm 1TB hard drive. The system includes a 720p front-facing webcam above the display, and wireless connectivity comes by way of Bluetooth 4.0 and dual-band 802.11ac Wi-Fi. Dell supports the laptop with a one-year limited warranty, and offers a one-year McAfee LiveSafe subscription.

Dell Inspiron 15 7000 Series (7559)

PROS Affordable. Solid gaming performance. Includes full-HD display, backlit keyboard, lots of storage space.

CONS Heavy. Speakers sound tinny at full volume.

FLASHES OF RED

Though it comes at an entry-level price, Dell's Inspiron 15 7000 Series laptop has surprisingly good gaming chops, and red accents to make sure you know it.

PERFORMANCE

Our review unit of the 7000 Series came with a 2.3GHz Intel Core i5-6300HQ processor and 8GB of memory. Combined with the discrete Nvidia GeForce GTX 960M video card, this system is well equipped for most work and entertainment tasks. It scored 2,833 on the PCMark 8 Work Conventional test, not too far behind the Acer Aspire V 15 Nitro (3,160), which costs $400 more, and ahead of the Dell Inspiron 14 5000 Series (2,732).

The 7000 Series acquitted itself well on our multimedia tests, too, finishing the Photoshop and Handbrake tests in 4 minutes, 31 seconds, and 1:35, respectively. These times are close to what we saw from the V 15 Nitro (4:11 on Photoshop, 1:17 on Handbrake), the Inspiron 14 5000 Series (4:55 on Photoshop, 4:26 on Handbrake), and even the much pricier Alienware 15 (3:36 on Photoshop, 2:25 on Handbrake). Its CineBench score of 464 was similarly impressive—it's much higher than the Alienware 15's (332).

The main consideration, of course, is gaming, and the 7000 Series performs admirably in that regard. It scored 12,950 on the 3DMark Cloud Gate test and 1,992 on the more demanding Fire Strike Extreme. Its Cloud Gate score compares well with that of the Alienware 15 (12,382), though the Alienware's Fire Strike Extreme score (3,128) demonstrates the gulf between that machine and the 7000 Series in terms of hardware. Still, the Dell came close to the V 15 Nitro on Cloud Gate (15,727) and beat it on Fire Strike Extreme (1,796).

Performance was equally good on the Heaven and Valley gaming tests, with the 7000 Series achieving 74 frames per second (fps) on both at medium quality settings. It still fared well on our ultra-quality tests, scoring 24fps on Heaven and 19fps on Valley. The V 15

The main consideration, of course, is gaming, and the 7000 Series performs admirably in that regard.

HARDWARE THAT ISN'T SOFT
The 7000 Series' CPU, memory, and video card help it perform as well as laptops that cost hundreds of dollars more.

VALUE VIRTUE
Considering all you get in terms of display, hardware, and additional features, the $799.99 7000 Series is a terrific value.

Nitro scored 21fps and 24fps, respectively, on the Ultra settings; the Alienware 15 managed 38fps and 44fps on the same tests. We consider 30fps the threshold for smooth gameplay, so you might have to lower a few settings in some games. Generally, the 7000 Series can run games on all but the highest settings, and hangs closely with more expensive laptops.

On our battery rundown test, the Inspiron 15 lasted 7 hours, 28 minutes. That's significantly longer than the V 15 Nitro (4:10) and the Alienware 15 (5:28), and slightly longer than the Inspiron 14 5000 Series (7:16).

CONCLUSION

The Dell Inspiron 15 7000 Series is an excellent value, offering good gaming and productivity performance at a reasonable price—even when compared against more expensive systems. And it sports a solid (albeit somewhat hefty) chassis and a full-HD display, while managing to include extras like dual-band wireless, Ethernet, Bluetooth, a backlit keyboard, and a fine port selection. Our previous entry-level gaming laptop Editors' Choice, the Alienware 15, is at the top end of the budget price range, and though it does offer more features and performs better on some tests, the differences aren't worth the $700 jump in price. For those reasons, the 7000 Series supplants it as our top pick.

MATTHEW BUZZI

Velocity Micro Vector Z35

$1,379 (as tested)

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Velocity Micro's Midrange Desktop Can Do It All

PC MAGAZINE EDITORS' CHOICE

The Velocity Micro Vector Z35 is a midrange Windows 10 desktop that can do it all. For a reasonable price, it offers powerful hardware for work and multimedia tasks, with plenty of storage and a wide array of port options. Its Intel processor and discrete video card are more than enough to power demanding gaming sessions, and there's room to upgrade in the well-designed, well-organized case.

DESIGN AND FEATURES

The Vector Z35 features Velocity Micro's black, all-aluminum MX3 chassis. It doesn't boast flashy lighting or colors, but looks slim for a full desktop tower, measuring 15 by 7 by 19 inches (HWD). The only flourishes are more like understated highlights: A small Velocity Micro logo on the bottom center of the front panel and the fan on top of the system glow with blue LED lights.

Opening the case is easy; a simple pull on the side door will do it. A set of pins fastens the door to the case, and it only takes a few seconds to line them up again and pop the door back into place. The case is built to accommodate two video cards, but is still perfectly suited to the Vector Z35's less-demanding, single-card configuration. Thoughtful wire management improves internal airflow and leaves room for future upgrades.

Our review unit came equipped with two 250GB solid-state drives (SSDs) in a RAID Level 0 array, as well as a 1TB 7,200rpm hard drive, and there are two more free bays. There's also 16GB of memory, with two more DIMM slots free; the system can support up to 32GB. Three USB 3.0 ports and two USB 2.0 ports are located on the rear panel, along with two DVI ports, one HDMI port, and one DisplayPort connector. The top of the case has two more USB 3.0 ports and headphone and mic jacks, and the DVD-RW drive and the Power button live on the front panel. The desktop does lack the NFC sensor and Qi wireless charging pad you'll find on the Asus M70AD-US003S (though those are admittedly more bonuses than essentials), but it's also missing the Wi-Fi and Bluetooth wireless connectivity included in the Asus model. The Vector Z35 comes with Windows 10, and thankfully, there's no bloatware installed. Velocity Micro offers a one-year warranty.

PERFORMANCE

In addition to the 16GB of memory, our review unit featured a 3.2GHz Intel Core i5-6500 processor and an Nvidia GeForce GTX 960 video card. The system scored a solid 3,499 on the PCMark 8 Work Conventional test, falling in behind the Digital Storm Eclipse (3,809). The machine made quick work of our multimedia tests, completing the Handbrake encoding test in 1 minute, 15 seconds, and the Photoshop test in 3:02; it also scored 553 on the CineBench test. The Eclipse was slightly faster overall, finishing Handbrake in 1:09 and

Velocity Micro Vector Z35

PROS Excellent performance. Sleek case allows for easy upgrades, maintenance. Discrete graphics. Plenty of storage.

CONS Lacks integrated Wi-Fi.

Photoshop in 2:46, and scoring 608 on CineBench.

Despite not being built specifically for gaming, the Vector Z35 excelled in our gaming tests, scoring 17,230 on the 3DMark Cloud Gate test and 3,534 on the Fire Strike Extreme test. This compares well with gaming-centric desktops like the entry-level Lenovo Erazer X315 (9,332 on Cloud Gate, 1,752 on Fire Strike), and the more expensive Digital Storm Eclipse (19,815 on Cloud Gate, 4,830 on Fire Strike) and Maingear Vybe (23,449 on Cloud Gate, 5,768 on Fire Strike).

At medium quality settings, the desktop managed 128 frames per second (fps) and 127fps respectively on the Heaven and Valley gaming tests—much higher than needed for smooth gameplay. On the highest quality settings, the Z35 scored 40fps and 46fps on Heaven and Valley, which is still more than playable at 1080p resolution. It edged the Lenovo X315 (18fps and 22fps) and again came in behind the Eclipse (63fps and 71fps) and the Vybe (85fps and 84fps), both of which cost more. Overall, the Z35 is more than capable of playing demanding games smoothly.

CONCLUSION

The Velocity Micro Vector Z35 is a capable and comprehensive desktop, packing the power you need for the occasional game as well as work and multimedia tasks. There are plenty of connectivity options, case construction is attractive and solid, and there's room to grow. The competing Asus M70AD-US003S offers a few features that the Velocity Micro lacks, such as an uninterruptible power supply, Wi-Fi capability, wireless charging, and NFC, and is less expensive. For just $180 more, however, the Vector Z35 packs a faster processor, a more powerful discrete video card, and more storage. It also includes a stronger power supply and more free hard drive bays and memory slots, making it more future-proof. As such, the Velocity Micro Vector Z35 is our Editors' Choice for midrange, general-purpose desktops.

MATTHEW BUZZI

A Wow-Worthy Workstation

Digital Storm Slade Pro

$6,163 (as tested)

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PC MAGAZINE EDITORS' CHOICE

The Digital Storm Slade Pro is a powerful desktop workstation with an easily accessible case. It performed very well on our benchmark tests, keeping pace with much more expensive systems, thanks to its ten-core Intel Xeon processor, discrete Quadro graphics, and large amount of memory. It also offers plenty of expansion space, and stays cool and quiet—everything you'd want in a single-processor workstation.

DESIGN AND FEATURES

The Slade Pro's tower is all black, with plastic side and top panels and a brushed-aluminum front face, and measuring 19.75 by 8.5 by 21 inches (HWD)—on the heavy and cumbersome side. The system is vented front to back with twin fans that pull cool air through the system, and there is room on the top panel for two more fans. A cutout on the left side panel pops off, giving you extra ventilation or space for another fan. The vents are all covered with removable, magnetically attached filters that catch

dust and other particles to keep the interior clean. Digital Storm's 120mm Vortex CPU cooler also keeps the processor from getting too hot.

A button on the back opens the side of the system for full access to the interior, which is roomy and organized, as well as easily accessible for repair or upgrades. You can open the front panel on either side—though the hinges are a bit small and flimsy—or remove it altogether. Each panel is lined with sound-dampening foam to keep the system running quietly. Our review unit came with a single 2TB 7,2000rpm hard drive (alas, no solid-state drive), with five drive bays and a PCI Express (PCIe) card slot free for future upgrades.

The front of the system sports two USB 3.0 ports and a headphone jack next to the Power button. If you open or remove the front panel, you'll find a media card reader with SDHC, Compact Flash, Memory Stick, Secure Digital, Multi Media Card, Smart Media, and microSD compatibility. The Blu-ray drive can also be accessed with the panel open. There are ten USB 3.0 ports on the rear, along with audio jacks and two Ethernet ports. There are four DisplayPort connectors and one VGA port on the back of the tower; a DisplayPort-to-DVI adapter is included, but you'll need a third-party adapter to connect an HDMI display. Digital Storm offers lifetime tech support and customer service, and a three-year limited warranty.

Digital Storm Slade Pro

PROS Solid performance. Good price. Easy-access case with plenty of room to expand. High-end components. Lifetime customer support.

CONS Big tower. No solid-state drive as configured. Lacks Wi-Fi.

GET TO WORK
An attractive, no-frills design and attention to detail (such as sound-dampening construction) make the Digital Storm Slade Pro ideal for any work environment.

PERFORMANCE

Our review unit of the Slade Pro included a ten-core 3.1GHz Intel Xeon E5-2687W v3 processor, an 8GB Nvidia Quadro M4000 video card, and 32GB of DDR4 memory (with four DIMM slots still free). In other words, this computer packs a ton of processing power, so you can multitask and complete media projects with ease. Unsurprisingly, the Slade Pro scored 3,760 on the PCMark 8 Work Conventional productivity test, beating the Origin Chronos Pro (3,453), the Falcon Northwest Tiki Workstation (3,263), and the Dell Precision Tower 5810 (3,608), all three of which are significantly more expensive.

The workstation made quick work of the multimedia tests as well, coming close to the other systems. It finished the Photoshop and Handbrake tests in 3 minutes, 5 seconds, and 0:36, respectively. The Dell 5810 finished Photoshop and Handbrake in 3:11 and 0:36, with the Tiki Workstation (2:56 and 0:31) and the Chronos Pro (2:00 and 0:33) being a bit faster. The Slade Pro scored 1,571 on CineBench, which is on par with the Tiki Workstation (1,582), but behind the Dell 5810 (2,510) and the Chronos Pro (2,494).

It did not score quite as closely to the others on the 3D and gaming tests, although the results were still strong. The Slade Pro's tallies of 30,384 on the 3DMark Cloud Gate test and 3,590 on the 3DMark Fire Strike Extreme test were a bit lower than we saw from the Tiki Workstation (37,320 and 8,039) and the Dell 5810 (33,357 and 4,581). On the

“This computer packs a ton of processing power, so you can multitask and complete media projects with ease.”

UPWARDLY MOBILE
Want to expand the capabilities of the Slade Pro? It has lots of free space for adding more memory or drives.

Heaven and Valley gaming tests at medium quality settings, the Slade Pro managed 124 frames per second (fps) and 107fps, respectively, which is well above what is needed for smooth gameplay. On the same game tests at the highest quality settings, it still posted playable numbers (44fps and 50fps), although the Tiki Workstation (104fps and 101fps), the Chronos Pro (68fps and 73fps), and the Dell 5810 (57fps and 68fps) fared better. The system is certainly capable of 3D animation in real time for CAD/CAM and CGI visualization tasks.

CONCLUSION

Although bang for the buck is not always the main concern when buying powerhouse workstations, the Digital Storm Slade Pro showed similar performance to pricier systems, even the Dell Precision Tower 5810, which costs almost three times as much. If it's not quite as IT-friendly as the Dell, the Slade Pro is easily upgradeable, and it's designed to run cool and quiet. It's certainly a fine fit for a small business or proprietorship that doesn't have to worry about IT protocols and centralized management. As such, the Slade Pro is our new Editors' Choice for single-processor workstations.

MATTHEW BUZZI

For Pocket Computing, Intel's Device Still Sticks

Intel Compute Stick
STK1AW32SC
$159

Last year, Intel fulfilled futurists' dreams with its Compute Stick, a pocket-size, Windows-equipped PC that let you turn a monitor or an HDTV into a large-screen, all-in-one desktop in seconds. This year's iteration still looks like a jumbo USB stick (albeit with an HDMI plug), but it has updated hardware and a couple of new features that improve its connectivity. Ultimately, however, the new Compute Stick is an evolutionary step, not the radical upgrade it needs to be to distinguish itself from up-and-coming competitors.

DESIGN AND FEATURES

The Compute Stick measures 0.47 by 1.5 by 4.5 inches (HWD), so it looks like a large pack of chewing gum. Overall, it's a bit longer than last year's version, which measured 0.5 by 1.5 by 4 inches, and a bit more compact than the 0.67-by-1.2-by-4.8-inch Asus Chromebit. Both Compute Sticks and the Chromebit have removable caps to protect their HDMI plugs when they're not in use. The black matte finish on the new Compute Stick seems like it will be more resistant to scratches than the older model's, but both devices have a similar design, with relatively large cooling vents and a prominent Intel logo on the top surface.

There's now a USB 3.0 port in addition to the USB 2.0 port, so you can connect a keyboard and

a mouse simultaneously. Alternately, you can plug in a USB dongle for a wireless keyboard and mouse, and keep the USB 3.0 port free for hard drives. You will, however, still need a wired USB mouse to connect a Bluetooth keyboard or mouse, as Windows 10 doesn't automatically search for devices. In comparison, the Chromebit looks for Bluetooth devices during its initial setup. For wireless connectivity, the Compute Stick has Bluetooth 4.0 and has upgraded to dual-band 802.11ac Wi-Fi.

As before, there's 32GB of integrated eMMC flash storage, with 19.6GB free after accounting for the Windows 10 Home OS and its recovery partition. That's not a huge amount, but it's certainly more space than the 16GB you get on the Chromebit (which, admittedly, comes with 100GB of free Google Drive storage to balance things out), and you can add up to 128GB of storage to the Compute Stick via the microSD card slot.

Setup is fairly straightforward. First, you plug the Compute Stick into a free HDMI port on a computer monitor or an HDTV. You may need to use the included HDMI extension cable in tight quarters, but as long as you have enough space behind your display, the device is light enough to stay plugged in. Connect the included AC adapter to the micro USB port on the device, and you can then hit the Compute Stick's Power button. (You can also power the Compute Stick by connecting to a USB port on your HDTV, a convenience that the Chromebit lacks. But the AC adapter that comes with the Compute Stick has a permanently attached cable, so you'll need a spare micro USB cable, such as from your smartphone, to connect the system to your HDTV's USB port for power.) The Compute Stick comes with a one-year warranty.

Our review unit had an Atom x5 processor, but other versions of the Compute Stick will be available soon with either Intel Core m3 ($399) or Core m5 ($499) CPUs. Both of these models come with a USB Type-C

Intel Compute Stick
STK1AW32SC

PROS Light, compact design. Plugs directly into any HDTV, monitor HDMI port. Includes lots of connectivity options. Comes with Windows 10. Quiet operation. Improved 3D performance over previous generation.

CONS Needs a USB mouse to set up Bluetooth devices. May require use of included HDMI extension cable. Limited onboard storage.

port, 4GB of memory, and 64GB of eMMC flash storage. The Intel Core m3 configuration comes with Windows 10; the Core m5 vPro model, which is aimed at the business sector, doesn't come with an operating system. Business customers for that model will need to work with a value-added reseller to choose which version of Linux or Windows 10 (Enterprise, Pro, Education, and so on) will work best for their needs.

PERFORMANCE

The Compute Stick features an Atom x5-Z8300 processor and 2GB of RAM, which helps keep the price low and the system compact and cool. (The Cherry Trail–based Atom x5 is a quad-core CPU that only requires a minuscule, quiet fan to keep it from overheating.)

The Compute Stick's score of 1,324 on the PCMark 8 Work Conventional test is on par with what we've seen from other inexpensive desktops. That score falls just behind that of last year's Compute Stick (1,414) and the Zotac Zbox CI320 nano Plus (1,496).

The Compute Stick was at the back of the pack on the Handbrake test, though, returning a time of 8 minutes, 53 seconds. The older Compute Stick was a bit faster (8:20), but the Zbox and the HP Pavilion Mini were significantly speedier (7:22 and 7:19, respectively), thanks to their faster-clocked processors.

Gaming performance was good for the category, but that doesn't really mean a whole lot if you're, say, a true enthusiast. The Compute Stick returned a good score of 1,606 on the 3DMark Cloud Gate test, beating the other sub-$250 systems handily. Only the $449 Pavilion Mini was better (2,814). Its frame rates on Heaven and Valley at medium quality settings were equivalent to slideshows, though. You might be able to play Minecraft on the Compute Stick at low resolution with the Optifine mod installed, but you'd probably be happier with simpler games like Candy Crush Saga.

CONCLUSION

The new Intel Compute Stick is a solid update for one of the smallest PCs available. The 802.11ac Wi-Fi, USB 3.0 port, and improved 3D graphics are certainly welcome additions. But the 2GB of memory and 32GB of storage are drawbacks if you're an early adopter who wants something significantly better than the previous model. Of course, you are still getting an instant Windows 10 PC you can stick into an HDMI slot on your TV for just $160.

We awarded the first Compute Stick an Editors' Choice on the strength of its innovation, but we don't believe that the new model's relatively minor improvements merit a repeat. That decision comes sharply into focus when you consider that the Asus Chromebit has much of the Compute Stick's media viewing and online functionality, but costs $74 less. True, the Chromebit doesn't run Windows, but if your primary activities are viewing movies on Netflix, shopping for deals on Amazon, and updating your Facebook status, it does the job just as well.

JOEL SANTO DOMINGO

“The new Intel Compute Stick is a solid update for one of the smallest PCs available.”

Plentiful, Portable Storage You Can Really Afford

PC MAGAZINE EDITORS' CHOICE

As time goes by, it seems like we always need more storage. Even a 128GB phone will fill up with files eventually, and for many, those files are photos and videos that can't be easily replaced. The 4TB Seagate Backup Plus Portable Drive has the capacity to store hundreds of thousands, if not millions, of pictures and videos, as well as files from your laptop or desktop. It has the same capacity as Seagate's 4TB Backup Plus Fast, another top pick, but comes at almost half the cost per gigabyte. That means that for general backups and everyday storage purposes, it's a terrific option.

Seagate Backup Plus Portable Drive (4TB)

$149.99

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DESIGN AND FEATURES

The drive is a basic box that measures 0.8 by 3.1 by 4.5 inches (HWD), and weighs about 8.6 ounces. It has a black satin finish on its top lid, along with a disk activity light and Seagate's new swirly logo. The logo is also echoed in the bottom-panel molding. The base of the drive lacks rubber feet, so it has a tendency to slide off of non-flat surfaces. There is a micro USB 3.0 port on the side for the included USB 3.0 cable.

Formatted for NTFS out of the box, the drive will work right away with any Windows PC. If you're a Mac user, you will first have to install the included NTFS driver in order to use the Backup Plus Portable. If you don't want to add another

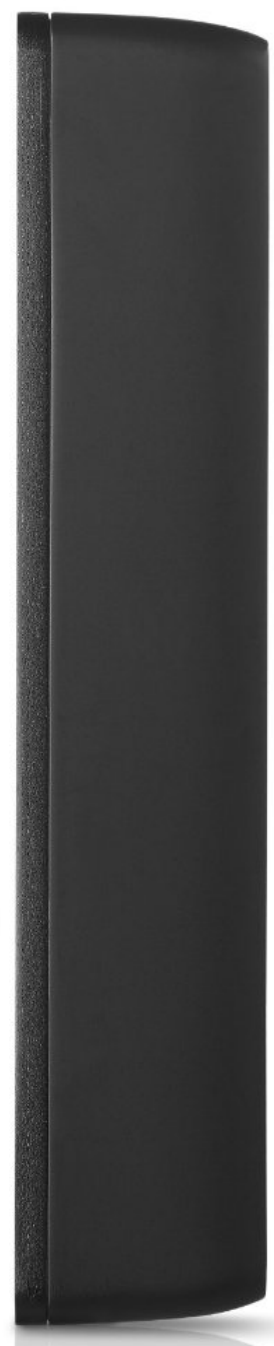
driver, you can reformat the drive for HFS+ to use it with your Mac exclusively.

The included setup program also installs Seagate Dashboard, a utility that helps you back up your data and save and share your social media pictures and videos. Seagate also includes a free two-year subscription to 200GB of cloud storage on Microsoft's OneDrive service; and the Seagate Lyve app, which lets you turn the Backup Plus Portable into a personal cloud drive so you can access your documents from your laptop, phone, or tablet (Android, iOS, Kindle, Mac, or Windows). You can also share your pictures and videos with friends over the Internet by emailing them a link that opens in their browser. You will have to keep your desktop or laptop on for the duration, but it's an easy way to share files over your network without having to set up a network-attached storage (NAS) appliance. The drive comes with a two-year warranty, which is better than the one-year warranty you get with most basic drives but not quite as lengthy as the three years Western Digital offers for its 2TB My Passport Ultra.

Seagate Backup Plus Portable Drive
(4TB)

PROS Large storage capacity. Includes Mac NTFS driver. Seagate Lyve app creates NAS-like capability. Includes free OneDrive storage.

CONS No rubber feet under the case.



PERFORMANCE AND COST

The Backup Plus Portable performed well on our benchmark tests. It scored 7,504 on the PCMark05 hard drive test and 1,985 on the PCMark7 test. That's significantly faster than the My Passport Ultra, the Adata HE720, the Toshiba Canvio Connect II, and the

Buffalo MiniStation Extreme NFC on the same tests. The Backup Plus Fast scored a whopping 87,971 on PCMark05, however, which shows it has the edge if you need speed for video work or transferring a lot of files.

On the drag-and-drop test, the Backup Plus Portable took 12 seconds, which is better than average for a USB 3.0–equipped drive. The Backup Plus Fast, the Canvio Connect II, and the My Passport Ultra each took 13 seconds. That's about as fast as you can go without moving to a solid-state or RAID drive.

With 4TB of space, the Backup Plus Portable's cost works out to an excellent $0.038 per gigabyte, which is a little more than half that of the 4TB Backup Plus Fast ($0.06 per gigabyte) and the 2TB My Passport Ultra ($0.065 per gigabyte).

CONCLUSION

The 4TB Seagate Backup Plus Portable Drive is one of the largest-capacity portable drives available today. Adding to the appeal are the drive's speed, extra features like the Lyve personal cloud service, and a relatively inexpensive cost per gigabyte. It's a much less expensive way to store your files locally than on cloud-based services or buying a NAS for your home. The Backup Plus Fast is a bit faster on some benchmark tests, but it's double the price per gigabyte; unless you're using it as a scratch disk for video projects, however, that extra speed is not worth the difference in cost. Thus, 4TB the Backup Plus Portable Drive is our new Editors' Choice for portable external hard drives.

JOEL SANTO DOMINGO

Netgear ReadyNAS 202

$298.99

Easily Back Up, Share Files With This Inexpensive NAS

PC MAGAZINE EDITORS' CHOICE

The Netgear ReadyNAS 202 is an economical, two-bay network-attached storage (NAS) device that provides file sharing and backups over your home network. It's capable of speedy file transfers, and it's certainly powerful enough to stream your music and videos. It also lets you set up a personal cloud so you can access your files over the Internet from apps for Android, iOS, Mac, and Windows, as well as using a browser on your PC. The ReadyNAS 202 represents a good combination of convenience, speed, and value.

DESIGN AND FEATURES

The black-metal-and-plastic ReadyNAS 202 measures 5.6 by 4 by 8.7 inches (HWD) and weighs about 4.5 pounds. A swinging door protects the drive sleds, but because this is a home NAS, there aren't any keyed locks on the sleds

themselves. Covered sleds don't really matter in a home environment, but they can be a welcome security feature if you have curious pets or toddlers in the house.

There are a pair of status lights for the two drive bays, as well as an overall activity light, a backup status light, and a button to start backups from the front-mounted USB 3.0 port. There are two more USB 3.0 ports on the back panel, along with two Gigabit Ethernet ports, an eSATA port, a Kensington lock port, and a single port for the AC adapter. (Pricier, office-oriented NAS units, such as the Western Digital My Cloud DL4100, have two AC adapter jacks for redundancy.) Unlike the QNAP TS-251, the ReadyNAS 202 lacks an HDMI port, which isn't necessarily a must-have feature for a home NAS, but it would have let you hook the device up to an HDTV.

The ReadyNAS 202 is sold without drives, so you'll have to buy one or two NAS-optimized hard drives for the unit. Unlike most NAS enclosures, the ReadyNAS 202 is designed for quick drive installation and replacement. The two drive sleds don't require tools; just pop in a drive using a pair of permanently attached retracting rails built into each sled, and it automatically locks to the sled. The sleds can then slide home, at which point you can start your setup.

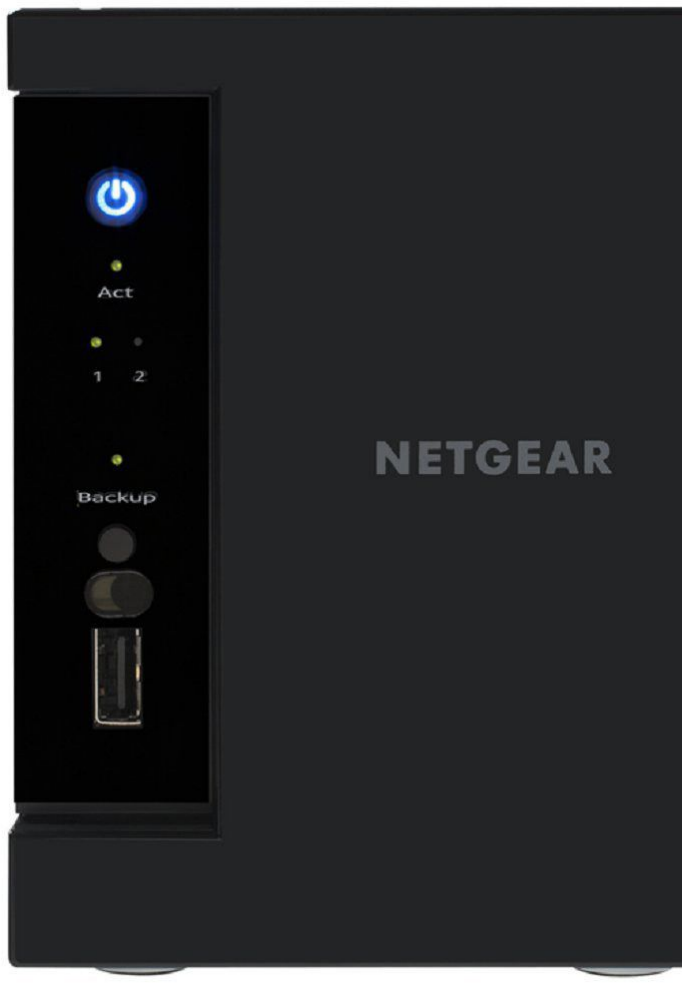
Setting up the NAS involves only plugging it in to your router, turning it on, and visiting Netgear's ReadyNAS website on your computer. The website then connects to the ReadyNAS device on your LAN. Create a ReadyCloud account online when prompted, Netgear pairs the NAS to that account, and the NAS is ready to use.

By default, the system is preconfigured for file service to Windows, Mac, and Linux clients. You can also access these files from a Web browser interface on the ReadyCloud website from your home or while you're away. The ReadyNAS 202 is compatible with Time Machine backups on Macs, and you can download and

Netgear ReadyNAS 202

PROS Simple Web-based, tool-free setup. Personal Cloud features phone camera backup, remote file access. Can support up to 12TB of storage.

CONS Single power jack. No HDMI port.



READY, SETUP, GO The ReadyNAS 202 is easy to set up. Just add one or two drives, plug it in to your router, then visit Netgear's website.

install a ReadyCloud client that lets you back up and sync folders on your Windows PC.

The device's admin interface lets you turn on DLNA- and iTunes-equipped media servers, so you can access your stored music, photo, and video files on DLNA devices like HDTVs; PlayStation, TiVo, and Xbox consoles; or iTunes on your iPad, iPhone, Mac, or Windows laptop. The ReadyNAS has a TiVo backup feature, so you can archive the programs off of your TiVo DVR and free up some space. The device also has the ability to download and run a Plex media server, which is much easier to use than DLNA or iTunes. Other add-on apps for BitTorrent, DVBlink, Memeo, and Sync are available as well.

Using the ReadyCloud app for Android and iOS is easy. You just log in to your ReadyCloud account on the app, and you get access to all of the media stored in the ReadyNAS 202 on your device while you're on the road. Granted, you'll be burning through your data plan if you download movies from your NAS over a cellular connection, but at least it's possible. You can also stream music and view photos over Wi-Fi or 4G LTE.

The ReadyCloud app has a backup feature that lets you copy all of your photos from the Camera Roll on your iPhone or Android phone, so you can then free up space. The beauty of personal cloud services like ReadyCloud is that you don't have to muck about with port forwarding and router settings. Your data is served from your ReadyNAS at home for free, so you don't have to use online cloud service storage that may involve paying a monthly fee or setting up a home VPN. The ReadyNAS 202 is covered by a three-year warranty, exclusive of the drives you put in it.

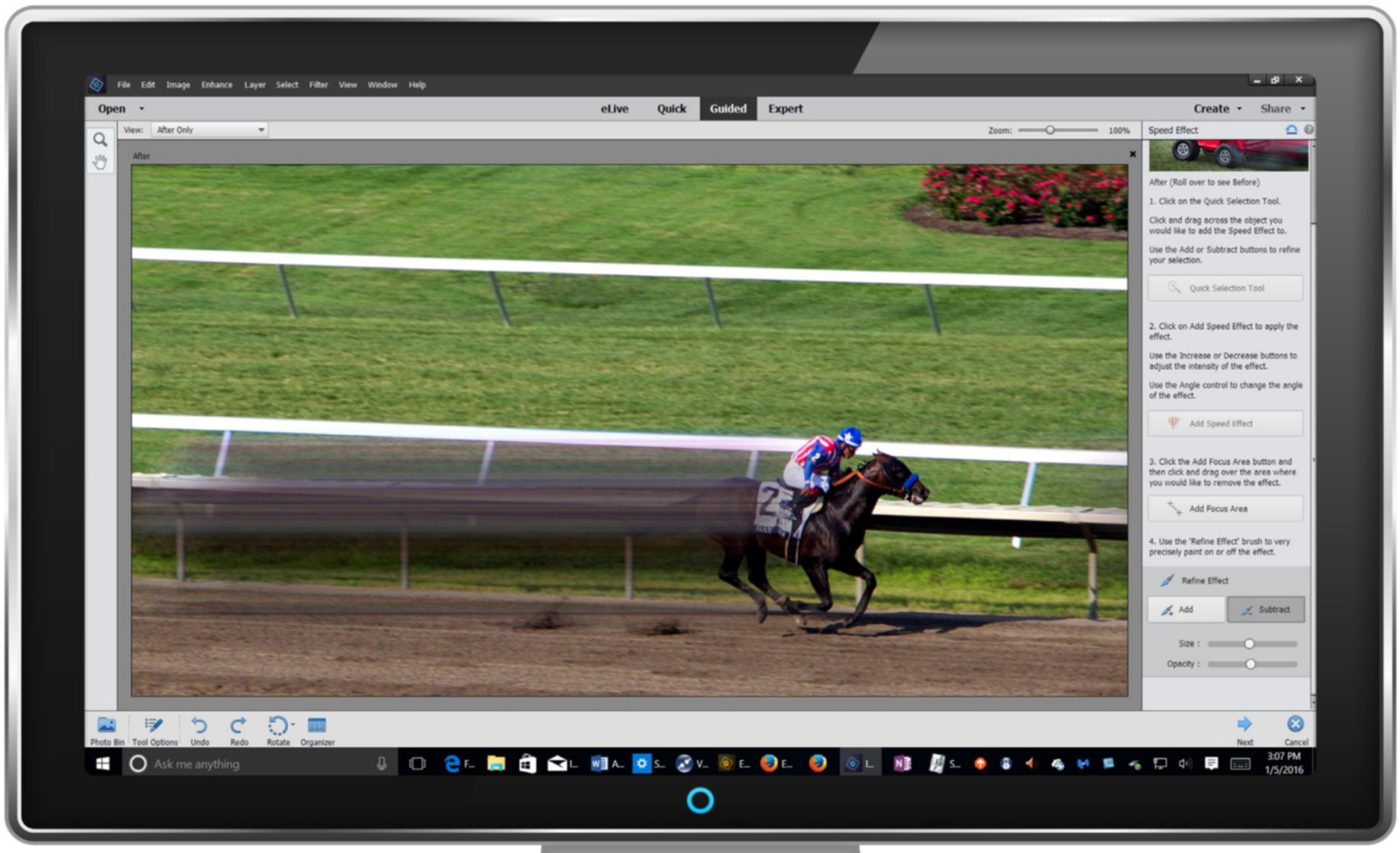
The beauty of personal cloud services like ReadyCloud is that you don't have to muck about with port forwarding and router settings.

PERFORMANCE AND CONCLUSION

The ReadyNAS 202 has an ARM Cortex A15 dual-core processor, along with 2GB of on-board memory. That gives the NAS more than enough power to serve files over a network. We were able to transfer our test folder at speeds of 64.5MBps (write) and 90.7MBps (read) over a wired LAN. That's a bit behind the QNAP TS-251+ on write speeds (75.4MBps), but a lot faster when reading (67.1MBps). That means that backing up to the ReadyNAS 202 is slightly slower, but once your files are there, they will be served to clients quickly. Speeds over wireless are significantly slower (16.4MBps write, 13.4MBps read), but still fast enough for serving 1080p HD videos to several client PCs or mobile devices simultaneously.

Overall, the Netgear ReadyNAS 202 is a top-notch consumer NAS that's primed to back up your files and grant access to them from your PC or mobile device. It works seamlessly on your home network, and is easily accessible over the Internet via the ReadyCloud account and app. And the ReadyNAS 202 offers similar performance and hardware features as our former top pick for consumer/SOHO NAS, the QNAP TS-251, but for $100 less, so it's our new Editors' Choice.

JOEL SANTO DOMINGO



Adobe Photoshop Elements 14

$99.99

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Professional Power in a Consumer Photo Editor

PC MAGAZINE EDITORS' CHOICE

Photoshop Elements has long made impressive Photoshop tricks easy for non-professionals to accomplish, and version 14 is no exception, adding the pro photo editor's camera-shake reduction, haze removal, fine-detail selection, and more. The latest version also updates the Organizer ancillary application with better People and Places organization, makes quick edits even quicker, and adds intelligence to filters by suggesting effects based on a photo's characteristics. More Guided Edits round out the terrific swath of updates.

GETTING STARTED

You can purchase Photoshop Elements either together with its enthusiast-level video-editing companion, Premiere Elements, for $119.99, or alone for $69.99. A 30-day trial version is available for download, too. Speaking of downloading,

the app's installer is not on the small side, at 1.4GB, and the installed program takes up a hefty 3GB, so make sure your PC (or Mac, for which Elements is also available) has enough free storage space. The software runs on Windows 7 SP1 or higher and Mac OS X versions 10.9 or higher.

THE ORGANIZER

Elements' welcome screen offers a choice between Organize and Edit that makes the separation between the Organizer app and the actual editor clear. The Organizer is where that you import, organize, and export the photos. Options include face- and geo-tagging with built-in maps, captions, star ratings, and tags. Furthermore, you can use Organizer to do basic fixes such as rotation and autocorrections.

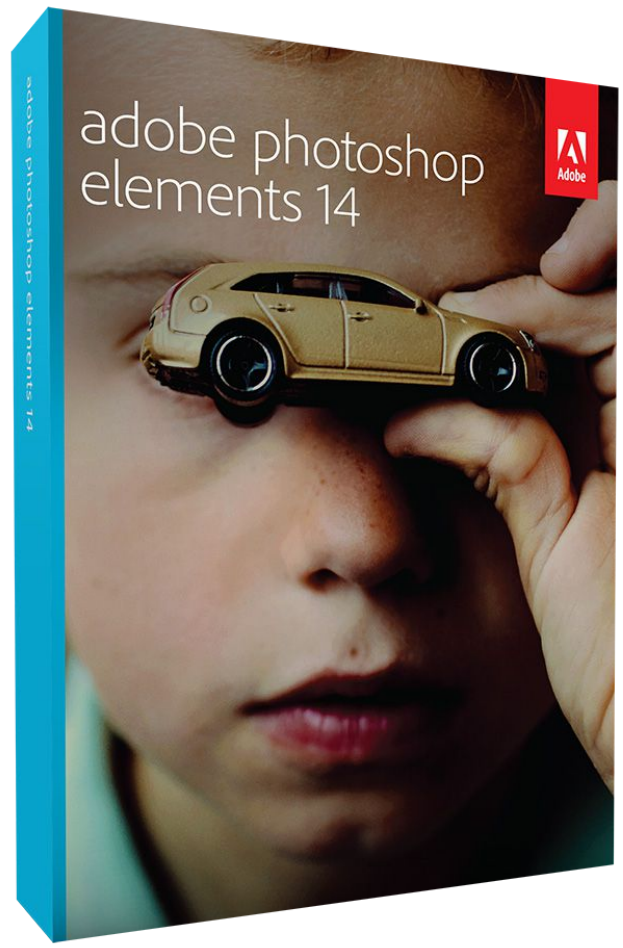
Organizer offers four main modes—eLive (with lots of tutorials, ideas, videos, and sample content), Media, People, Places (for seeing your photos on a map if they have GPS data embedded), and Events (collecting all photos within a tameframe)—as well as Add People, Add Places, Add Events, and Slideshow options. And when you use it to edit, you can open the selected images not only in the Elements editor, but also in Photoshop itself, or even another photo editor. The Instant Fix panel provides solid cropping (though no leveling), contrast, red-eye correction, color, sharpening, levels, and smart fix, which combines color and exposure fixes. And the Auto-Analyzer can identify photos that are sharp or blurry, high or low contrast, too bright or dark, contain people, and more, and apply tags you can filter by using the Tags/Info sidebar.

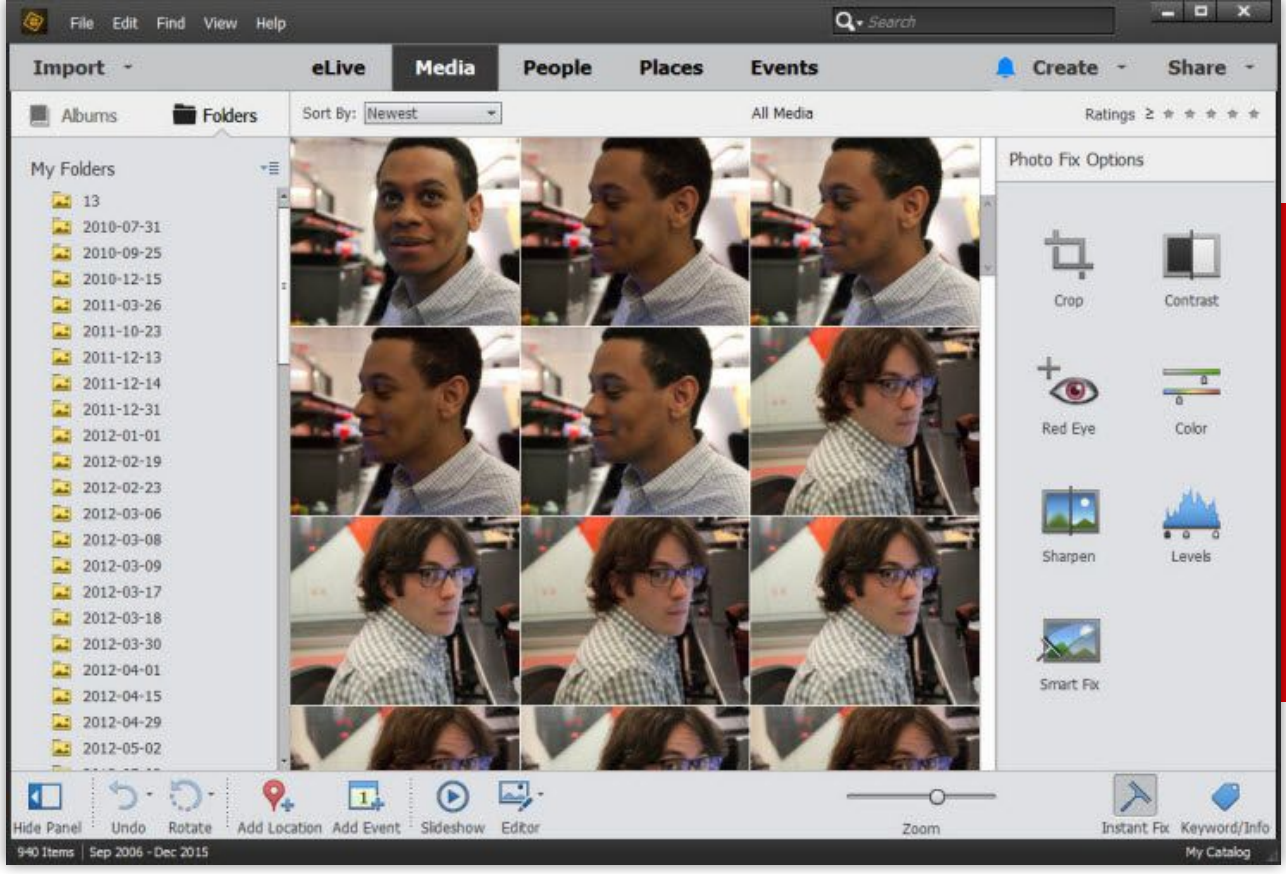
The Importer lets you automatically fix red eyes and can group similar images into stacks on import, but the only tagging option is to make the group name you've chosen for the set into a tag. Only photos from the most recent import appear in the Organizer's grid, but clicking Show All reveals the rest. Elements will also

Adobe Photoshop Elements 14

PROS Lots of powerful image manipulation tools. Strong face- and geo-tagging, with integrated maps. Excellent output options. Solid help for advanced edits.

CONS Slow import. Large storage footprint. Could have more sharing outputs.





GET ORGANIZED Adobe Photoshop Elements 14's built-in organizer offers many tools for managing and making basic adjustments to your photos.

watch folders and offer to import when new photos arrive in them. After an import, it analyzes your media for similar photos, and shows groups of these with an option to stack them into one unit.

Not only can Elements find and identify faces in your digital photos after you tag some of them with people's names, but it can also hook in to Facebook, download your friend list, and attach Facebook contacts' names to photos. It can't, however, handle profile views, and though the recognition was not always correct, it's now much improved over what we've seen in previous versions.

MAKING ADJUSTMENTS

Photoshop Elements really comes into its own when you move from the Organizer to its full editor, which contains many of Photoshop proper's high-end image manipulation capabilities in easier-to-use incarnations. Many of the tools, particularly content-aware ones that let you do things like removing areas or objects without disrupting the background, are unique to Adobe software.

Elements effects give you control with which Instagram can't begin to compete. Smart Looks, which chooses an effect based on image analysis; the Quick mode's FX options (Vintage, Cross Process, Toy Camera, and others); and the crop tool, which proposes cuts based on faces and other criteria, all offer you four variations of their effects to choose from. All are well executed.

Expert mode offers near-Photoshop levels of control, complete with filters, layers, action execution (but not creation), histograms, and tons of artistic and graphic effects. Comic, Graphic Novel, and Pen & Ink are among the more impactful filters you can apply to your images. There's also a generous selection of content, such as backgrounds, frames, and shapes, that you can use to spruce up a photograph. The Text tool is less flexible than Photoshop's, but it still lets

you wrap text around a shape outline so that it creates a nifty effect without overlapping important parts of the image.

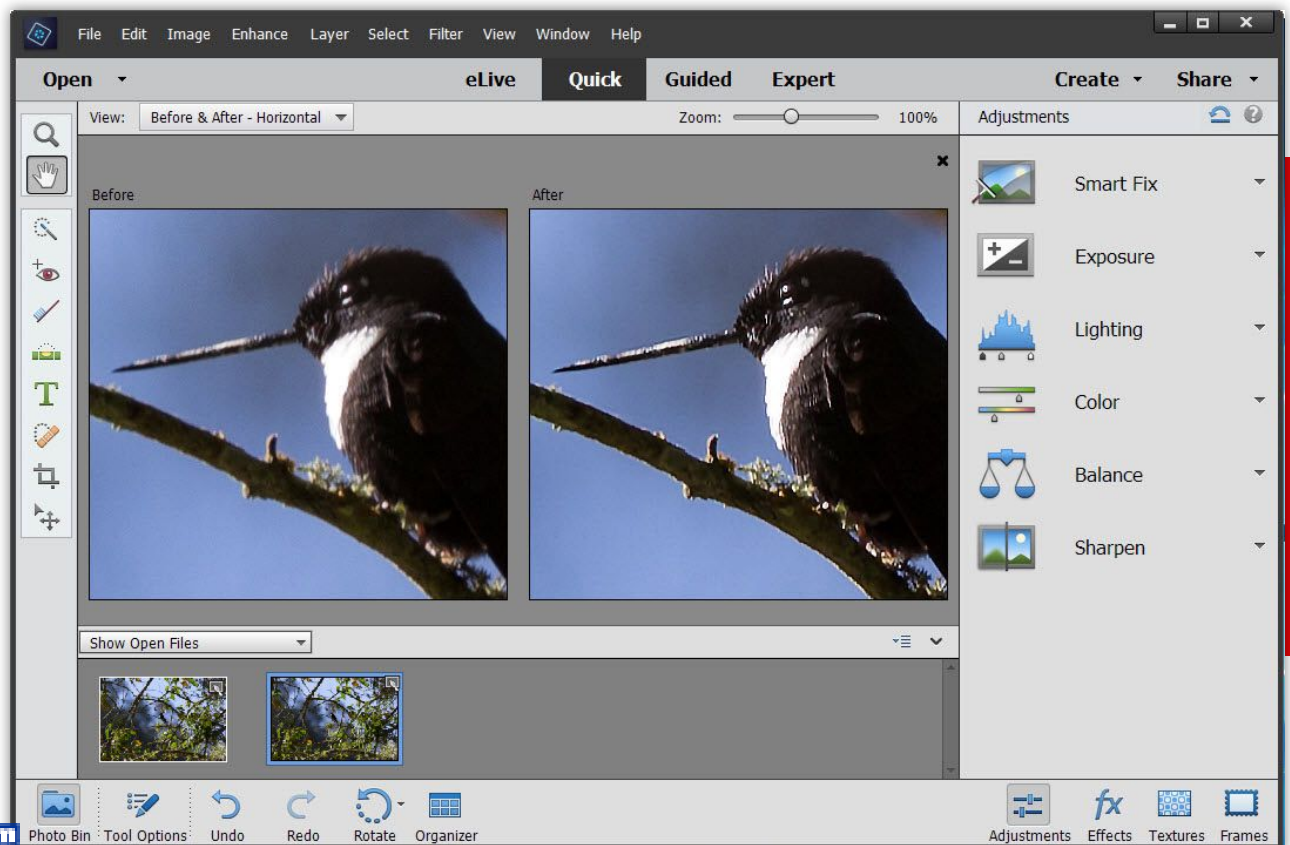
The Recompose tool is one of the program's most dazzling: It lets you change the aspect ratio of an image without stretching or squashing it. You can even remove selected objects and mark others for preserving. You can also do standard Photoshop things, such as blur, sharpen, and add imagery. The spot-healing brush does an excellent job at removing blemishes. I also removed a sign in the background of a photo by brushing in the texture from a forest in the image with the healing brush. And there's a good selection of clip art, too.

Raw files you open start out in a separate Adobe Camera Raw window, where you have access to color, exposure, and detail, controls. Noise reduction, red-eye reduction, and cropping are available, but there's no chromatic aberration correction. Hitting Start Editing gets you into the Elements editor proper.

NEW FEATURES

Version 14 of Photoshop Elements retains favorite features from earlier releases, such as the Refine Selection Brush (which switches between adding and subtracting from your selection depending on your position relative to the original selection), Smart Brushes (for painting effects and adjustments onto specific areas of a photo), Photomerge Group Shot (so you can get the best expression on each person's face from a series of group shots) and Photomerge Panorama (for creating a full panorama rather than one with twisted edges), but some additions are particularly worthy of notice.

Camera Shake Reduction, first previewed at the company's MAX conference in 2011, started out seeming like magic. Today, it's a bit more disappointing. It takes a long time to work—about half a minute for some images on a reasonably fast PC. It doesn't work with drastically shaken photos, understandably, but

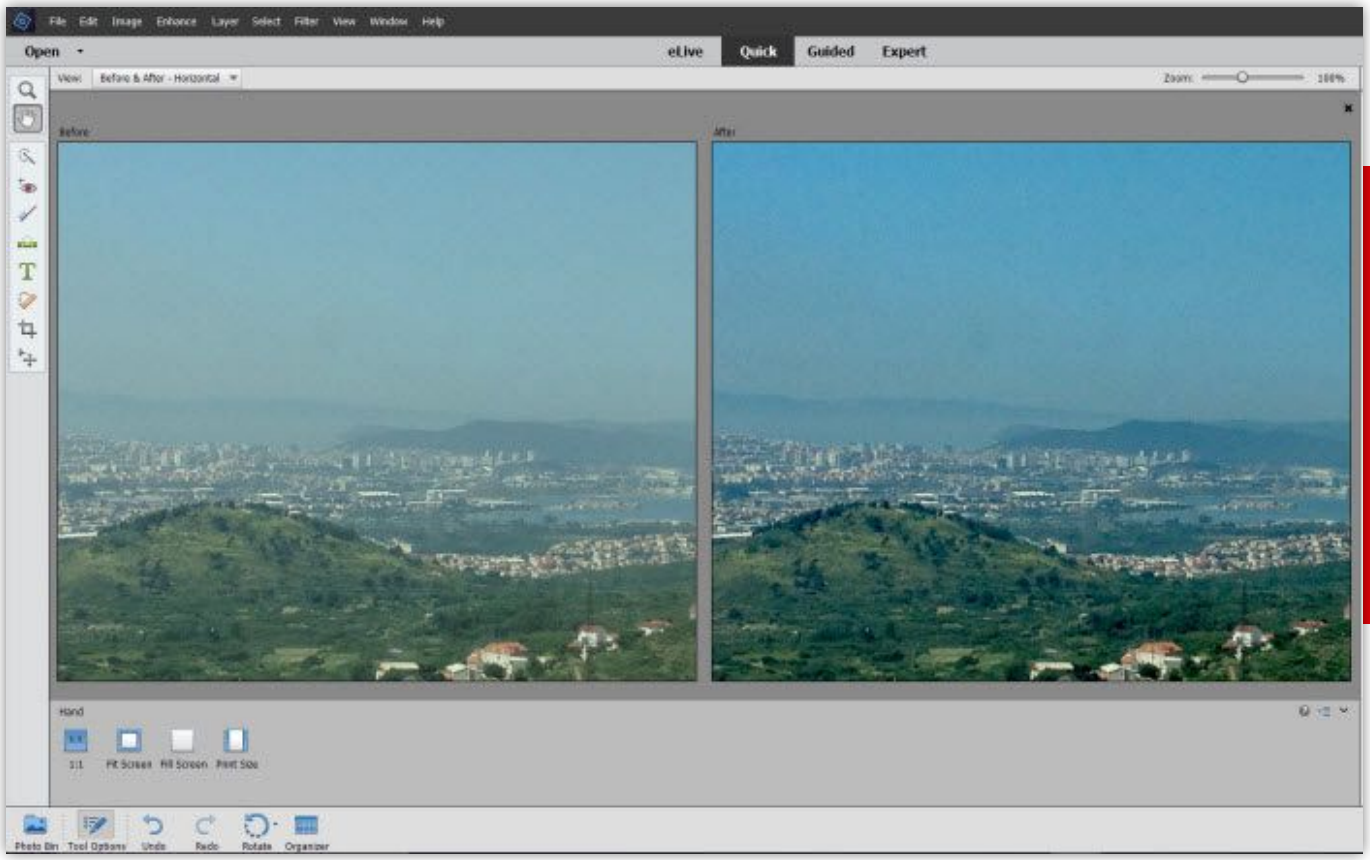


DON'T DO THE SHAKE
Shake reduction is a handy Photoshop Elements tool that lets you quickly and cleanly improve the clarity of the photos you've taken.

even with very slightly distorted images the fix looks a bit too much like sharpening, and the Elements version lacks Photoshop's tools for adjusting the intensity of the effect and targeting corrections.

Haze Removal is also accessible from the Enhance menu, and, again, you can only see before and after if you're in Quick mode, and there are no adjusters for the tools' strength. In a photo where the foreground isn't hazy but the distant part is, the tool doesn't really work effectively, but for more uniformly hazy subjects, it does a good job, bringing up contrast and darkening dark content.

Finally, new Guided Edits let you add motion effects and quickly resize images to fit particular use cases. A new gallery shows samples of what the Edits do, and let you see before and after shots. Once you're done making your changes, the Guided Edit panel gives you a choice of continuing to edit, saving the image, or sharing it to Facebook, Flickr, Twitter, and SmugMug.



HAZE CODE
If the only thing stopping your photos from looking gorgeous is the sun, try Photoshop Elements' Haze Removal tool.

SHARING AND OUTPUT

These days the most common way to share photos is through Facebook. Elements can make two of your most important Facebook photos—your profile and cover photos—stand out. The Create menu's Facebook Cover tool can automatically blend the two photos for a unique effect using a choice of 10 themes. One creates a profile picture that looks like part of the cover photo, and others frame multiple images creatively.

Elements also gives the most output options of any consumer photo editor—whether you're into creating slideshows, sending picture emails, printing via

Shutterfly, burning discs, or uploading to Web galleries. You can directly upload to a number of online photo sites, including Facebook, Flickr, SmugMug. Missing, however, are Tumblr and Pinterest, and Adobe's own Revel photo-sharing service has been discontinued. One minor disappointment is that Elements' own keyword tags don't carry over into Flickr, though you can add tags at the time of uploading.

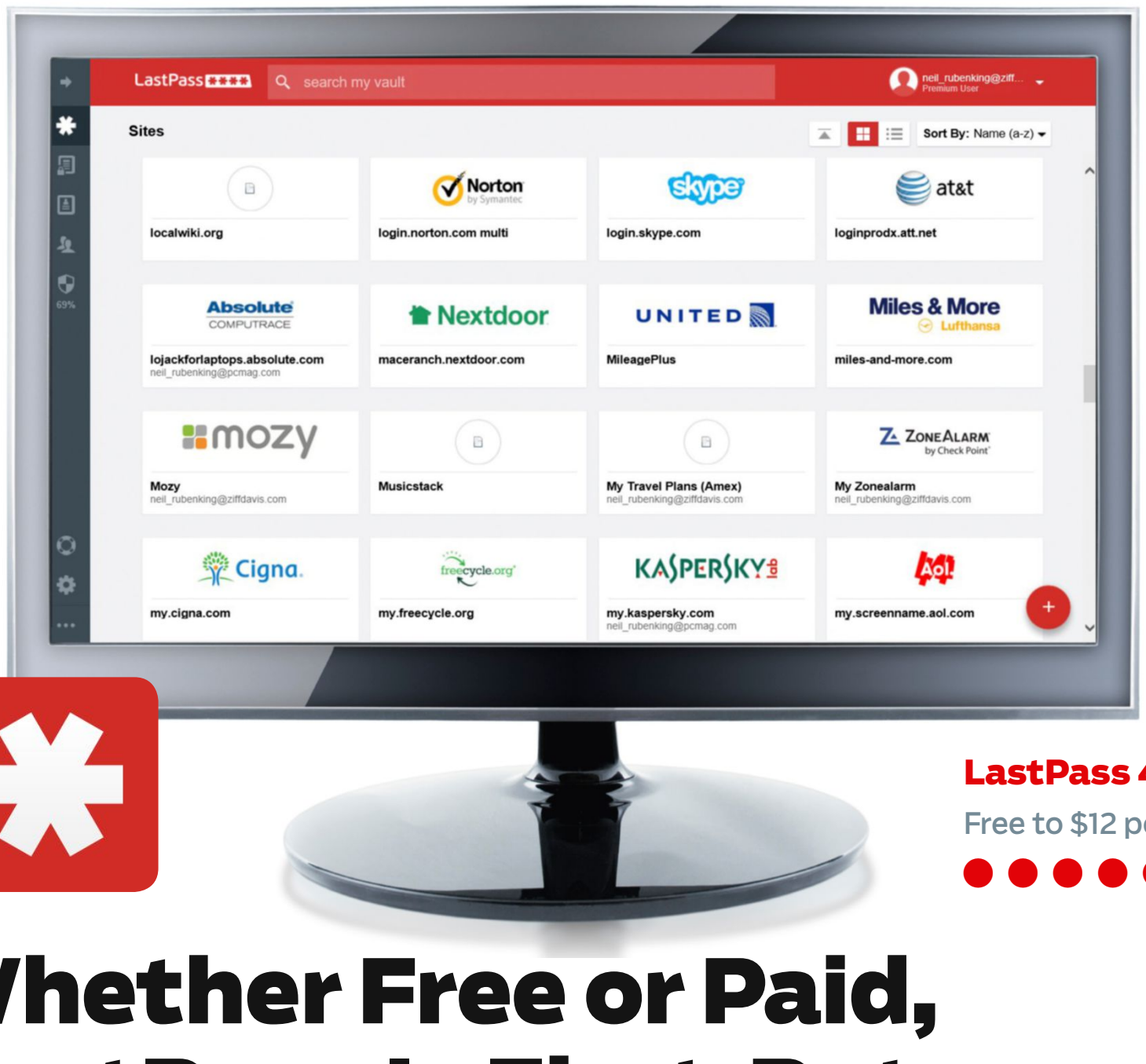
Slideshow creation is particularly detailed: You can even specify duration and transition style for each image. Pan and Zoom and appropriate background music? Not a problem. You can put multiple images on a single slide. The collage feature offers a few layouts and good control, but Windows Photo Gallery actually offers a cooler collage effect. Finally, the calendar builder offers 31 themes for holidays and other topics.

COVER MODEL
Elements has a tool that lets you create Facebook cover and profile images that are in perfect sync.

ALL OF THE ELEMENTS YOU NEED

If you want to organize and do interesting, creative things with your images, but don't want to invest the money and time necessary to buy and learn the full Photoshop, Adobe Photoshop Elements 14 is your best option. It offers a generous subset of what's in Photoshop, but at a much lower price and with a lower learning curve. Competitors can't match Elements' array of photo effects, organizational tools, and sharing and output options. With best-in-class tools for getting creative with your digital images, Photoshop Elements 14 remains our Editors' Choice for enthusiast photo editing.

MICHAEL MUCHMORE



LastPass 4.0

Free to $12 per year

Whether Free or Paid, LastPass Is First-Rate

PC MAGAZINE EDITORS' CHOICE

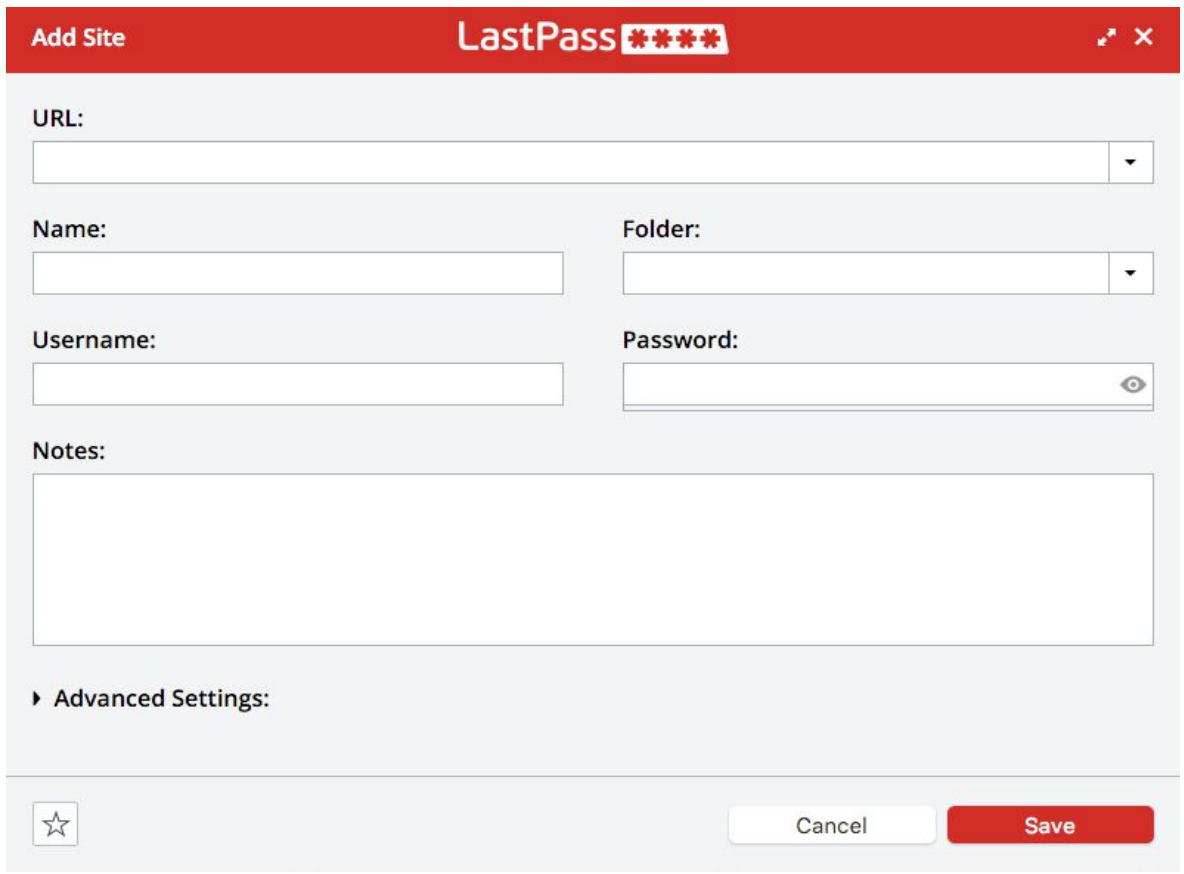
You've heard the saying, "If it ain't broke, don't fix it." Certainly if your password manager is doing everything it should, you don't necessarily need it to change. But sooner or later the interface starts to look dated, and the competition comes up with new features. The free LastPass 4.0 has a bold new online interface, and it adds a Sharing Center to manage shared passwords and Emergency Access so you can hand down your passwords to your heirs. These additions put the free LastPass ahead of many of its for-pay competitors—but its Premium version is also well worth paying $12 per year for.

GETTING STARTED

You can use many commercial password managers for free if you accept substantial limitations, such as a restricted number of passwords or installation

on only one device. That means these aren't really free products. But LastPass lets you use all its essential features for free on as many devices as you like, as long as you stick to one type of device. You can use it on multiple desktops (Windows, Mac, or Linux), multiple smartphones (Android, iOS, Windows Phone, or BlackBerry), or multiple tablets (Android, iOS, or Windows). Only if you want to cross the lines and sync between, say, a desktop and a smartphone must you upgrade to LastPass Premium.

Setting up a LastPass account is simple. Start by downloading and installing the free app, then either sign in to your account or create a new one. As always, you should create a strong master password, something



that you can remember but that nobody else would guess. You can also add a password hint and enable multifactor authentication. Nobody at LastPass has access to your data without that master password. In the past, if you forgot your master password and the hint didn't jog your memory, you had no recourse but to start over. Now when you install LastPass on a new device, you get the option to have it save a one-time password for account recovery. The recovery process

LastPass 4.0

PROS Automated password changing. Powerful multifactor authentication. Actionable security report. Enhanced sharing. Lets others "inherit" your passwords. Premium version adds excellent features.

CONS Default settings for password generator could be more secure.

SECOND SITE
Setting up and editing sites in LastPass 4.0 is easy. Not happy with your passwords? The software can help you generate new ones.

requires access to your email account and to the device, so this isn't too much of a security risk. Even so, I'd be inclined to stick with the master password.

During installation, LastPass offers to slurp up passwords stored insecurely in your browsers. It also deletes the passwords from unsafe storage and turns off the browser's password capture. In addition, you can import data from several dozen competing password managers.

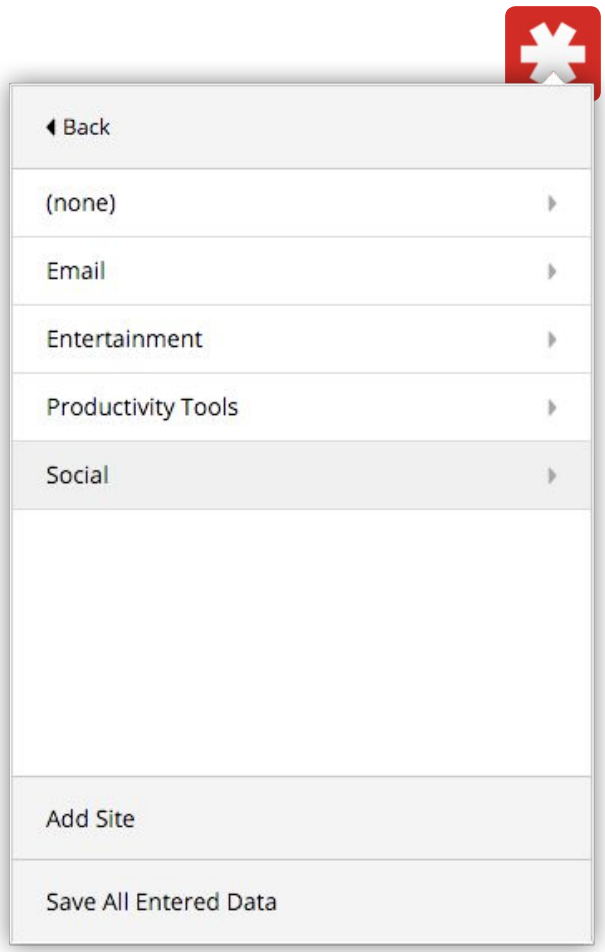
Once the LastPass extension is installed in your browsers, you know the drill: Log in to your secure sites as always and let LastPass save your credentials. You can assign a friendly name for the site at capture time, and add it to a new or existing folder. LastPass itself suggests folders for well-known sites. LastPass can easily handle sites with weird login pages, too. Clicking the LastPass toolbar button in your browser brings up a menu that includes a menu of all your saved sites. Each folder becomes a submenu, and you can have nested folders. (Premium users can download LastPass IE Anywhere and save it to a thumb drive; when launched, it provides full access to the program's features without relying on a browser extension.)

LastPass can easily handle sites with weird login pages.

FEATURES

Once you've stored your passwords, you can use Security Challenge to see how good or bad they are. It will inform you of old, weak, or reused passwords, and even warn you if they're being used at known compromised sites. You'll receive a score for both your individual passwords and your master password, and see how you stack up to others in the LastPass community. You can then choose to follow the software's suggestions to make all your passwords more secure. A single button even makes it possible to update up to 80 passwords at once.

By default, the password generator in LastPass creates 12-character passwords using at least one digit and a mix of capital and small letters—not as secure as it could



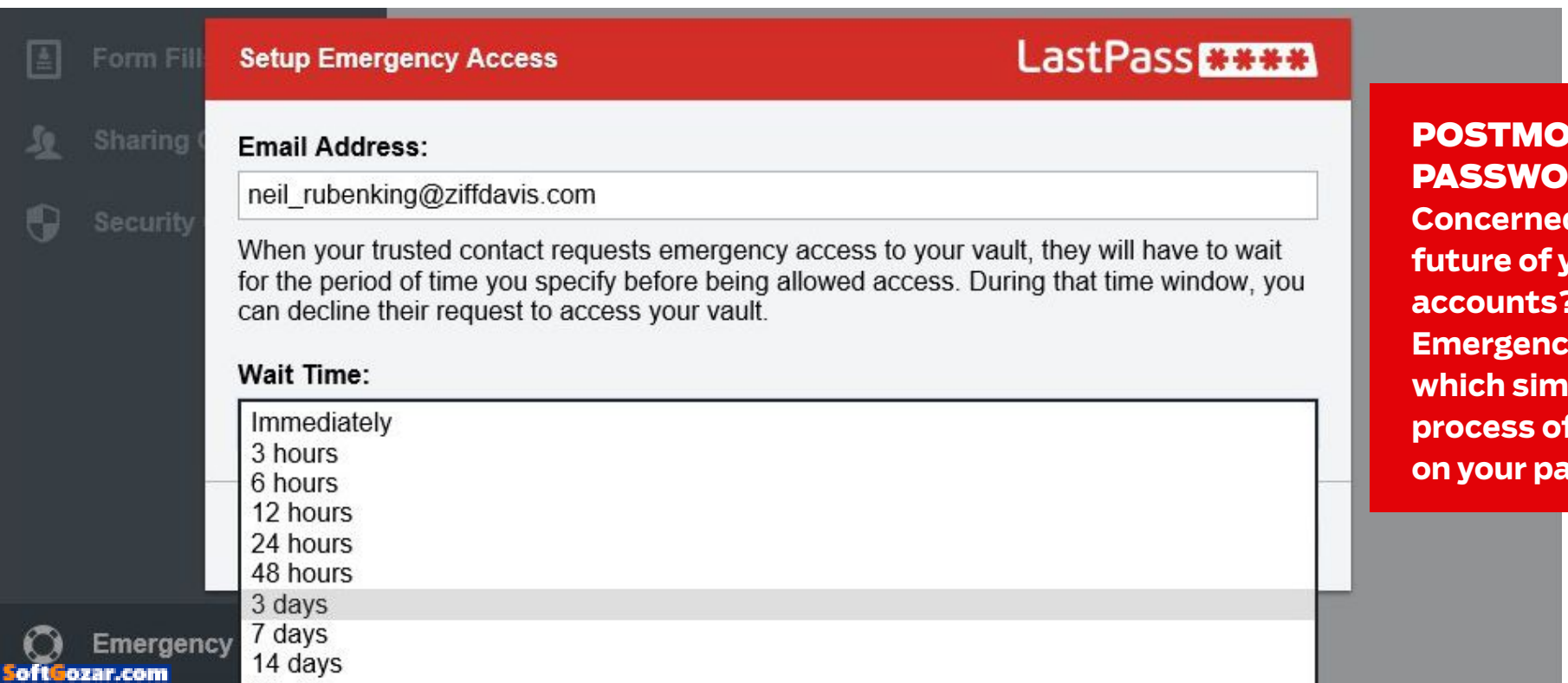
PASS GO
Click on the LastPass icon in your Web browser to view all your passwords in a neatly organized folder collection.

make them out of the box. You can crank up the length and include punctuation to get even stronger passwords or select Make Pronounceable for passwords that may be easier to remember. LastPass captures all credentials you enter for a site, and it offers to update its saved password when you make a change. This works whether or not you accept the aid of the password generator.

From the LastPass Vault you can view, edit, and organize all of your saved logins. You now have the option to see them displayed in a grid of tiles, much the way Dashlane does. The tiles in LastPass are rather large; the new ability to collapse the left-hand menu makes more room for them. Now you can add a new folder, secure note, or site, or share an existing item with other users (more about sharing later), all from one button. You can also select multiple items at once and perform bulk actions like moving them all to a folder, sharing them, or deleting them.

Emergency Access makes it easy for you to pass on your passwords after you pass on. You enter your recipient's email address and define a waiting period (during which time you can deny access if, in fact, you're still alive). Recipients must install LastPass, if they haven't already, and accept your connection request. Now if something happens to you, the recipient simply requests access to your account and will get it after the waiting period.

LastPass is the most flexible free password manager as far as sharing goes. Just point to an item in the vault, click the sharing icon, and enter the recipient's email address. Recipients who already use LastPass will see a notification that a new share has arrived; others will get an email message explaining how to create an account and accept the share. The recipient can use the shared item to log in; you choose whether or not to make the password visible. The new Sharing Center within the vault lets you easily manage your shared items. (Note, though, that folder sharing is a feature available only in Premium.)



POSTMORTEM PASSWORDS
Concerned about the future of your online accounts? Use Emergency Access, which simplifies the process of passing on your passwords.

Along with LogMeOnce and Norton Identity Safe, LastPass is one of the few free password managers that lets you automatically fill in login credentials—just click an icon the software adds next to a field in a Web form. You can define any number of full identity profiles, each including a variety of personal and contact information, along with one credit card and one bank account. Those with a certain level of Web design expertise can define custom fields, meaning that when LastPass encounters a field with a specific internal name, it will fill in that field with the selected data. You can even create profiles containing nothing but a credit card number, if you want to separate that information from your personal data.

Although LastPass requires email verification the first time you log in from a new device, you can seriously enhance your security by taking advantage of the available multifactor authentication options. LastPass supports Google Authenticator, as well as such work-alikes as Duo Mobile and Twilio Authy, plus the Toopher and Transakt apps. Premium adds fingerprint scanning and authentication via YubiKey (a $25 USB device, sold separately) or its proprietary Sesame app (which you download onto a key yourself). You can define specific devices as "trusted," so you can skip multifactor authentication and just use your master password, or restrict mobile logins to devices you own.

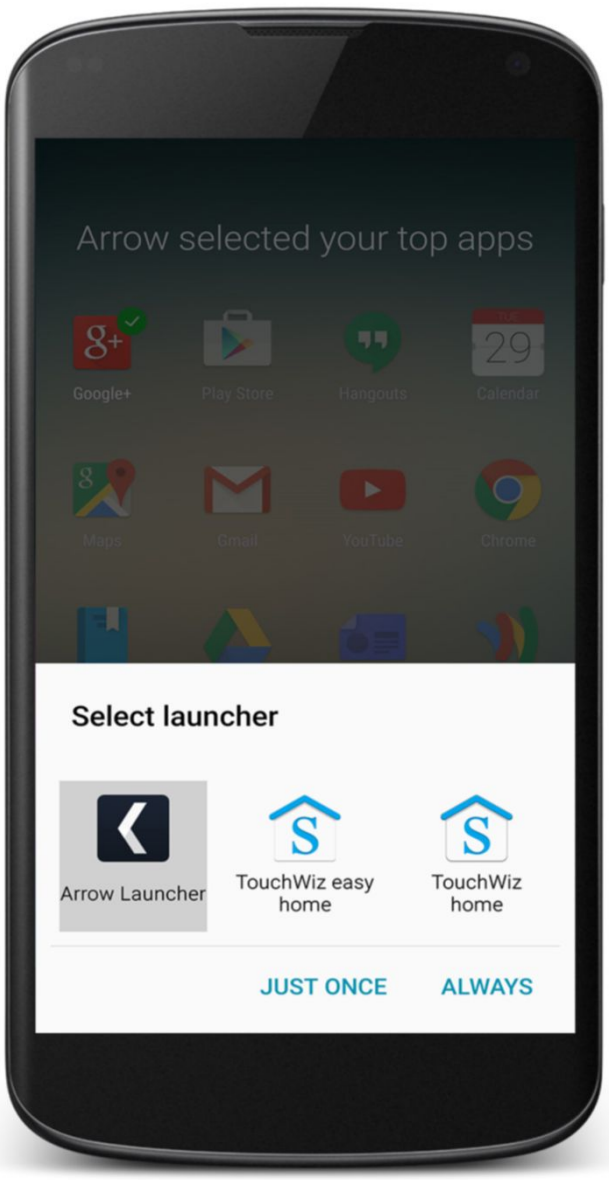
Whether you go for its free or paid version, LastPass is excellent.

STILL A WINNER

True, you can get a slicker experience with Dashlane, but LastPass 4.0 goes further in terms of features. Whether you go for its free or paid version, LastPass is excellent and well deserving of our Editors' Choice award. It's everything you need in a password manager.

NEIL J. RUBENKING

Our Favorite Apps



Microsoft Arrow Launcher Android

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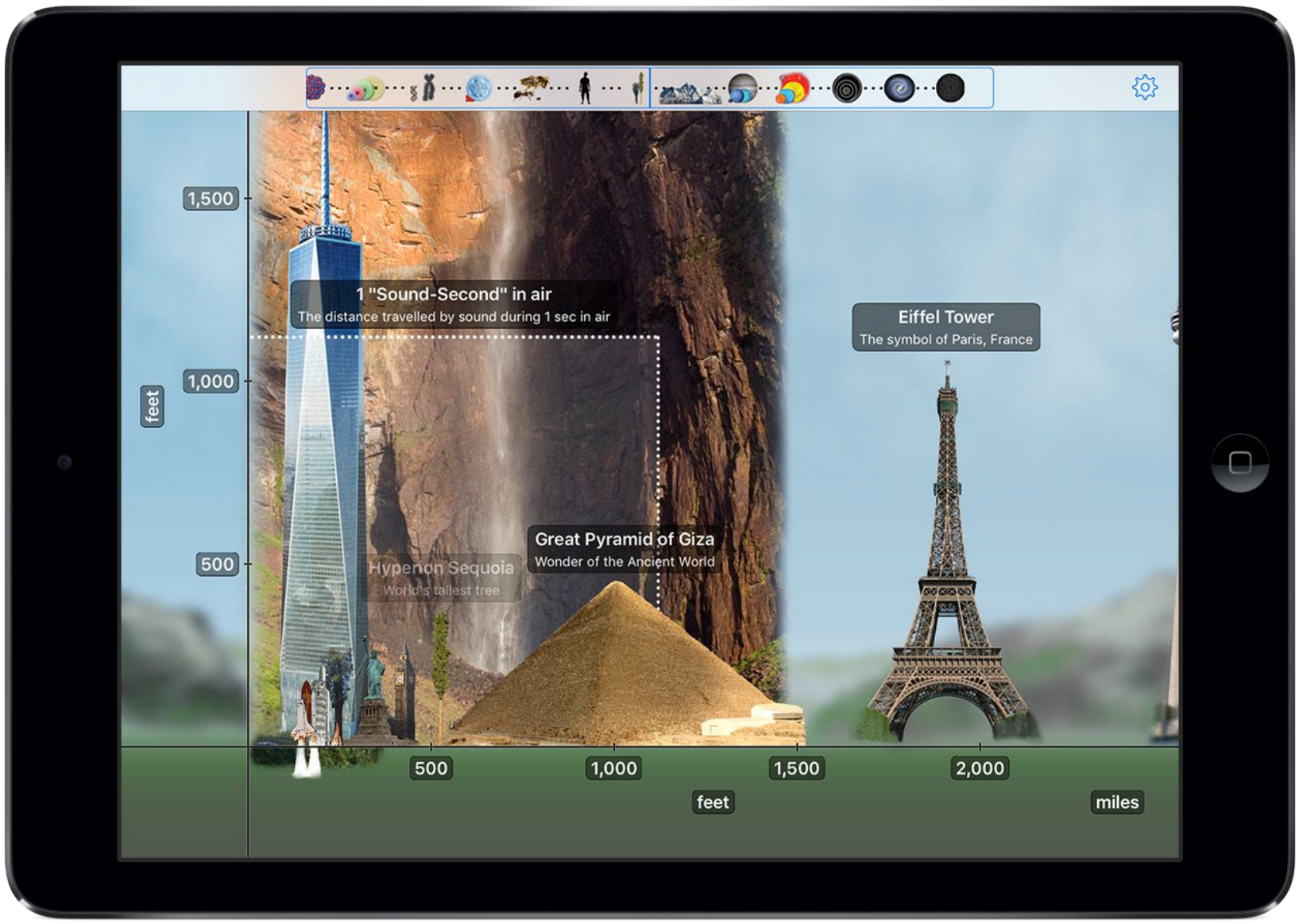
If you use a skinned Android interface on your phone, you know that it's not exactly straightforward: When you swipe in either direction on the home screen, you get pages of widgets, icons, and settings—but seldom what you need. Microsoft's Arrow Launcher is designed to simplify this experience by surfacing your most frequently used apps on the start page, and letting you see your most frequently contacted People, Notes and Reminders, Widgets, and Recent items with further swipes. It's a smart, refreshing update to an interface that too often is confusing.




Our Favorite Apps



Universal Zoom ios

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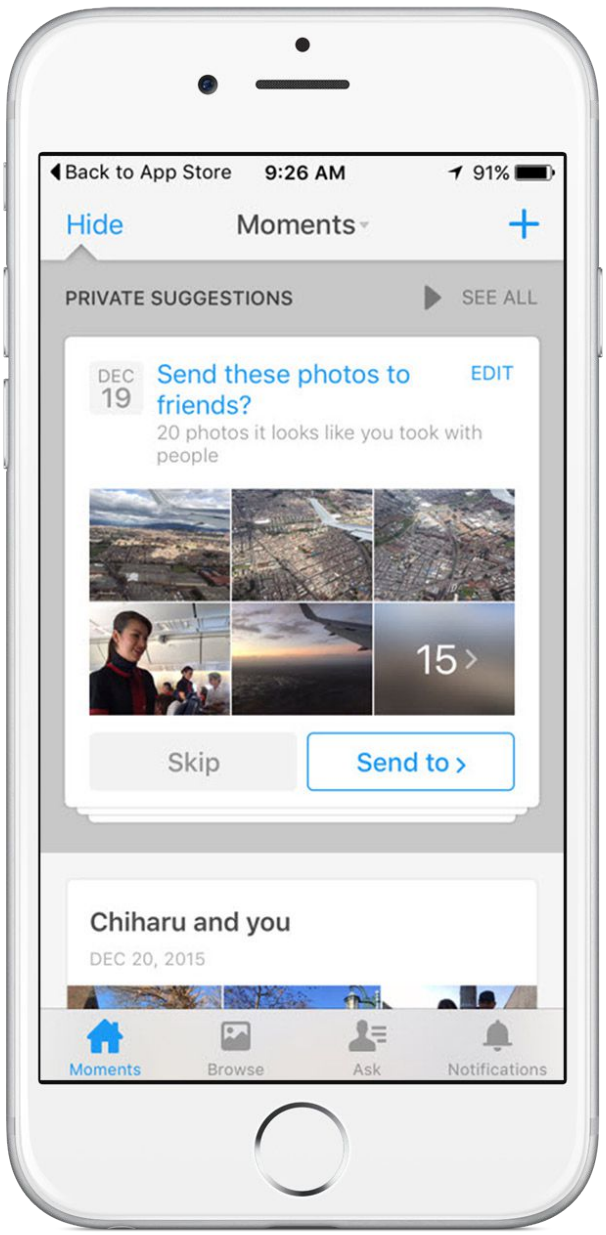
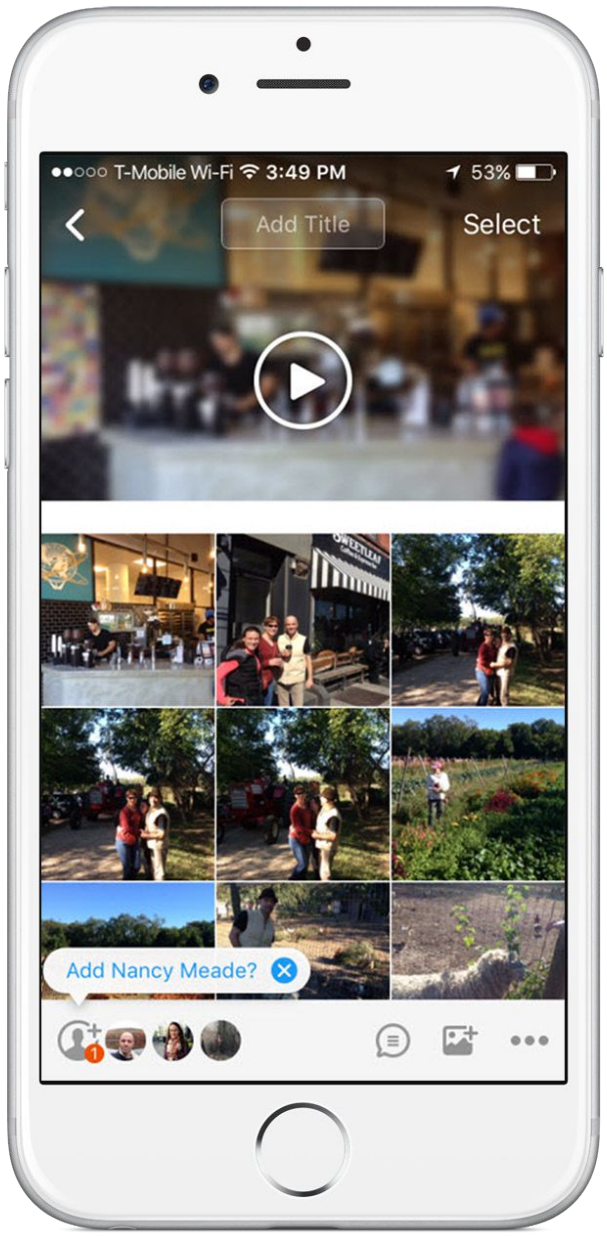
No, Universal Zoom isn't a camera app: It explores the scale of the cosmos and the relative sizes of various objects and the distances between them, from the tiniest subatomic particles to superclusters of galaxies. An average-height (5-foot-9-inch) human male is the baseline against which you can compare smaller animals (meerkats, hedgehogs), larger objects (mountains, planets, and galaxies), and much more. Attractive graphics and music, plus a number of navigation options, make Universal Zoom easy and fun to use for the enterprising student or the curious layman interested in knowing more about the world—and the universe—around us.




Our Favorite Apps





Facebook Moments Android, iOS

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Sharing photos from events you enjoyed has been a problem that technology companies have been trying to solve for more than a decade. With its Moments app, Facebook takes a lot of the pain out of the process. Moments finds photos in your phone from events based on when they were taken and who's in them and lets you easily and privately share sets and create full-featured, attractive slideshow videos. Friends can't view photo sets without the app and there's no support for including videos, but otherwise Moments is a powerful, simple-to-use solution to the problem of effective photo sharing.




Our Favorite Apps

D&D Lords of Waterdeep iOS

EDITORS' CHOICE ●●●●◐

You don't need any knowledge of Dungeons & Dragons to have plenty of fun with Lords of Waterdeep. This excellent, streamlined digital translation of the board game makes you a power broker who must both recruit eager adventurers to complete quests and manage resources (money, wizards, and so on) better than your opponents. Not hard to play or learn, Lords of Waterdeep looks lush and atmospheric, and has enough depth to keep you involved and making new discoveries during the many times you'll undoubtedly want to play it.

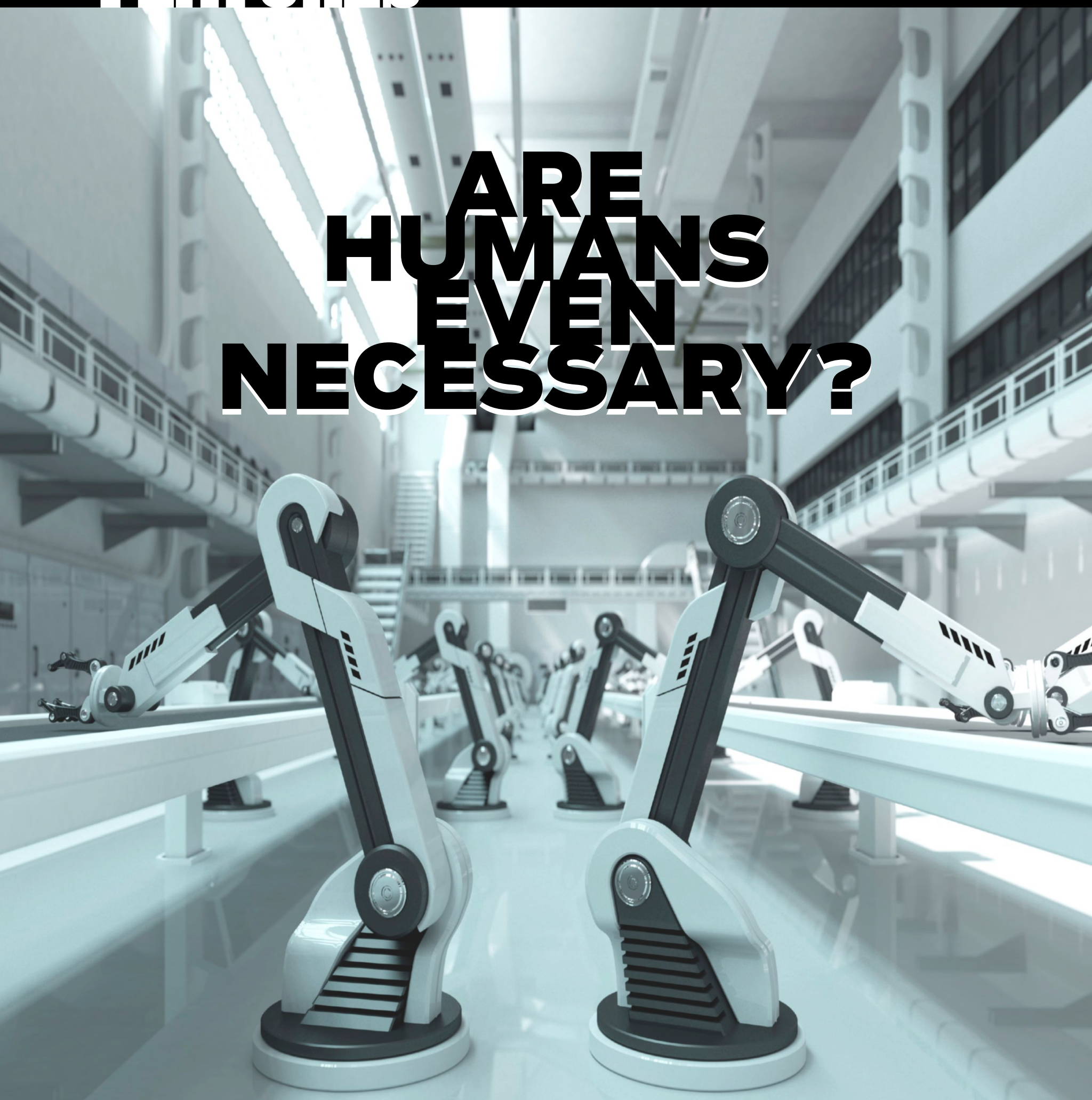



Features

ARE HUMANS EVEN NECESSARY?

9 TRENDS AT CES

ARE HUMANS EVEN NECESSARY?



The development of technology is reducing the need for human workers in many industries. But if this has some unsettling implications for the future, it also offers real reason for hope.

BY EVAN DASHEVSKY

A lone researcher recently made a remarkable discovery that may save millions of lives. She identified a chemical compound that effectively targets a key growth enzyme in *Plasmodium vivax*, the microscopic parasite responsible for most of the world's malaria cases. The scientist behind this new weapon against one of humanity's great biological foes didn't expect praise, a bonus check, or even so much as a hardy pat on the back for her efforts. In fact, "she" lacks the ability to expect anything.

This breakthrough came courtesy of Eve, a "robotic scientist" that resides at the University of Manchester's Automation Lab. Eve was designed to find new disease-fighting drugs faster and cheaper than her human peers. She achieves this by using advanced artificial intelligence to form original hypotheses about which compounds will murder malicious microbes (while sparing human patients) and then conducting controlled experiments on disease cultures via a pair of specialized robotic arms.

Eve is still under development, but her proven efficacy guarantees that Big Pharma will begin to "recruit" her and her automated ilk in place of comparatively measured human scientists who demand annoying things like "monetary compensation," "safe work environments," and "sleep."

AND EVE WAS NOT WEAK
The University of Manchester's robotic scientist Eve can discover new drugs faster than humans—and she never asks for vacation time.

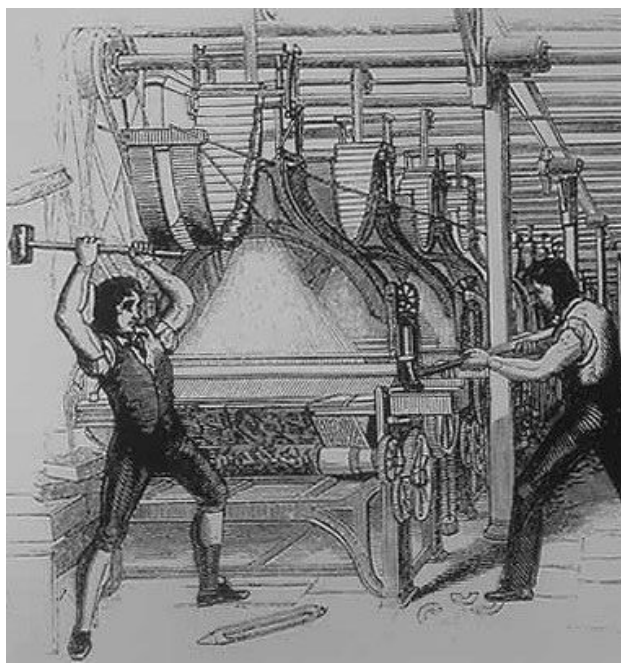
If history is any guide, human pharmaceutical researchers won't disappear entirely—at least not right away. What will probably happen is that the occupation will follow the path of so many others (assembly line worker, highway toll taker, bank teller) in that the ratio of humans to non-sentient entities will tilt dramatically.

Machines outperforming humans is a tale as old as the Industrial Revolution. But as this process takes hold in the logarithmically evolving Information Age, many are beginning to question if human workers will have any place in the future economy.

THE BRAND NEW THING THAT IS HAPPENING

The Luddites were an occasionally violent group of 19th-century English textile workers who raged against the industrial machines that were beginning to replace human workers. The Luddites' anxieties were certainly understandable, if—as history would eventually bear out—misguided. Rather than crippling the economy, the mechanization the Luddites feared actually improved the standard of living for most Brits. New positions that took advantage of these rising technologies and the cheaper wares they produced (eventually) supplanted the jobs that were lost.

Fast-forward to today and "Luddite" has become a derogatory term used to describe anyone with an irrational fear or distrust of new technology. The so-called "Luddite fallacy" has become near-dogma among economists as a way to describe and dismiss the fear that new technologies will eat up all the jobs and leave nothing in their place. So, perhaps the HR assistant who's been displaced by state-of-the-art applicant tracking software or the cashier who got the boot in exchange for a self-checkout kiosk can take solace in the fact that the bomb that just blew up in their lives was just clearing the way for a new higher-skill job in their future. And why shouldn't that be the case? This technology-employment paradigm has been validated by the past 200 or so years of history.



RAGE AGAINST THE MACHINES
As textile workers in the early 19th century, the Luddites saw their jobs and livelihood being threatened by technological advances, and destroyed machines and battled the British Army to make their displeasure known.

Yet some economists have openly pondered if the Luddite fallacy might have an expiration date. The concept only holds true when workers are able to retrain for jobs in other parts of the economy that are still in need of human labor. So, in theory, there could very well come a time when technology becomes so pervasive and evolves so quickly that human workers are no longer able to adapt fast enough.

There could very well come a time when technology becomes so pervasive and evolves so quickly that human workers are no longer able to adapt fast enough.

One of the earliest predictions of this personless workforce came courtesy of an English economist who famously observed, "We are being afflicted with a new disease of which some readers may not yet have heard the name, but of which they will hear a great deal in the years to come—namely, technological unemployment. This means unemployment due to our discovery of means of economising the use of labour outrunning the pace at which we can find new uses for labour."

That economist was John Maynard Keynes, and the excerpt was from his 1930 essay "Economic Possibilities for our Grandchildren." Well, here we are some 85 years later (and had Keynes had any grandchildren they'd be well into retirement by now, if not moved on to that great job market in the sky), and the "disease" he spoke of never materialized. It might be tempting to say that Keynes' prediction was flat-out wrong, but there is reason to believe that he was just really early.

Fears of technological unemployment (TU) have ebbed and flowed through the decades, but recent trends are spurring renewed debate as to whether we may—in the not-crazy-distant future—be innovating ourselves toward unprecedented economic upheaval. This past September in New York City, there was even a World Summit on Technological Unemployment that featured economic heavies like Robert Reich (Secretary of Labor during the Clinton administration), Larry Summers (Secretary of the Treasury, also under Clinton), and Nobel Prize–winning economist Joseph Stiglitz.

KEYNES EYE FOR DETAIL? Economist John Maynard Keynes (1883-1946) predicted the onset of technological unemployment decades before its time.

So why might 2016 be so much more precarious than 1930? Today, particularly disruptive technologies like artificial intelligence, robotics, 3D printing, and nanotechnology are not only steadily advancing, but the data clearly shows that their rate of advancement is increasing (the most famous example of which being Moore's Law's near-flawless record of describing how computer processors grow exponentially brawnier with each generation). Furthermore, as the technologies develop independently, they will hasten the development of other segments (for example, artificial intelligence might program 3D printers to create the next generation of robots, which in turn will build even better 3D printers). It's what futurist and inventor Ray Kurzweil has described as the Law of Accelerating Returns: Everything is getting faster—faster.

The evolution of recorded music illustrates this point. It's transformed dramatically over the past century, but the majority of that change has occurred in just the past two decades. Analog discs were the most important medium for more than 60 years before they were supplanted by CDs and cassettes in the 1980s, only to be taken over two decades later by MP3s, which are now rapidly being replaced by streaming audio. This is the type of acceleration that permeates modernity.

"I believe we're reaching an inflection point," explains software entrepreneur and author of the book *Rise of the Robots*, Martin Ford. "Specifically in the way that machines—algorithms—are starting to pick up cognitive tasks. In a limited sense, they're starting to think like people. It's not like in agriculture, where machines were just displacing muscle power for mechanical activities. They're starting to encroach on that fundamental capability that sets us apart as a species—the ability to think. The second thing [that is different than the Industrial Revolution] is that information technology is so ubiquitous. It's going to invade the entire economy, every employment sector. So there isn't really a safe

FORD EVERY DATA STREAM
In his book *Rise of the Robots*, Martin Ford looks at the possible future potential of robots, and explores the ways they could replace human beings in countless blue- and white-collar jobs.

haven for workers. It's really going to impact across the board. I think it's going to make virtually every industry less labor-intensive. "

To what extent this fundamental shift will take place—and on what timescale—is still very much up for debate. Even if there isn't the mass economic cataclysm some fear, many of today's workers are completely unprepared for a world in which it's not only the steel-driving John Henrys who find that machines can do their job better (and for far cheaper), but the Michael Scotts and Don Drapers, too. A white-collar job and a college degree no longer offer any protection from automation.

"A white-collar job and a college degree no longer offer any protection from automation."

IF I ONLY HAD A BRAIN

There is one technology in particular that stands out as a disruption super-tsunami in waiting. Machine learning is a subfield of AI that makes it possible for computers to perform complex tasks for which they weren't specifically programmed—indeed, for which they couldn't be programmed—by enabling them to both gather information and utilize it in useful ways.

Machine learning is how Pandora knows what songs you'll enjoy before you do. It's how Siri and other virtual assistants are able to adapt to the peculiarities of your voice commands. It even rules over global finances (high-frequency trading algorithms now account for more than three-quarters of all stock trades; one venture capital firm, Deep Knowledge Ventures, has gone so far as to appoint an algorithm to its board of directors).

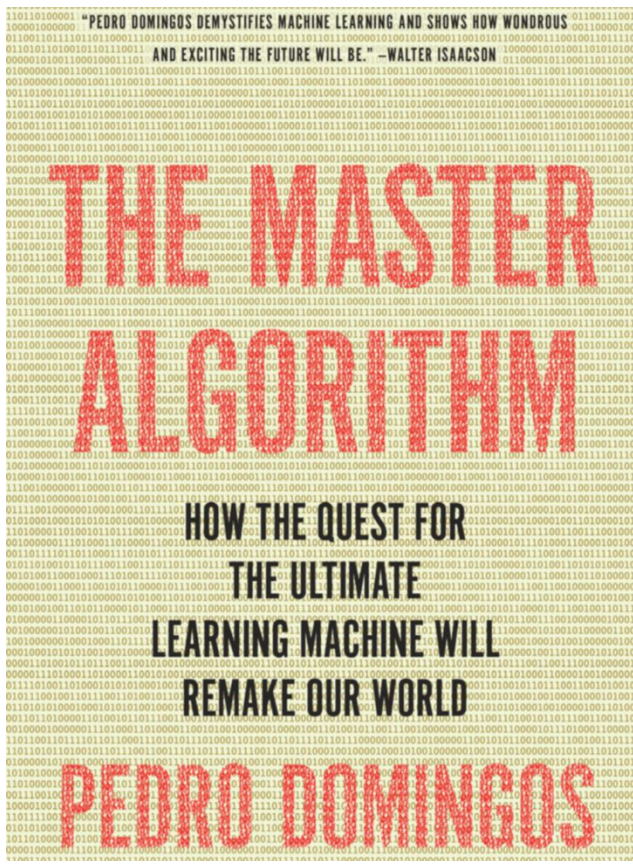
Another notable example—and one that will itself displace thousands, if not millions, of human jobs—is the software used in self-driving cars. We may think of driving as a task involving a simple set of decisions (stop at a red light, make two lefts and a right to get to Bob's house, don't run over anybody), but the realities of the road demand that drivers make *lots* of decisions—far more than could ever be accounted for in a single program. It would be difficult to write code that could handle, say, the

KNOW-IT-ALL
Machine learning could lead to a "universal learner" capable of performing any task, argues Pedro Domingos in his book, *The Master Algorithm*.

wordless negotiation between two drivers who simultaneously arrive at a four-way-stop intersection, let alone the proper reaction to a family of deer galloping into heavy traffic. But machines are able to observe human behavior and use that data to approximate a proper response to a novel situation.

"People tried just imputing all the rules of the road, but that doesn't work," explains Pedro Domingos, professor of computer science at the University of Washington and author of *The Master Algorithm*. "Most of what you need to know about driving are things that we take for granted, like looking at the curve in a road you've never seen before and turning the wheel accordingly. To us, this is just instinctive, but it's difficult to teach a computer to do that. But [one] can learn by observing how people drive. A self-driving car is just a robot controlled by a bunch of algorithms with the accumulated experience of all the cars it has observed driving before—and that's what makes up for a lack of common sense."

Mass adoption of self-driving cars is still many years away, but by all accounts they are quite capable at what they do right now (though Google's autonomous car apparently still has trouble discerning the difference between a deer and a plastic bag blowing in the wind). That's truly amazing when you look at what computers were able to achieve only a decade ago. With the prospect of accelerating evolution, we can only imagine what tasks they will be able to take on in another ten years.



IS THERE A *THERE* THERE?

No one disagrees that technology will continue to achieve once-unthinkable feats, but the idea that mass technical unemployment is an inevitable result of these advancements remains controversial. Many economists maintain an unshakable faith in The Market and its ability to provide jobs regardless of what robots and other assorted futuristic machines happen to be zooming around. There is, however, one part of the economy where technology has, beyond the shadow of any doubt, pushed humanity aside: manufacturing.

According to the Federal Reserve, between 1975 and 2011 manufacturing output in the United States more than doubled (and that's despite NAFTA and the rise of globalization), while the number of (human) workers employed in manufacturing positions decreased by 31 percent. This dehumanizing of manufacturing isn't just a trend in America—or even rich western nations—it's a global phenomenon. It's found its way into China, too, where manufacturing output increased by 70 percent between 1996 and 2008 even as manufacturing employment declined by 25 percent over the same period, according to the U.S. Department of Labor.

There's a general consensus among economists that our species' decreasing relevance in manufacturing is directly attributable to technology's ability to make more stuff with fewer people. And what business wouldn't trade an expensive, lunch-break-addicted human workforce for a fleet of never-call-out-sick machines? (Answer: all the ones driven into extinction by the businesses that did.)

The $64 trillion question is whether this trend will be replicated in the services sector that more than two-thirds of U.S. employees now call their

occupational home. And if it does, where will all those human workers move on to next?

"There's no doubt that automation is already having an effect on the labor market," says James Pethokoukis, a fellow with the libertarian-leaning American Enterprise Institute. "There's been a lot of growth at high-end jobs, but we've lost a lot of middle-skill jobs—the kind where you can create a step-by-step description of what those jobs are, like bank tellers or secretaries or front-office people."

JAMES PETHOKOUKIS
Columnist and blogger at the American Enterprise Institute.

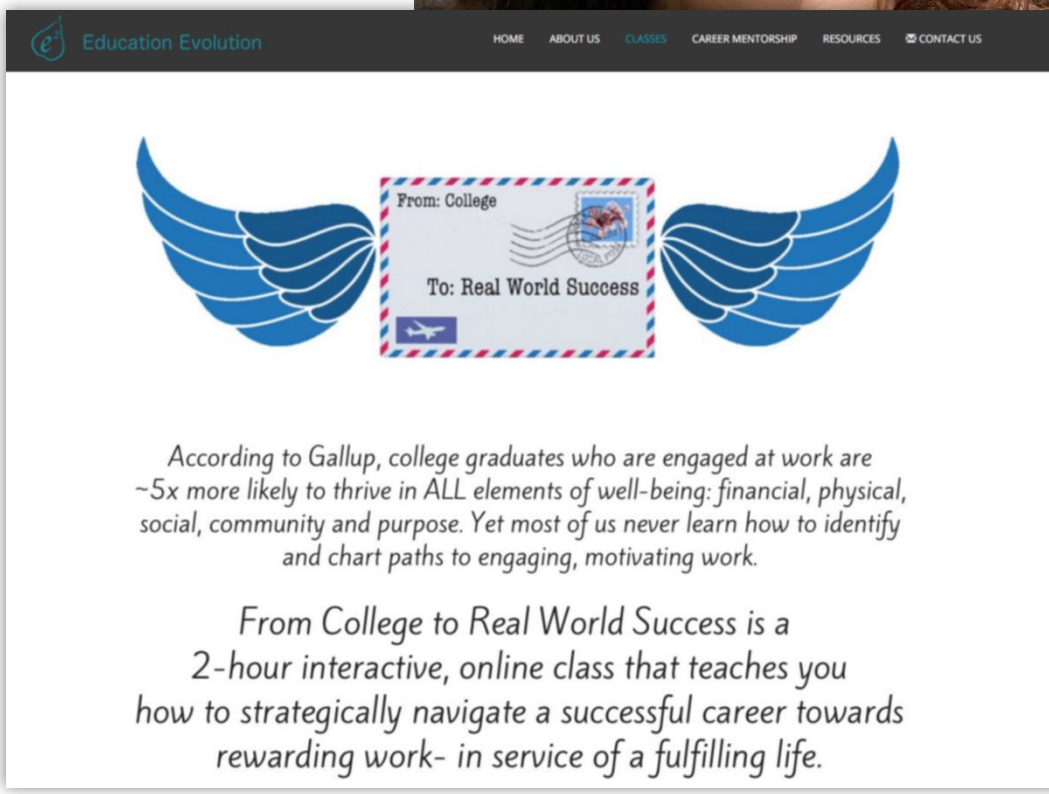
It may be tempting to discount fears about TU when we see corporate profits routinely hitting record highs. Even the unemployment rate in the U.S. has fallen back to pre-economic-train-crash levels. But we should keep in mind that participation in the labor market remains mired at the lowest levels seen in four decades. There are numerous contributing factors here (not the least of which is the retiring baby boomers), but some of it is surely due to people so discouraged with their prospects in today's job market that they simply "peace out" altogether.

Another important plot development to consider is that even among those with jobs, the fruits of this increased productivity are not shared equally. According to the Economic Policy Institute, between 1973 and 2013 average U.S. worker productivity in all sectors increased an astounding 74.4 percent, while hourly compensation only increased 9.2 percent. It's hard not to conclude that human workers are simply less valuable than they once were.

SO WHAT NOW, HUMANS?

Let's embark on a thought experiment and assume that TU is absolutely happening and its destructive effects are seeping into every employment nook and economic cranny. (To reiterate: This is far from a consensus viewpoint.) How should society prepare? Perhaps we can find a way forward by looking to our past.

Nearly two centuries ago, as the nation entered the Industrial Revolution, it also engaged in a parallel revolution in education known as the Common School Movement. In response to the economic upheavals of the day, society began to promote the radical concept that all children should have access to a basic education regardless of their family's wealth (or lack thereof). Perhaps most important, students in these new "common schools" were taught standardized skills and adherence to routine, which helped them go on to become capable factory workers.



"This time around we have the digital revolution, but we haven't had a parallel revolution in our education system," says economist and Education Evolution founder Lauren Paer. "There's a big rift between the modern economy and our education system. Students are being prepared for jobs in the wrong century. Adaptability will probably be the most valuable skill we can learn. We need to promote awareness of a landscape that is going to change quickly."

In addition to helping students learn to adapt—in other words, learn to learn—Paer encourages schools to place more emphasis on cultivating the soft skills in which "humans have a natural competitive advantage over machines," she says. "Things like asking questions, planning, creative problem solving, and empathy—those skills are very important for sales, it's very important for marketing, not to mention in areas that are already exploding, like eldercare."

One source of occupational hope lies in the fact that even as technology removes humanity from many positions, it can also help us retrain for new roles. Thanks to the Internet, there are certainly more ways to access information than ever before. Furthermore (if not somewhat ironically), advancing technologies can open new opportunities by lowering the bar to positions that previously required years of training; people without medical degrees might be able to handle preliminary emergency room diagnoses with the aid of an AI-enabled device, for example.

So, perhaps we shouldn't view these bots and bytes as interlopers out to take our jobs, but rather as tools that can help us do our jobs better. In fact, we may not have any other course of action—barring a global Amish-style rejection of progress, increasingly capable and sci-fabulous technologies are going to come online. That's a given; the workers who learn to embrace them will fare best.

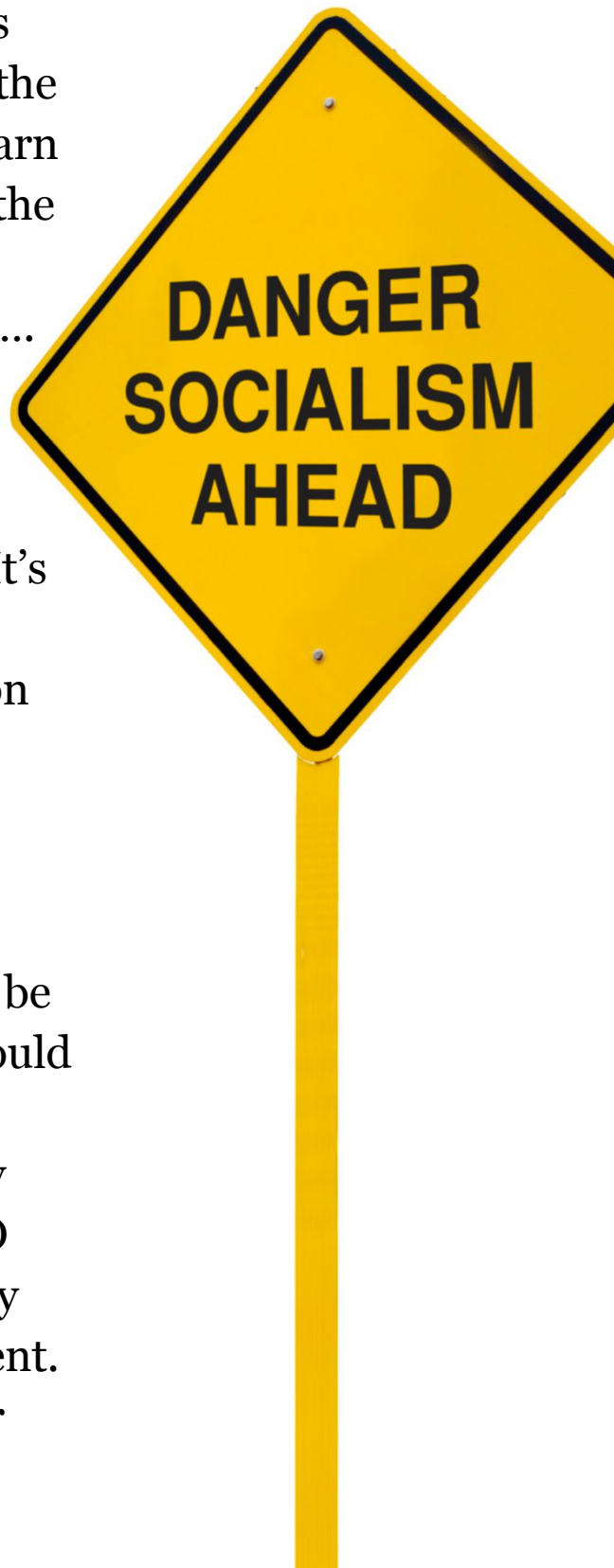
"There will be a lot of jobs that won't disappear, but they will change because of machine learning," says Domingos. "I think what everyone needs to do is look at how they can take advantage of these technologies. Here's an analogy: A human can't win a race against a horse, but if you ride a horse, you'll go a lot further. We all know that Deep Blue beat Kasparov and then computers became the best chess players in the world—but that's actually not correct. The current world champions are what we call 'centaurs,' that's a team of a human and a computer. A human and a computer actually complement each other very well. And, as it turns out, human-computer teams beat all solely human or solely computer competitors. I think this is a good example of what's going to happen in a lot of areas."

Technologies such as machine learning can indeed help humans—at least those with the technical know-how—excel. Take the example of Cory Albertson, a "professional" fantasy sports better who has earned millions from daily gaming sites using hand-crafted algorithms to stake an advantage over human competitors whose strategies are often based on little more than what they gleaned from last night's *SportsCenter*. Also, consider the previously mentioned stock trading algorithms that have enabled financial players to amass fortunes on the market. In the case of these so-called "algo-trading" scenarios, the algorithms do all the heavy lifting and rapid trading, but carbon-based humans are still in the background implementing the investment strategies.

Of course, even with the most robust educational reform and distributed technical expertise, accelerating change will probably push a substantial portion of the workforce to the sidelines. There are only so many people who will be able to use coding magic to their benefit. And that type of disparity can only turn out badly.

One possible solution many economists have proposed is some form of universal basic income (UBI), aka just giving people money. As you might expect, this concept has the backing of many on the political left, but it's also had notable supporters on the right (libertarian economic rock star Friedrich Hayek famously endorsed the concept). Still, many in the U.S. are positively allergic to anything with even the faintest aroma of "socialism."

“Accelerating change will probably push a substantial portion of the workforce to the sidelines.”



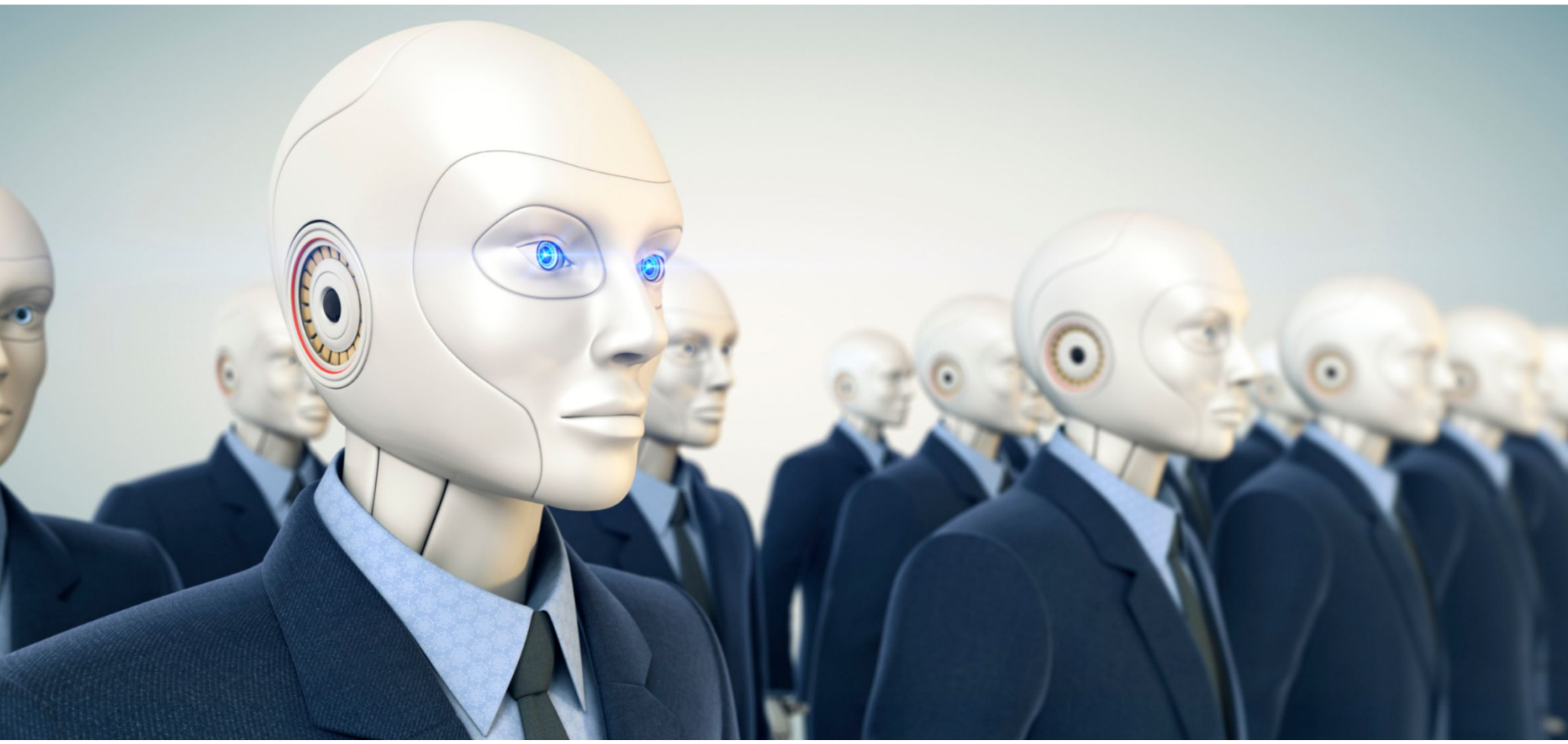
"It's really not socialism—quite the opposite," comments Ford, who supports the idea of a UBI at some point down the road to counter the inability of large swaths of society to earn a living the way they do today. "Socialism is about having the government take over the economy, owning the means of production, and—most importantly—allocating resources.... And that's actually the opposite of a guaranteed income. The idea is that you give people enough money to survive on and then they go out and participate in the market just as they would if they were getting that money from a job. It's actually a free market alternative to a safety net."

The exact shape of a *Homo sapiens* safety net depends on whom you ask. Paer endorses a guaranteed jobs program, possibly in conjunction with some form of UBI, while "the conservative version would be through something like a negative income tax," according to Pethokoukis. "If you're making $15 per hour and we as a society think you should be making $20 per hour, then we would close the gap. We would cut you a check for $5 per hour."

In addition to maintaining workers' livelihoods, the very nature of work might need to be re-evaluated. Google CEO Larry Page has suggested the implementation of a four-day workweek in order to allow more people to find employment. This type of shift isn't so pie-in-the-sky when you consider

that, in the late 19th century, the average American worker logged nearly 75 hours per week, but the workweek evolved in response to new political, economic, and technological forces. There's no real reason that another shift of this magnitude couldn't (or wouldn't) happen again.

If policies like these seem completely unattainable in America's current gridlock-choked political atmosphere, that's because they most certainly are. If mass technological unemployment does begin to manifest itself as some anticipate, however, it will bring about a radical new economic reality that would demand a radical new political response.



TOWARD THE *STAR TREK* ECONOMY

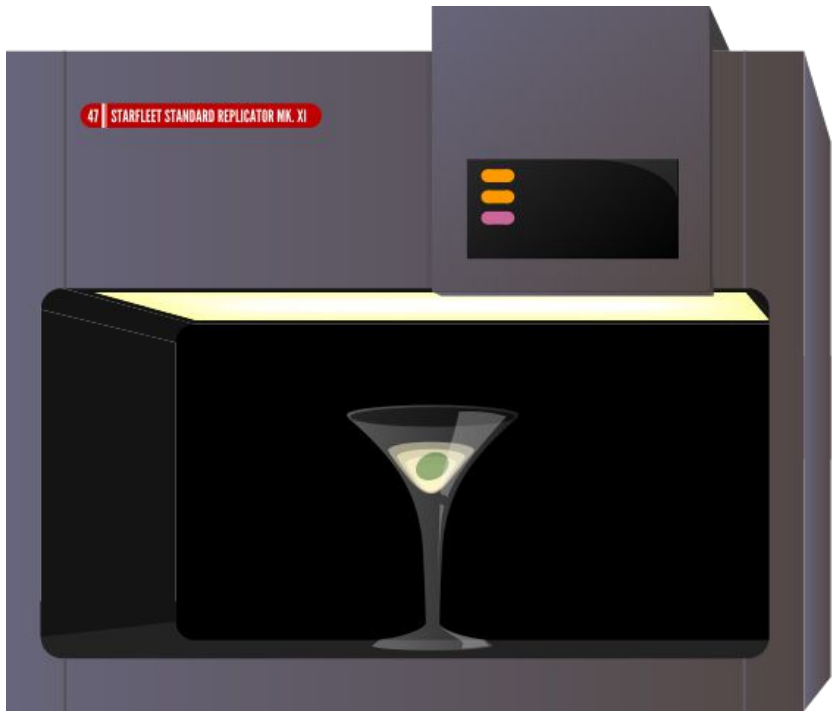
Nobody knows what the future holds. But that doesn't mean it isn't fun to play the "what if" game. What if no one can find a job? What if everything comes under control of a few trillionaires and their robot armies? And, most interesting of all: What if we're asking the wrong questions altogether?

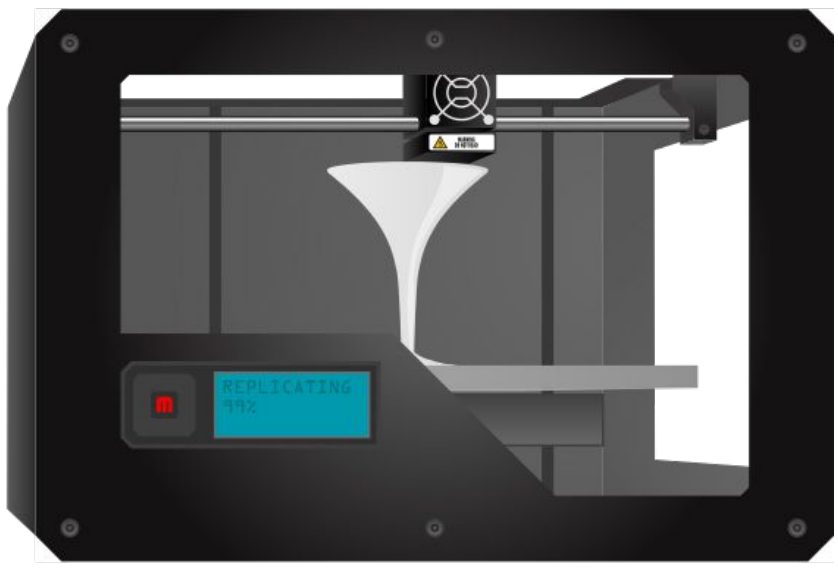
What if, after a tumultuous transition period, the economy evolves beyond anything we would recognize today? If technology continues on its current trajectory, it inevitably leads to a world of abundance. In this new civilization 2.0, machines will conceivably be able to answer just about any question and make just about everything available. So, what does that mean for us lowly humans?

"I think we're heading towards a world where people will be able to spend their time doing what they enjoy doing, rather than what they need to be doing,"

Planetary Ventures CEO, X-Prize cofounder, and devoted techno-optimist Peter Diamandis told me when I interviewed him last year. “There was a Gallup Poll that said something like 70 percent of people in the United States don’t enjoy their job—they work to put food on the table and get health insurance to survive. So, what happens when technology can do all that work for us and allow us to actually do what we enjoy with our time?”

It’s easy to imagine a not-so-distant future where automation takes over all the dangerous and boring jobs that humans do now only because they have to. Surely there are drudging elements of your workday that you wouldn’t mind outsourcing to a machine so you could spend more time with the parts of your job that you do care about.





One glass-half-full vision could look something like the galaxy portrayed in *Star Trek: The Next Generation*, where abundant food replicators and a post-money economy replaced the need to do… well, anything. Anyone in Starfleet could have chosen to spend all their time playing 24th-century video games without the fear of starvation or homelessness, but they decided a better use of their time would be spent exploring the unknown. Captain Picard and the crew of the USS Enterprise didn’t work because they feared what would happen if they didn’t—they worked because they wanted to.

Nothing is inevitable, of course. A thousand things could divert us from this path. But if we ever do reach a post-scarcity world, then humanity will be compelled to undergo a radical reevaluation of its values. And maybe that’s not the worst thing that could happen to us.

Perhaps we shouldn’t fear the idea that all the jobs are disappearing. Perhaps we should celebrate the hope that nobody will have to work again.

9 TRENDS AT CES

In the tech world, nothing is more prized than being on the cutting edge. If you're not looking to the future and figuring out what the next hot thing will be, you might be in the wrong industry. And the place to go to find the hottest of the hot new things, from virtual reality headsets to smart refrigerators, is the Consumer Electronics Show.

CES, which is held in Las Vegas every January, is where companies go to offer up their latest wares to masses of tech journalists. By paying attention to trends, it's also where you can figure out what directions tech will move in during the new year. So now it's time to step back and look at the bigger picture. Here are some of the top trends we saw at the show.

BY JORDAN MINOR

GETTING IN GEAR
Samsung's Gear S2 smartwatch typified a new commitment to form and function.

WEARABLES SHIFT FOCUS FURTHER TOWARD FITNESS

There were some general smartwatches at CES, but when it comes to wearables, it's becoming increasingly obvious that dedicated fitness trackers dominate the space. The Fitbit Blaze (right) may look just like an Apple Watch and lack GPS, but this high-end tracker still impresses with loads of useful features including automatic activity and sleep tracking, five-day battery life, and an unbeatable companion app. Other activity trackers found new ways to differentiate themselves, too. The Misfit Ray is stylish and small. The e-ink display on the Withings Go (bottom) can last for eight months. The ReliefBand interacts with your body's neural pathways to reduce nausea, and the durable Casio Smart Outdoor Watch is built for adventurers.

OPENING PRESENCE
The Netatmo Presence security camera can tell the difference between humans and animals.

CONNECTED HOME TECH KEEPS GETTING SMARTER

Home appliances for the masses are becoming smarter. When the Netatmo Presence security camera (top) detects an intruder, it can distinguish between a harmless animal and a real potential threat. Flic smart buttons (right) connect home devices like smart lights and speakers, and make controlling them as easy as pressing a button. Finally, the Samsung Family Hub Fridge (bottom) could be the first truly smart appliance. This intelligent refrigerator has a 21.5-inch, 1080p touch screen that's surprisingly useful. You can write notes, watch videos, access the fridge's internal cameras, and order new food if the old food starts to go bad.

TYPHOON MERRY
For full 360-degree photography, Yuneec's elaborate Typhoon H drone hits all the right angles.

DRONES STILL DOMINATE

It's only a matter of time before drones command our airspace, fighting our wars and delivering our Amazon orders. But if the legion of quadcopters we saw at CES is any indication, at least our new sky overlords will look cool and pack cutting-edge flight and image technology. Yuneec's affordable Typhoon H (top) can record incredibly stable video with a camera that spins all the way around to up your action photography game. DJI's Phantom 3 (right) offers 4K video recording for less than $1,000. And in addition to a funky name, the Parrot Disco (bottom) sports a modular fixed-wing design, a single rear 8-inch propeller, and top stable speeds of up to 50mph. We also got to check out The Drone Rodeo, a cowboy-themed drone expo that was exactly what it sounds like.

WE ARE VR
Many virtual reality booths, such as this one from Virtuix, put CES attendees in the games they played.

VIRTUAL REALITY KEEPS UP ITS GAME

If you can't wait to completely leave this physical world behind, we have good news: Virtual reality is finally ready to reach the mainstream. The Oculus Rift (right) is now available for preorder, and we got to test out the final version of the headset and its touch controllers. But if that may be the first VR headset consumers can try (outside of Samsung's Gear VR), it won't be the last. We also got to use HTC's updated Vive Pre headset (bottom), made in partnership with PC gaming juggernaut Valve. And if you need content to watch on your pricey VR headset, you can create your own with the two spherical camera sensors of the Yezz Sfera smartphone.

TABLET OR TABLE? Large tablets, such as the 27-inch Lenovo Yoga Home 900, are about to become more common fixtures in homes everywhere.

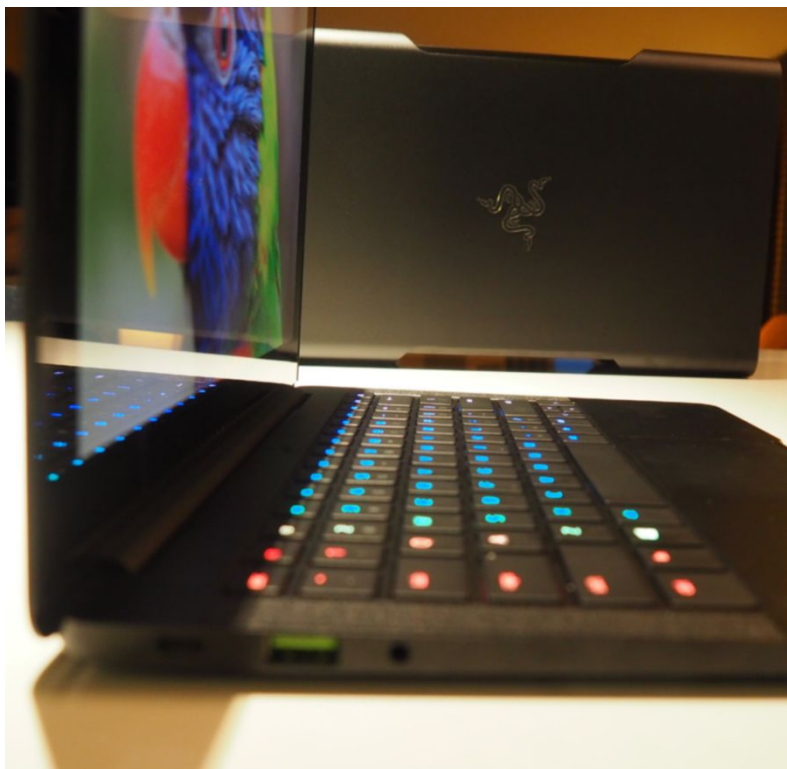
LAPTOPS AND TABLETS CONTINUE TO MERGE

Microsoft's decision to merge laptop and tablet with the Surface Pro becomes more validated by the minute. The iPad Pro's larger screen and hardware keyboard certainly seemed inspired by Redmond's tablet, and at CES the most exciting laptops we saw were the ones meeting tablets in the middle. The Samsung Galaxy TabPro S (right) has the thin-and-light design you'd expect from Samsung's popular Android tablets, but this device runs Windows 10 on a Core M processor. The Lenovo Yoga 900S hybrid laptop (bottom) is similarly thin, light, and convertible, but still packs an Intel Core i7 CPU. Dell's Latitude two-in-one tablets are sleek, professional, and available soon, as will be the HP Spectre x360. The message is clear: Laptops should be more like tablets, and vice versa.

MOTHER MAY I?
USB Type-C ports are finally appearing on motherboards, too, such as the Asus RoG Maximus VIII Formula.

USB TYPE-C GAINS GROUND

Last year, we weren't huge fans of how the new Apple MacBook only featured a single port, and a new one that no one else was using: USB Type-C. Almost a year later at CES 2016, and most of the laptops we saw at the show are using the faster, more versatile USB Type-C connector. LaCie also announced a slate of upcoming storage devices compatible with USB Type-C. Beyond increasing adoption, some companies are even trying to improve the physical connection itself. Griffin's magnetic USB Type-C adapter brings one of the coolest MacBook innovations, the MagSafe connector, to USB Type-C devices.



LA VIDA
TCL was not shy in displaying its collection of stunning high-resolution HDTV screens.

NEW DISPLAY TECH IS REACHING ITS APEX

Just as 1080p HD was fully settling in as the new standard for visual quality, 4K came along to show us a future filled with even crisper and more beautiful images. We saw the slow but steady adoption of 4K during CES last year, and this year more companies are stepping up to make enjoying 4K content actually feasible. We saw 4K DVRs and 4K Blu-ray players, as well as affordable 4K televisions from TCL, Hisense, Sharp, and Vizio. But if you're itching to know what your next display upgrade should be, keep your eye on 4K OLED TVs like the one LG showed off. HDR is also waiting to break big.

NA-NA-NA-NA-NA
That's not the Batmobile, it's the new Faraday Future FFZero1 concept racecar.

CONNECTED AND AUTONOMOUS CARS RULE THE ROAD

Can cars drive themselves better than people can? That's what automakers seem to think, as CES 2016 was filled with autonomous vehicles and cars with other smart functionality. Kia wants fully autonomous cars by the end of the next decade. Ford showed off cars (right) with built-in Amazon integration. Volkswagen tried to distract us from its emissions scandal with its BUDD-e concept van (bottom). And although it's not autonomous, the 2017 Chevy Bolt can travel 200 miles on a single electric charge. One concept car from Faraday Future, the FFZero1, even looked just like the Batmobile!

LESS RADICAL, MORE REAL

As exciting as these concepts may seem, the majority of them are trends we also observed at CES 2015. Instead of introducing radical new ideas, this year's show was about getting closer to turning radical old ideas into a reality. That's not surprising, and it's probably the right call, but it can be a little boring in a business that doesn't like to look back.

GET ORGANIZED

Stay Focused With Personal Kanban

TIPS

Master Windows 10 Keyboard Shortcuts

HOW TO

Take Your Home Office on the Road

CONNECTED TRAVELER

Never Lose Your Luggage Again

Digital Life

Stay Focused With Personal Kanban

BY JILL DUFFY

Imagine a management system for your life, something that is easy to learn how to use, keeps everything organized, prevents you from multitasking, and helps you reach your goals. That's personal kanban.

Although kanban is gaining in popularity for project management in office environments, people are also borrowing core ideas from it to organize aspects of their personal lives, from planning weddings to managing family chores. So what is personal kanban, how does it work, and what can it do for you?

WHAT IS KANBAN?

Simply put: With kanban, you write information on cards and then arrange the cards on a board. It's a style of working that began in Japanese automobile manufacturing plants and is popular today among software developers and people who work in professional services because it creates a visual representation for something that otherwise is not visual at all.

Kanban software makes it easy for you to move virtual cards around on the board, and even deposit them neatly into columns. Traditionally, the columns are labeled, from left to right, “To Do,” “Doing,” and “Done.” Some tools let you customize the purpose or label of the columns.

Kanban tools are generally collaborative, so many people can access the same board and cards. A card typically has an assignee who is charged with completing the task on it. Everyone on the team can see all the cards or tasks, where they are in their life cycle, and who is responsible for them.

Personal kanban adopts a number of these core ideas, but leaves out or makes optional many of the rules that are specific to professional productivity and office work. Depending on what you put onto your kanban board, you might share it with family members, friends, caretakers, tutors, or a wedding planner.

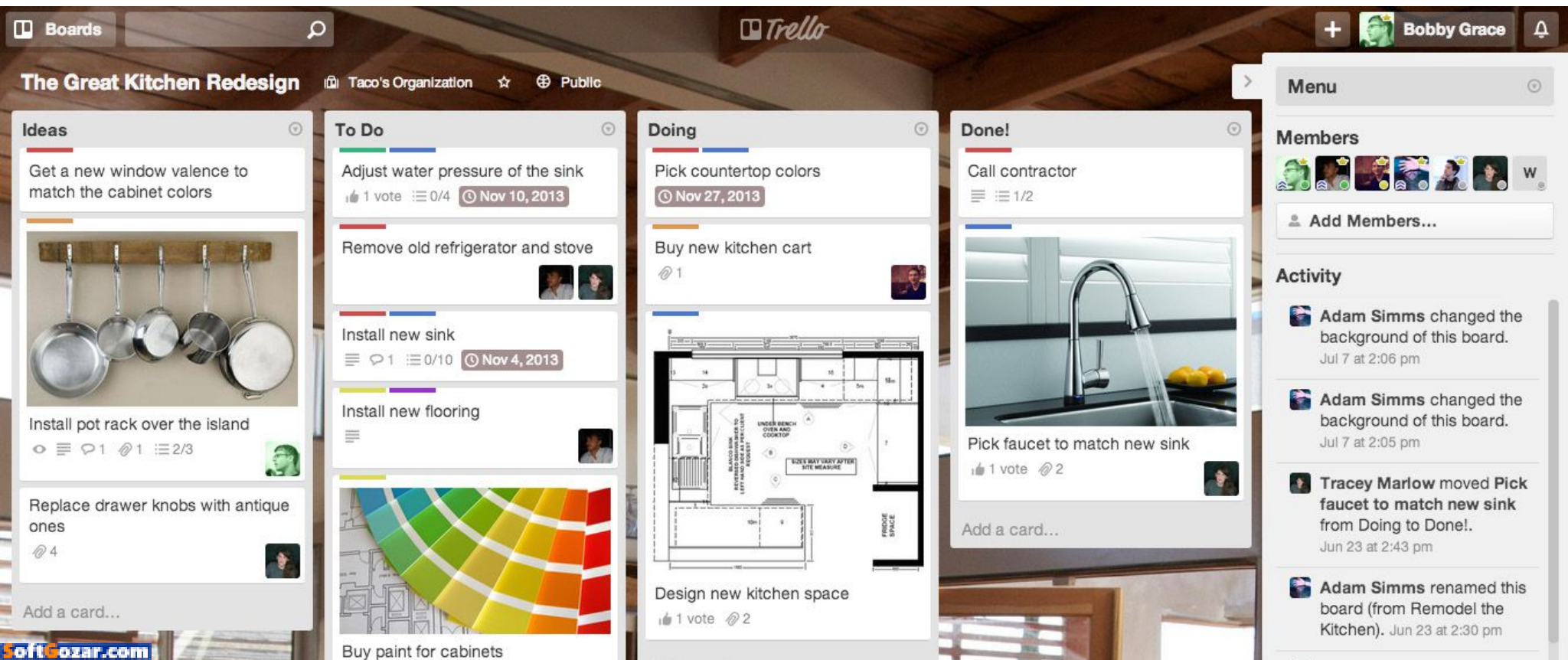
Two kanban apps on the market include SwiftKanban and Trello (though the latter is not technically a kanban board but rather was inspired by them).

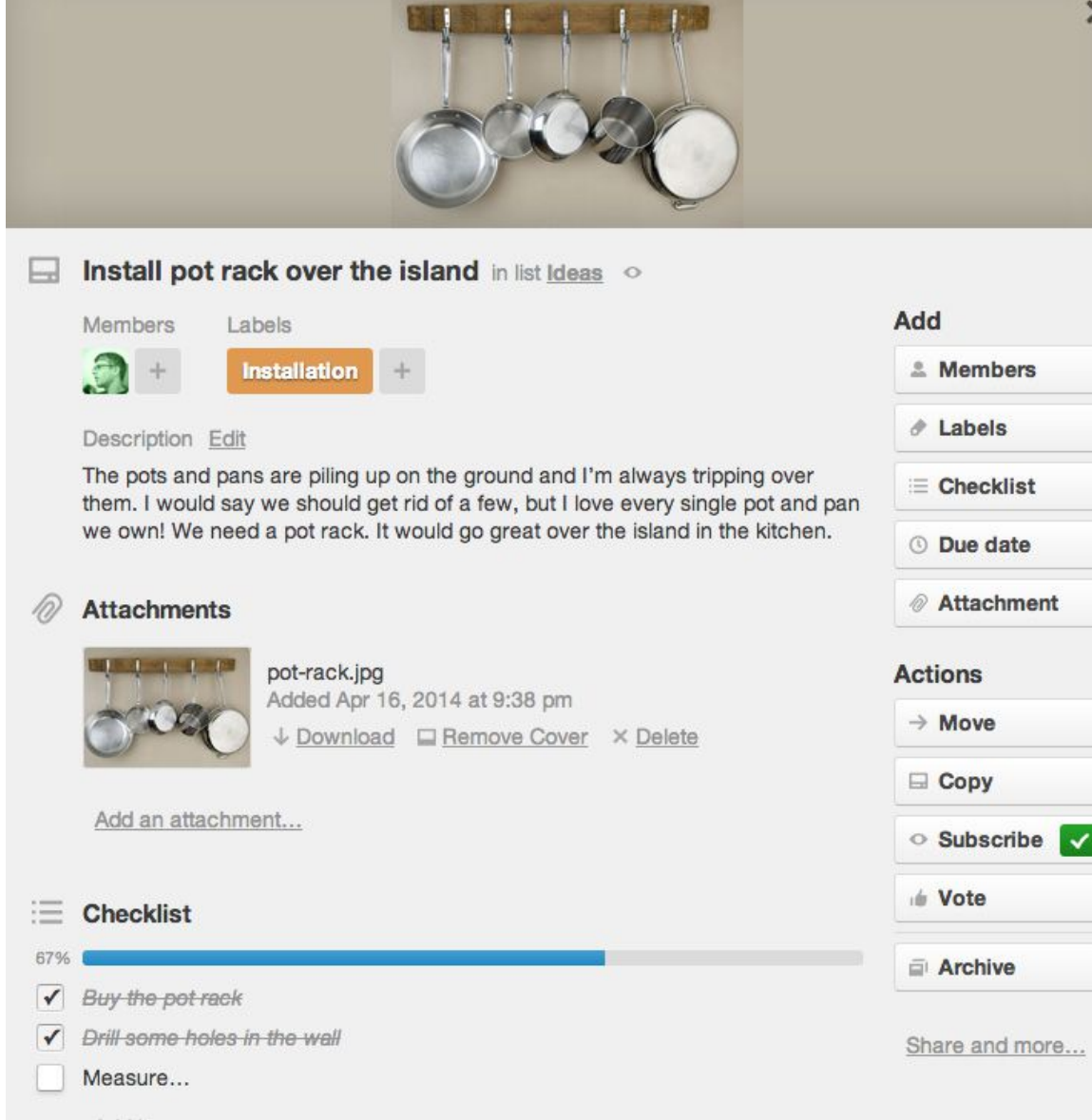
HOW PERSONAL KANBAN WORKS

At the heart of personal kanban is a visualization of whatever it is you need to manage and how it will get done.

“There are different forms of visual management out there, and one advantage that kanban gives is it limits work in progress,” says Janice Linden-Reed, president of LeanKanban University, an organization that teaches kanban to professionals and promotes its use. “It has a way of addressing issues around multitasking and helps people focus so they’re not overwhelmed. The thing that makes it kanban as opposed to just a task board is limiting work in progress and flow.”

Linden-Reed describes kanban as a pull system rather than a push system. “You only take on as much work as you can handle at any given time,” she says.





"If you only want to have three tasks at any given time, you have your three, and when you finish one, you can pull the next one. By having a limited pull system, it can help you stay focused and organized." In other words, if you use the traditional setup, you would never have more than three cards in your "Doing" column.

According to Trello CEO Michael Pryor, the purpose of his company's tool is to "distill [kanban] down to something very simple, which is just a list of lists, in the same way that a spreadsheet is a group of numbers, and if you change one cell then another cell changes. It's just a way to visually organize whatever it is you're thinking about." In that sense, Trello is ideal for managing your personal life because it doesn't pigeonhole you into using the structure and lingo you'll find in kanban apps made for business project management.

WHY PERSONAL KANBAN WORKS

A major reason kanban is effective at helping people stay organized is that it forces them to think through whatever it is they want to manage in order to map it to a kanban board.

Let's take the example of using personal kanban to organize family chores. The columns might be "To Do," "Doing," and "Done," but they could also be more elaborate—say, "To Do Daily," "To Do Weekly," and "To Do Monthly." Perhaps on the first Sunday of the month your kid is responsible for pulling one chore from the monthly column. Maybe every Saturday your partner is responsible for pulling two weekly chores. Whatever you decide, writing down the process by mapping it to the kanban board forces you to think through how the work happens naturally, as well as how you want it to be managed.

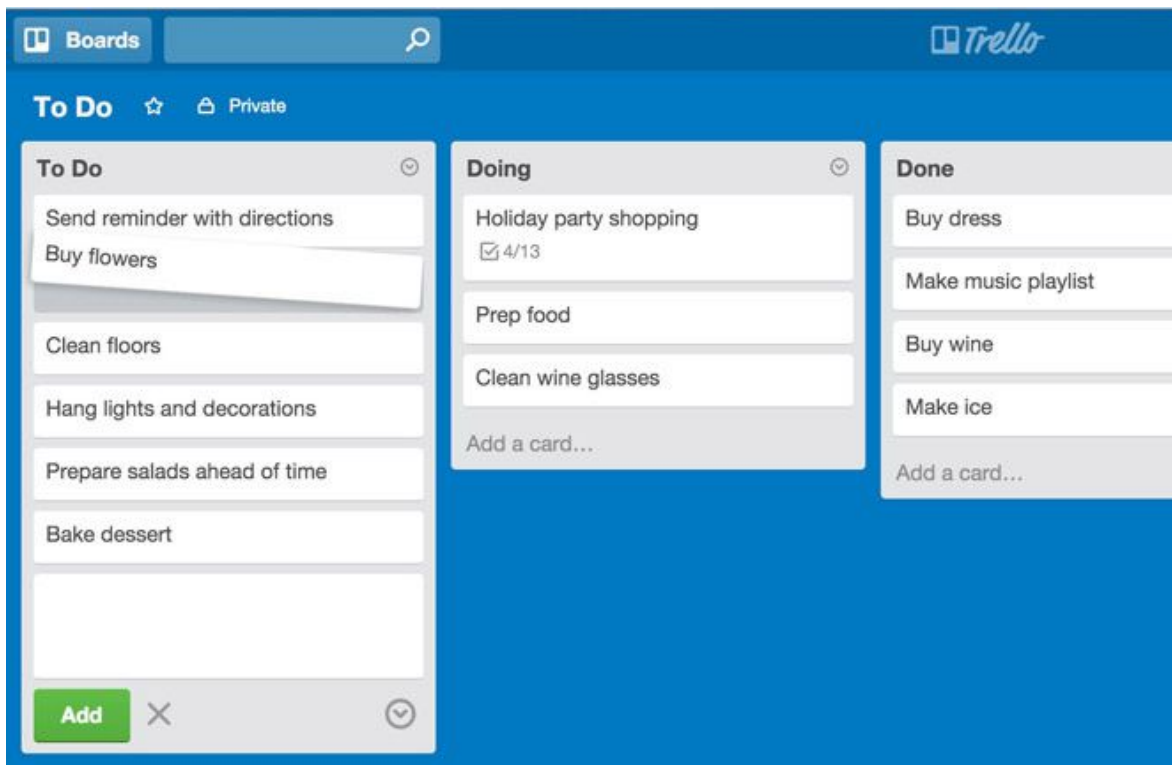
Linden-Reed used personal kanban to manage chores when her daughter was just six years old. This gave her daughter agency and also taught her how to tackle just one task at a time.

Tonianne DeMaria Barry, author of *Personal Kanban: Mapping Work | Navigating Life,* says that personal kanban creates a narrative of work. "Personal kanban transforms our work into a story, a system. It takes even the most tedious tasks and turns them into a game that's appropriate and compelling for all ages," she told me by email. When someone plots out a to-do list on a board, "work ceases to be a collection of unrelated tasks and instead becomes a series of events and options that impact each other and flow from one to the next."

WHO BENEFITS FROM PERSONAL KANBAN?

I asked Linden-Reed and Pryor about the kinds of people who are best suited for kanban. They both said that visually oriented people do well with kanban, then added a few more thoughts.

"Anyone who is struggling with issues of being overburdened or having quality issues in their work, people who miss deadlines, people who have problems meeting expectations" can all benefit from kanban, according to Linden-Reed.



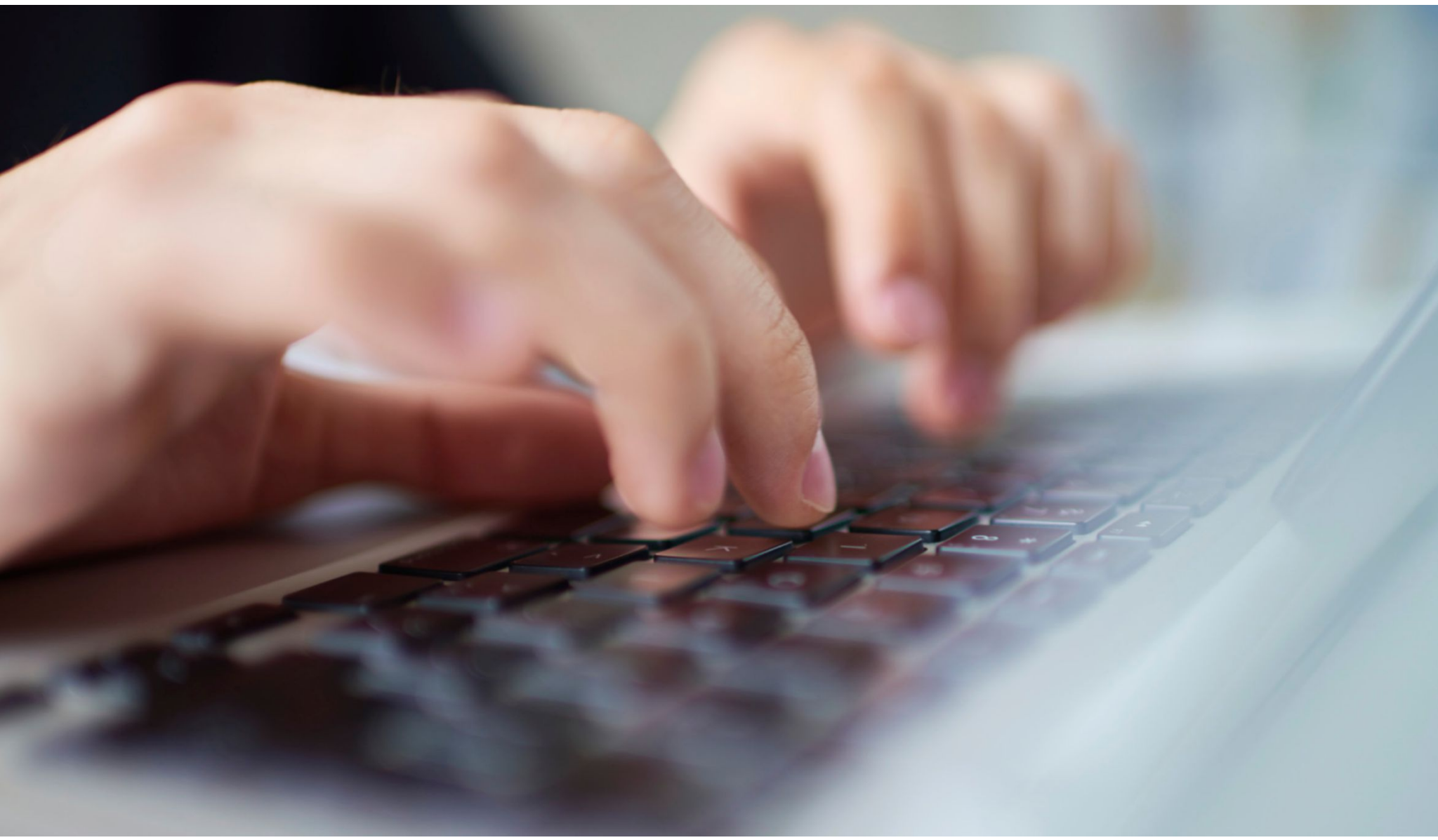
DeMaria Barry noted that kids with Asperger syndrome often do well when they use personal kanban. "The kinesthetic feedback and serotonin boost they get from pulling into and seeing their work in the 'Done' column compels them to complete rather than intensely focus on or ruminate over just a single task," she said. She also said that children with ADHD often succeed with it because "implementing a work-in-progress limit compels them to focus on the tasks at hand rather than get distracted by starting many but completing none."

Pryor said that nearly everyone is well suited for Kanban, because it's made to match how we already think.

"If you look at the way people try to organize their lives—if you look at a computer with Post-it notes all over it, a refrigerator with notes on the door, people making index cards and laying them out in front of them—we have a very spatial memory," Pryor said. "The visual organization of ideas can be very helpful to people."

Master Windows 10 Keyboard Shortcuts

BY LANCE WHITNEY



Whether you're running Windows on a desktop, a laptop, or a tablet, keyboard shortcuts are always available as a quick way to run a command, open a program, or perform a certain task. The problem with keyboard shortcuts, though? They can be difficult to remember, especially in Windows 10, which introduces a host of new shortcuts to tap into its features. This guide should help, presenting all the new and most important shortcuts. Try them and you'll discover that they're capable of transforming and improving the way you work and play.

VIRTUAL DESKTOPS

Windows 10's new virtual desktops let you create multiple "themed" desktop screens, and switch among them at will. This way, you can create separate desktop areas so that each houses a unique sets of shortcuts and windows. You can then shunt each one off to the side until you need it. You don't have to sift through a giant garbage dump of icons scattered across your one and only desktop. For example, you may want to create one virtual desktop to organize your current work, and another to contain the Mail and Calendar apps. This way, you keep one desktop open while you are working, then switch to the other when you need to check your messages or appointments. In that scenario, knowing how to use all your desktops efficiently is key.

THE SHORTCUT	WHAT IT DOES
+ Ctrl + D	Creates a new virtual desktop and switches to it.
+ Ctrl + Tab	Opens the Task View to display all Virtual Desktops. Each one will have a number, such as Desktop 1 and Desktop 2. You then use the Virtual Desktop switcher at the bottom of the screen to click or tap on one of your desktops to switch to it.
+ Ctrl + ◄	Switches to the virtual desktop on the left.
+ Ctrl + ►	Switches to the virtual desktop on the right.
+ Ctrl + F4	Closes the current virtual desktop.

EDGE BROWSER

Edge is Microsoft's new Web browser, designed as an alternative to the aging Internet Explorer. Set up as the default in Windows 10, Edge takes a more minimalist approach to Web browsing, jettisoning some of the menus and toolbars that clutter IE, leaving more real estate for viewing webpages. Like IE, however, Edge is loaded with shortcuts that you can use to run its various features and navigate the Web.

THE SHORTCUT	WHAT IT DOES
Ctrl + D	Adds current site to Favorites or Reading list.
Ctrl + I	Opens Favorites pane.
Ctrl + J	Opens Downloads pane.
Ctrl + H	Opens History pane.
Ctrl + P	Prints the current page.
Ctrl + F	Finds specific text on your current page.
Ctrl + Shift + R	Toggles reading view, which displays a webpage in a more user-friendly format for reading.
F12	Opens Edge's Developer Tools to display a page's HTML and scripting code.

THE SHORTCUT	WHAT IT DOES
F7	Turns on "caret browsing" on for the current tab. This displays a cursor on webpages that you can use to select text with the keyboard.
Ctrl + Shift + Delete	Opens the Clear browsing data pane, so you can delete your browsing history, cookies, download history, and other data.
Ctrl + T	Opens a new tab.
Ctrl + Shift + T	Reopens the last closed tab.
Ctrl + F4	Closes the current tab.
Ctrl + K	Duplicates your current Web page in a new tab.
Ctrl + N	Opens a new window.
Ctrl + Shift + P	Opens a new InPrivate Browsing window.
Ctrl + Tab	Switches to the next tab.
Ctrl + Shift + Tab	Switches to the previous tab.
Ctrl + 1 + 2 + 3	Switches to a specific tab number.

THE SHORTCUT	WHAT IT DOES
Ctrl + 9	Switches to the last tab.
Ctrl + + OR Ctrl + -	Zooms in or out 25 percent.
Ctrl + 0	Resets zoom level to normal.
Backspace	Goes back to the previous page. (or Alt+Left Arrow)
Alt + ►	Goes forward to the previous page.
F5	Refreshes the current page. (or Ctrl+R)
Esc	Stops Edge from trying to load the page.
F4	Selects the URL in the address bar.
Ctrl + Enter	Auto-adds “www.” to the beginning and “.com” to the end of text typed in the address bar.
Ctrl + 	Opens the current link in a new tab.
Ctrl + Shift + 	Opens the current link in a new tab and switches to the tab.
Alt + Shift + 	Opens the current link in a new window.

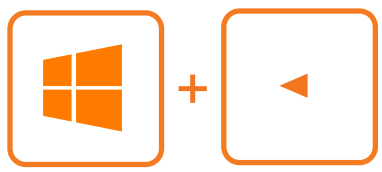
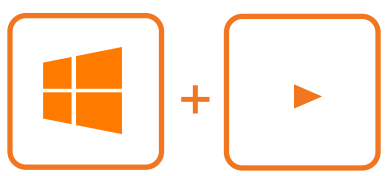
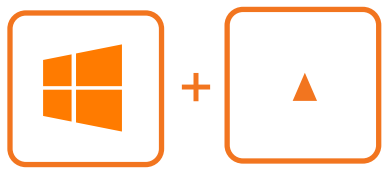
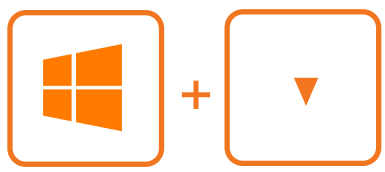
COMMAND PROMPT

You'd never think it given how slick the rest of the OS looks, but the command prompt is alive and well in Windows 10. It's not quite as popular as it was a decade or more ago, but it still comes in handy if you need to run certain techier commands that aren't directly accessible through Windows. And Windows 10's command prompt, which adds copy and paste and other useful tools, is the most functional yet—and these shortcuts use it to its fullest when the need arises.

THE SHORTCUT	WHAT IT DOES
Ctrl + Shift + Home	Moves the cursor to the beginning of the command prompt's text output, selecting all text between the cursor and the beginning.
Ctrl + Shift + End	Moves the cursor to the end of the command prompt's text output, selecting all text between the cursor and the end.
Ctrl + ▲ OR Ctrl + ▼	Moves one line up in the command prompt's history OR Moves one line down in the command prompt's history.
Ctrl + M	Enter "mark mode," which lets you select text.
Ctrl + F	Opens a Find dialog to search for specific text in the command prompt's output.
Ctrl + C	Copy the selected line of text
Ctrl + X	Cut the selected line of text.
Ctrl + V	Paste the selected line of text.
Alt + F4	Close the Command Prompt window.

SNAPPING WINDOWS

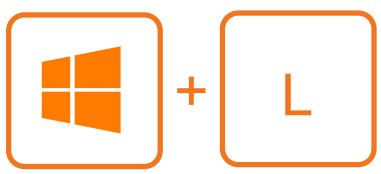
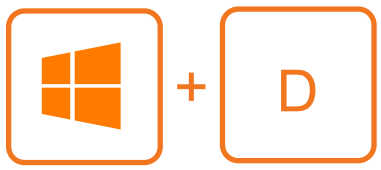
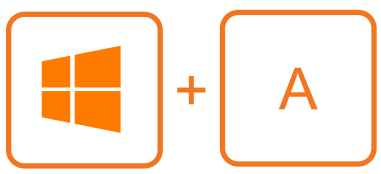
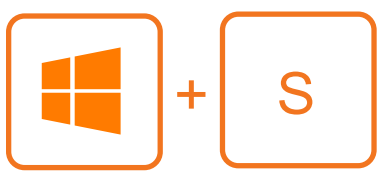
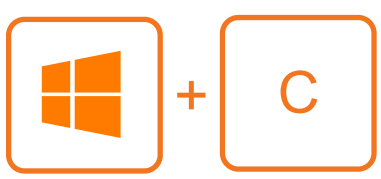
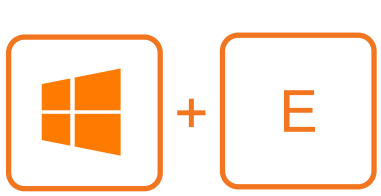
The ability to "snap" windows, or instantly relegate them to certain predefined areas of the screen (such as the left or the right side), was a major addition to Windows 7 and received some additional refinement in Windows 8 and 8.1. But this functionality has been given a sharp upgrade in Windows 10 that adds even more usability to this already incredibly handy feature. These shortcuts will help you make window snapping even more of a snap, so you don't have to reach for your mouse to get the effect you want.

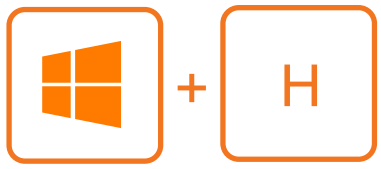
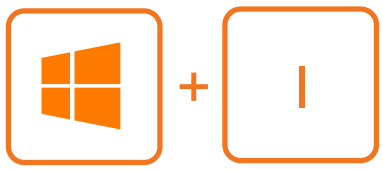
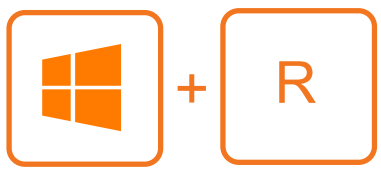
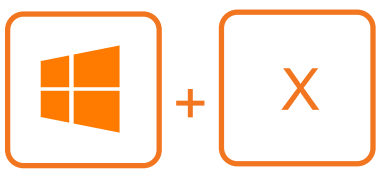
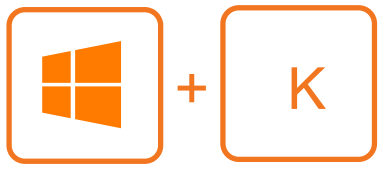
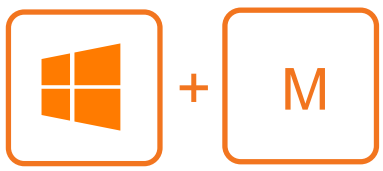
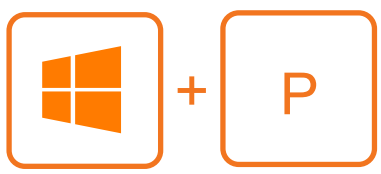
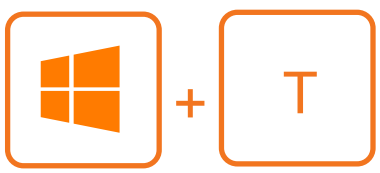
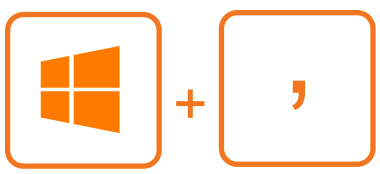
THE SHORTCUT	WHAT IT DOES
	Snaps the current window to the left side of the screen, or to its previous position if already snapped right.
	Snaps the current window to the right side of the screen, or to its previous position if already snapped left.
	Maximizes or snaps the current window to the top of the screen.
	Minimizes or snaps the current window to the bottom of the screen.

You can cycle through the different positions of a window using these shortcuts. For example, continually pressing Windows Key+Left Arrow snaps your current window from the right side to a restored position to the left side, while pressing Windows Key+Right Arrow snaps your current window from the left side to a restored position to the right side.

GENERAL SHORTCUTS

The following shortcuts work across Windows 10 as a whole, or with specific features, such as Cortana and File Explorer. So consider this a miscellaneous collection of helpful shortcuts.

THE SHORTCUT	WHAT IT DOES
	Opens the Start menu or Start screen.
	Switches from one open window to another. Press the Tab key again to flip between windows, and release the key to select a window.
	Locks your PC, or switches accounts.
	Hides or minimizes all open windows on the desktop.
	Opens or closes the Action Center.
	Opens the search tool.
	Opens Cortana in listening mode.
	Opens a File Explorer window.

THE SHORTCUT	WHAT IT DOES
	Opens the Share screen.
	Opens the Settings screen.
	Opens the Run command.
	Opens the Start button's Quick Link menu.
	Opens the Connect menu to search for wireless devices.
	Minimizes all open windows.
	Opens the presentation menu to switch the display to another device, such as a projector.
	Cycles through apps on the Taskbar.
	Peeks at the desktop.

Take Your Home Office on the Road

BY ERIC GREVSTAD

Hotels and inns have courted travelers for centuries by promising all the comforts of home. Actually, I'm happy to forego those comforts—the cat walking on the bed, cold cereal for breakfast—in favor of getting all the productivity of home. But is it possible to replicate your home office when you're away?

Not surprisingly, the answer is: It depends. If your home office PC is a fire-breathing workstation with 8TB of storage and four 27-inch monitors, teamed with a laser multifunction printer with twin 550-sheet paper trays, you might as well stay home. But if you make do with a more modest hardware setup, you may be pleasantly surprised by what it's possible to accomplish from a hotel room desk, a client's office, or the front seat of your car (parked, of course).

First, you'll need a laptop. Some of you may be tempted by a tablet with a folding keyboard cover, especially a model with cellular connectivity such as

Apple's iPad Air 2 or the HP Spectre x2, but notebooks' bang-for-the-buck quotient is considerably higher.

Real laptops have processors from the Intel Core family instead of Pentium, Celeron, or Atom, and displays with resolutions of 1,920 by 1,080 or higher instead of lowly 1,366 by 768 (we will grandfather-clause Apple's 13-inch MacBook Air, though we wouldn't accept its 1,440-by-900 resolution on a new laptop today). Don't settle for less than 4GB of memory, preferably 8GB if you do any serious multitasking. And 128GB of flash storage is a little thin (we recommend 256GB), but it's tolerable with cloud storage so readily available and worth it for the sake of getting solid-state storage rather than the slower mechanical variety.

TWO SCREENS TO GO

If your laptop lacks high resolution, consider hitting the road with a monitor in your briefcase. This way, you can work on two screens in your hotel room or give a presentation without inviting your audience to look over your shoulder. But if your display's resolution is high enough—1,920 by 1,080 at the minimum, though higher is better—you may be able to get away without a second monitor.

If you don't think a monitor will fit in your briefcase, then you have never seen a USB monitor. The Asus MB169B+, for example, is a 15.6-inch In-Plane Switching (IPS) display that weighs just 1.8 pounds, and uses a single USB 3.0 cable for both power and video data. Though not as bright as you're probably used to from a standard desktop monitor (200 nits), the full HD panel is perfectly adequate for indoor use. Its carrying case doubles as a stand that holds the display in either landscape or portrait orientation. And you can find it for less than $200 online.

Next, you'll need Internet access. Because you're boldly going where no Wi-Fi hotspot has gone before, that means mobile broadband or that cellular connectivity I mentioned earlier. Yes, real hotels have free Wi-Fi but we all know that many are still greedy for those $15-a-day fees and, when you're visiting a client's office, it can be awkward to ask for the Wi-Fi password.

Better to bring the Web with you in the form of the Verizon Jetpack 4G LTE Mobile Hotspot AC791L, which costs $50 with a two-year contract plus $50 per month for 4GB of data. This shirt-pocket-size Internet gateway works for more than 20 hours on a charge (it can also charge your smartphone in a pinch), connecting your laptop, phone, tablet, camera—up to 15 devices—to the Web.

THE PAPER CHASE

What if you need hard copy on the highway? For most of us, that means trotting down to the hotel's business center with a document on a flash drive. But if you need portable printing—making handouts for a presentation, say, or flyers for a realty open house—you should check out the Epson WorkForce WF-100, a 3.5-pound inkjet about the size of a box of Kleenex that chugs along, printing surprisingly crisp documents and borderless photos, on either AC or battery power (albeit at half speed on the latter). The $200 WF-100 also has Wi-Fi Direct for making connections when you're away from your wireless network.

If you're seeking a mobile equivalent to what I call the hub of a home office, a multifunction printer/copier/scanner, there's the HP Officejet 150 Mobile All-in-One, but that Bluetooth-based device is substantially bulkier and costs more than the WF-100. I'd suggest you look at Fujitsu's 0.9-pound ScanSnap iX100 or another portable scanner instead.

Even on the road, of course, you can't do without backup. I use a mix of cloud and pocket storage, uploading files to OneDrive (I have 1TB of space as an Office 365 Home subscriber) and, because I have an Android phone, carrying SanDisk's 64GB Ultra Dual USB Drive 3.0, which has a USB 3.0 plug on one end and a micro USB plug on the other.

Finally, if you use your laptop on a plane or train, you may be irritated—and, at worst, your business may be endangered—by a nosy seatmate reading what's on your screen. One row behind and across the aisle is the ideal vantage point for snooping, by the way. A privacy and screen protector such as those offered by 3M can thwart prying eyes while you're on the go.

Never Lose Your Luggage Again

BY SASCHA SEGAN

Bluesmart's Smart Suitcase is the luggage you cannot lose. A longtime Indiegogo fave, the connected carry-on is finally real, and it's coming in a checked-bag size as well.

I took a closer look at the product while I was at CES in Las Vegas. The $399 suitcase has several useful tricks. A 3G module with GPS tracks your suitcase wherever it goes, so if you lose it you can locate it with a smartphone app.

The module has a built-in Telefonica SIM card that automatically works with roaming partners such as AT&T in the U.S. It can remain alive for up to 30 days on a full charge of the suitcase's 10,000Ah battery (which can also be used to charge your phone, at the expense of some of the GPS unit's life). The suitcase comes with two years of service, and founder Diego Saez-Gil said Bluesmart is trying to figure out service plans beyond that.

But wait—there's more. The handle has a scale in it; tell the app what flight you're on, and it will cross-reference with your airline's baggage limits to tell you if you've overpacked. The app can lock and unlock the suitcase via Bluetooth. The app will also connect to travel management services in the future, Saez-Gil said.

As a suitcase, the Bluesmart is basic but efficient. It's a hybrid hard-sided/soft-sided suitcase, with an easy-open front pocket to store documents and a laptop and four rotating, hollow wheels. Inside, it's basically one big compartment, although there's a laundry divider in the main area.

The location features are really going to come into their own on the new checked-baggage model, which doesn't yet have a detailed design or a price.

I think the Bluesmart's built-in scale function sounds terrific, especially for people who regularly fly on low-cost European airlines, which tend to have very low baggage weight limits.

The GPS tracking is less valuable in a carry-on. But it's already getting popular for checked luggage with add-on gadgets like the LugLoc, Trakdot, and Spot, which typically cost between $70 and $90, but also charge you for service. Integrating it into the bag you always bring with you means that you can never leave the tracker behind, although it also means you can't use it to track other things. For frequent travelers, the Bluesmart looks very smart indeed.

JOHN C. DVORAK

The Year of Big Obfuscation

Everyone seems to think that the cloud and Big Data are going to be bigger than ever in 2016. Those of us who are "data civilians" (a new term I just ran across) will only need a terminal and a mobile phone, and maybe a notepad, to get access.

This vision would be a little more attractive if today's cloud offerings worked as advertised. That includes Adobe's Creative Cloud, Microsoft Office 365, and cloud initiatives by Autodesk and others, none of which work as smoothly as they should and must be a support nightmare. This holds true for anything with the "cloud" moniker, including various "personal clouds" in the form of network-attached storage (NAS) devices with some Internet access.

Exactly why the simplicity of a backup system consisting of a USB-attached drive and a decent software application is eschewed in favor of the cloud is beyond me. The only relevant argument against in-house backup is if the place burns down. So yes, you need an off-site backup. Fine. I personally keep a backup drive in my car trunk or at someone else's house. Apparently General Motors cannot do that.

Meanwhile, because data is being accumulated in these various "clouds," the idea that this information can provide a source for analysis is being chatted up, unlike anything I've seen since the days of "client-server."

The level of linguistic nonsense used to hype the idea is reaching an all-time high. Let me relate a few gems in a recent article from the India Infoline

News Service regarding Oracle's predictions for 2016 regarding Big Data. It's as though the editors sat around dreaming up the most ludicrous and meaningless phrases they could imagine. Adderall is at work here.

This is the thesis sentence used to describe what will happen in the coming year: "2016 will witness an increase in the proliferation of experiments, default risk, policy underwriting, and fraud detection as firms try to identify hotspots for algorithmic advantage faster than the competition." Translation: In 2016, we will struggle to make anything work.

Then there's this gem: "In 2016, simpler big data discovery tools will let business analysts shop for datasets in enterprise Hadoop clusters, reshape them into new mashup combinations, and even analyze them with exploratory machine learning technique." Translation: In 2016, we'll see a lot of confusing tools that will do nothing useful.

Onward: "Organizations will witness that successful data virtualization technology will offer performance equal to that of native methods, complete backward compatibility and security." Translation: This makes no sense, but sounds like it might make sense.

Next: "But in the big data era data lineage is a must-have because customers are mashing up company data with third-party data sets." Translation: We will try not to lose data in a simple merge-purge operation.

Another one: "Highly secure IoT Cloud services will help manufacturers create new products that safely take action on the analyzed data without human intervention." Translation: Let's make the most idiotic assertions and see what happens.

I'd advise everyone, especially investors, to study these kinds of reports, as they contain all the

> **These technologies are mostly a con; otherwise, why can't someone actually explain the benefits in plain English?**

newest Silicon Valley jargon and nonsense for your use at the next board meeting. Mix and match and call it a trend. Something like "Balance controlled security subsystems using AI techniques will eliminate the need for intervention regarding vendor verifications." Cool!

What I see is obfuscation and nonsense. People will lap this up because they are indeed dull-witted and this sounds smart to them. What it tells me is that these technologies are mostly a con; otherwise, why can't someone actually explain the benefits in plain English? It's because it ends up coming out like the above translations.

We'll be able to do it someday—after the nonsense dissipates. I can do it with cloud services, for example. Translation: Cloud services are searchable and sometimes manipulatable off-site data backup stores. Also a way to make more money."

I can now do it for Big Data. Translation: Big Data is a meaningless term employed as a promise for some unobtainable utopia of information analysis. Also a way to make more money.

So when someone uses the moniker "Big Data" at a cocktail party, immediately call them a communist and walk away.

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