Consumer Technology Association™

INSIDE CES 2018
TRENDS & TAKEAWAYS

CES® 2018 | JANUARY 9-12 | LAS VEGAS, NV

INTRODUCTION

Every January, the world's most **INNOVATIVE COMPANIES** converge on CES.

Embedded among the 20,000 new products and services introduced here every year is a concentrated number of trends that fundamentally shape how we'll live out our future. Subtle technological transformations materializing around smart cities, self-driving vehicles, 5G connectivity, drones, Internet of Things, virtual reality, augmented reality, wearables, robotics, artificial intelligence and cybersecurity will have massive ramifications on real sectors of the economy and individuals across the globe in the coming years. Inside CES 2018–Trends and Takeaways highlights and explores the cutting-edge trends unfolding at CES. These intricately connected catalysts of change and shifts in the marketplace are defining tomorrow.

YOU SAW THEM FIRST AT CES.

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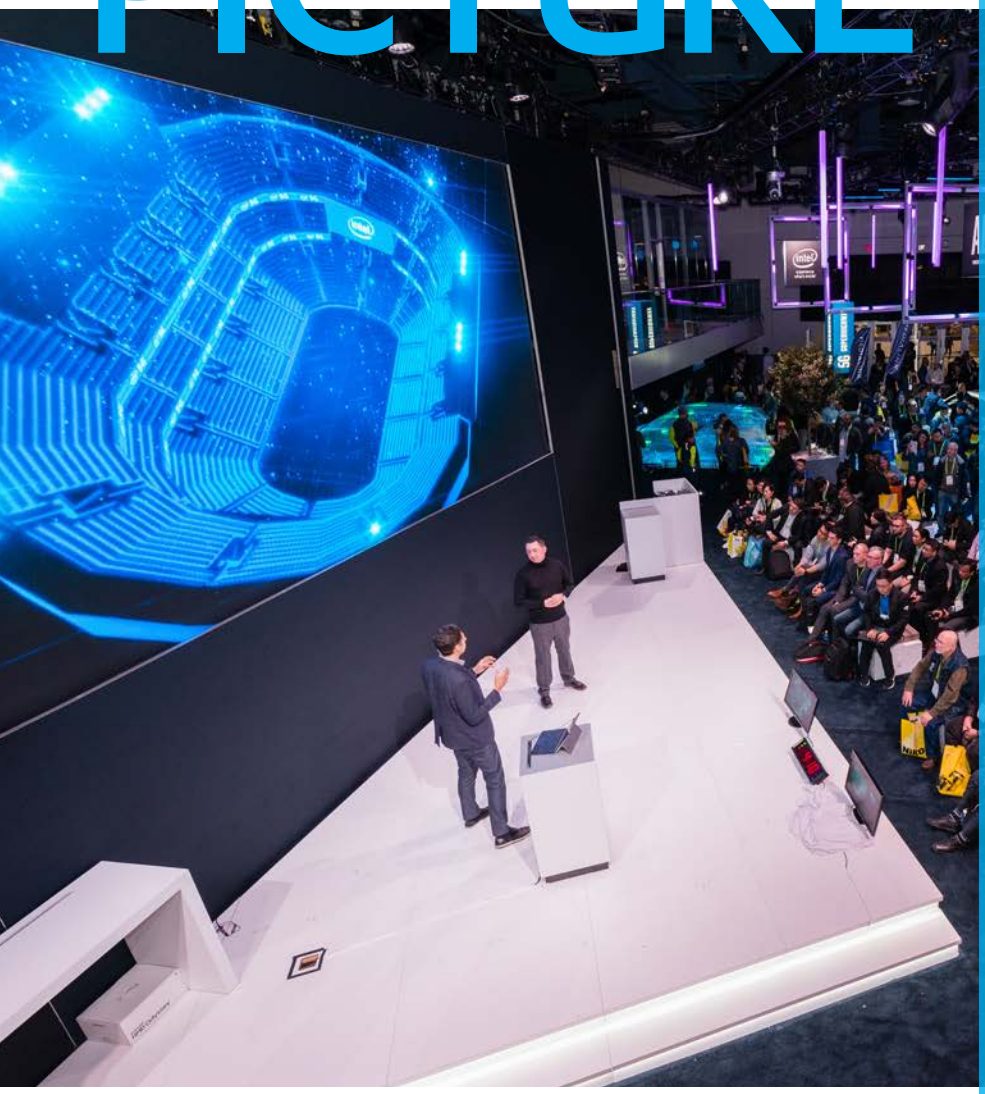
Go Touch VR

» CES 2018

Over its 50+ year history, CES has been the global launch pad for more than 700,000 new products and services. Each and every year, CES showcases the latest technology innovations, and 2018 was no exception.

THE BIG PICTURE



CES 2018 proved once again why it is the global stage for innovation and the largest and most influential technology event on the planet. But CES 2018 showed that it was also much more than the annual gathering place for every major tech company. Virtually every industry was also represented. Whether they were Fortune 100 companies or fresh faced startups from distant corners of the globe, some 3,900 companies came to CES. Their collective focus was bringing to market disruptive technologies aimed at solving real-world problems. Over 170,000 executives joined these companies to explore how their respective industries and businesses are being transformed.

Amongst the thousands of trends that are on display each year at CES, four megatrends left an undeniable footprint on CES 2018. First, artificial intelligence (AI) is influencing both hardware and services across not only technology but a wide swath of industries. Secondly, voice is the next major computing interface and it is being embedded in far more places than most of us ever envisioned. Thirdly, a number of innovations are combining to drastically change the landscape of cities and how individuals perceive and experience mobility. And finally, transportation is being transformed in ways that will forever change how society lives. These core themes interact, overlap and use common building blocks, and CES is the only place where they all come together to tell the story of our future. We'll take a quick look at each of these in succession and in the following section we'll explore each more deeply, highlight what CES brought us, discuss what it signals for the future and explain what it means for executives everywhere.

ARTIFICIAL INTELLIGENCE BECOMES PERVASIVE

AI was ever present at CES 2018 but in ways many never imagined. The progression of AI in the last few years has been astounding, and CES 2018 proved to be AI's coming out party to the world. At CES it became clear AI has moved from the theoretical to the practical. It wasn't only specific applications of AI on display at CES 2018; it was AI's omnipresence. AI has the potential to transform every industry in a myriad of meaningful ways.

AI is a term with a variety of definitions, they all start with data. As Intel CEO Brian Krzanich noted in his CES keynote, "data is going to introduce social and economic changes that we only see perhaps once or twice in a century...data is going to redefine how we experience life." In many ways the rush of breakthroughs in recent years to capture and employ data culminated at CES in the form of wide and varied applications of AI. These applications included speech recognition, computer vision and machine learning. CES showed real-world examples of how AI is changing how we use and experience technology and the services delivered through technology. CES made clear AI is impacting every business within every industry, each in its own nuanced ways.

AI is pushing intelligence inside of devices and services, which in turn is enabling companies to personalize and customize the experience. What became evident at CES 2018 is that innovation can be adaptive to the individual and their preferences, even when those preferences aren't explicitly stated. Machines are being given access to data, allowed to learn for themselves and in turn deliver a subtly unique experience to each of us. This is the heart of machine learning: use algorithms to parse data, learn from it, and then apply that knowledge by making predictions and ultimately decisions. At CES we saw many applications of machine learning and AI across a wide spectrum of devices, services and experiences, and we explore some of those in the pages ahead.

VOICE IS THE NEXT COMPUTING INTERFACE

Speech recognition is a form of AI but there were so many applications incorporating voice interfaces and highlighting advances in speech recognition at CES 2018 that it stands by itself as one of the four megatrends. Voice interfaces helped delineate and show what the future of technology and innovation looks like, or perhaps more accurately, sounds like. Voice is the next major computing interface, and it is being embedded in far more places than most of us ever envisioned. After a decade focused on touchscreen technologies, CES 2018 showed that a voice interface is a must for anyone delivering a consumer-facing product or service.

Advances in speech recognition are drastically changing the way we interact with technology. In the 1980s and 1990s companies such as IBM and Microsoft began exploring the commercialization of speech recognition. In those early days, the technology worked in only very narrowly defined cases. It would take decades of training before the technology could handle conversational speech.

Speech recognition accuracy is measured by a metric known as the word error rate (WER). The WER indicates how many words are incorrectly interpreted. In those early years, the WER was nearly 100 percent. The technology barely worked. By 2013, the WER had declined to roughly 25 percent. In other words, roughly one in every four words was being interpreted incorrectly. The technology had improved but it still wasn't great. Missing one of every four words left users with a relatively poor experience and hindered adoption. But then the technology began to improve significantly. In the next 36 months, the WER would improve from roughly 25 percent to close to 5 percent. It is worth putting a 5 percent error rate into perspective. Humans transcribe conversational English with a 5 percent error rate. In other words, digital speech recognition today is as good as human speech recognition.

Speech recognition is just part of what is driving voice to become the default interface of our connected lifestyle. Converting speech to words is the first step. But devices and services have to understand context to provide a meaningful experience. That's what digital assistants are working to achieve. The technology and services are doing more than just deciphering words. They are increasingly dealing with the ambiguity and nuances of natural language in order to deliver a contextually rich experience.

There's still a tremendous amount of work to be done. Speech recognition has improved to the point of human parity. The next big thrust is building out meaningful use-case scenarios. Coming out of CES, the key question every executive will be exploring is how this new paradigm will change the underlying experiences they seek to deliver to their customers–something we'll discuss throughout this report.

SMARTENING UP OUR CITIES, REDEFINING MOBILITY AND CHANGING HOW WE LIVE

Massive urban migration and the exploding population are changing the face of cities. The United Nations estimates 66 percent of the world's population will live in cities by 2050. Cities are challenged with managing scarce resources such as real estate, energy, transportation and food. Increasingly, urban leaders around the globe are employing diverse technologies to help monitor infrastructure, energy use and other pertinent city resources. These cities are morphing into digitized, connected, urban landscapes. To solve some of their most complex challenges, cities are embedding dynamic new technologies into century-old services.

Data will be central to the development of smart cities. Digitized information is helping monitor the flow of people and objects within cities. Data-driven decisions will optimize energy, reduce congestion, minimize waste and improve quality of life for citizens. Curtailing congestion, improving emergency response and reducing waste are just some of the real-world problems cities are facing. In response, cities are exploring self-driving technologies, communication innovations and other technologies to improve efficiencies. IHS predicts there will be at least 88 smart cities worldwide by 2025.

We saw at CES that smart city is more than just a single thing. It's a collection of thousands of innovations stitched together. These innovations are combining to drastically change the landscape of cities and how we as denizens perceive and experience mobility. Technological advances in areas including 5G cellular connectivity, self-driving technologies, automation, sensorization and analytics are helping grow the burgeoning class of smart cities. We'll discuss all of these in the pages that follow.

TRANSPORTATION TRANSFORMATION

CES 2018 showed the world that everything we thought we knew about transportation is about to change. For several years CES has highlighted the steady advances being made around self-driving vehicles. At CES 2018 the exhibits spilled into streets as self-driving vehicles carried CES attendees onto the open roads of Las Vegas.

But the transportation transformation unfolding at CES wasn't just happening in and around self-driving vehicles. CES 2018 showed that the connected car is becoming a reality and has pronounced implications for how we live our lives and how business might get done in the future. Infotainment systems are being reframed as we embed them with AI and equip them with voice interfaces.

We also saw that self-driving vehicles are not limited to just passenger vehicles, and as a result they have the potential to impact a plethora of adjacent industries including retail, food services and healthcare. We'll explore specific announcements from CES 2018 and their implications for executives in the pages ahead.

FINAL THOUGHTS ON THE BIG PICTURE

We saw the future of innovation and technology at CES. And in the process we also gained a glimpse into the future of CES. CES has long been the place where new products come to play. But this year we saw something more. CES has become the place where ecosystems come together. CES is the place where partnerships and alliances are formed. CES is the place where dispersed innovations combine to create entirely new realities.

CES changed in one other important way. CES has become the waypoint along a progression path of innovation. Each year, companies across every industry use CES to show the world they are getting closer to the goals they've set out to achieve. CES has become the culmination of years of technological advancement and the promise of more to come in the years ahead. It is the optimistic promise that innovation is making life better in incredibly diverse and rich ways. At CES 2018 we saw both how innovation is changing the world in which we live today and how it is changing the world we'll occupy in the future.

MEGATRENDS

Each year, thousands of different technologies advance at different speeds and in different directions. From these microtrends, a few megatrends surface. Technological shifts are never confined to a single calendar year. They ebb and flow and build over decades. But within any given calendar year, certain trends capture the broad advances being made across the technological landscape.

The previous section introduced four megatrends that surfaced at CES 2018. This section provides a deeper look at each of these, highlights advances announced at CES, and discusses the implications for businesses. These trends encapsulate the thousands of trends that are building and developing across the totality of CES.

ARTIFICIAL INTELLIGENCE BECOMES PERVASIVE

We've experienced a long sequence of digital technology introductions over the past century. The first automatic electronic digital computer—the ABC named for its creators John Atanasoff and Clifford Berry—was successfully tested in 1942. Sony launched the first digital CD player at CES in 1981. After being showcased at CES for years, the first digital television was sold in California in 1998. Numerous digital firsts have followed, with countless introductions occurring at CES over its long history.

The technology industry is shifting from digitization to datafication. We have always been surrounded by information, but technology has sufficiently advanced to enable us to transform these data into new forms of value. We are using data to customize services from hospitality to food services to entertainment. We are using data to personalize technologies. We are using data to characterize and understand new forms of risk that impact age-old industries. The datafication of cities is ushering in smart cities and improving waste management, energy conservation, transportation and citizen engagement.

AI represents a seachange for CES. In the early age of consumer tech, hardware and services were decidedly separate. Hardware was created with the hope that compelling services would come around to take advantage of the hardware, drive consumer adoption and ultimately grow the addressable market. At times, this model worked well. The portable cassette player, the VCR and the DVD player are all great examples of hardware that grew a service market and where both markets benefited tremendously.

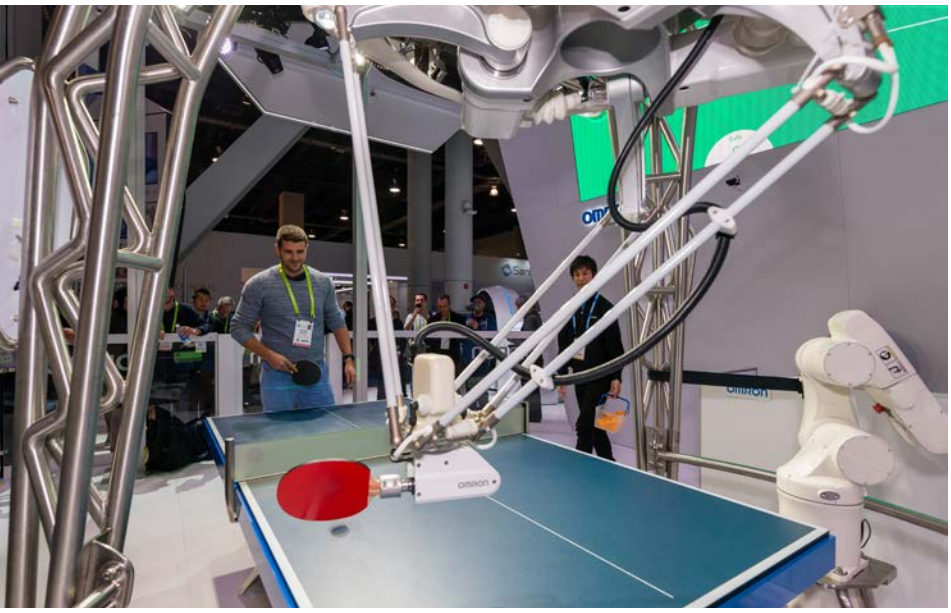
Increasingly, tech hardware is integrating and embedding services as core elements of the user experience. The hardware couldn't exist without the service, and conversely the service couldn't exist without the hardware. Companies are focused on delivering compelling and holistic experiences that leverage hardware, software and services and AI is a crucial part of their overall strategy.

AI is being used to enhance decision making by providing informed recommendations and automating choice. AI is remaking the consumer experience. Within the next decade, most hardware and services will incorporate AI at some level. AI will enhance existing services and give rise to entirely new services. AI applications are centrally focused on improving the user experience.

AI is giving rise to autonomous and semi-autonomous services where hardware and services work collectively on behalf of the end user. Tasks might include adjusting temperatures in the home or ordering supply replacements when needed. AI applications are moving from services such as spam filters for mail inboxes to hardware and service combinations such as self-directing home vacuums, washing machines and vehicles.

AI algorithms are creating personally relevant experiences. Consider the Huawei Mate 10 Pro. CES 2018 marked the U.S. release of Huawei's Mate 10 Pro, which Huawei touts as the first AI smartphone. The smartphone learns behavior over time, and the embedded AI personalizes the experience. Say a user opens

AI represents a seachange for CES and for the broader technology industry.



the selfie mode most frequently when they use the camera. The smartphone's AI will notice this over time and make that the default setting. This is how AI is being leveraged to create a customized experience, and it will become increasingly commonplace.

Another example of the combinatorial role of datafication and AI at CES is Sony's Aibo robot dog. Aibo has three touch sensors, two cameras (a front one for image recognition and a rear one for simultaneous localization and mapping), a Time-of-Flight (ToF) sensor for proximity detection, an illuminance sensor to sense presence from behind, four microphones and a motion detector. Aibo then leverages AI to react to touch and voice commands. Aibo uses AI to learn from interactions with its owner and develop a unique personality over time.

At the CES 2018 SuperSession "Turning AI into New Ways of Doing Business," IBM executives discussed ways IBM Watson, IBM's AI platform, is changing business. For example, together with an IBM AI application on a smartphone, consumers can scan a product using a small optical device attached to their smartphone to see in-depth information about a product. Consumers can see if the optical signature of something like wine is consistent with the year and region that it is being marketed as. They can compare different types of engine oil to decipher between grades–something the naked eye can't determine. Because the AI solution can distinguish at the micron level, it can be used to detect toxins in water. It can also be used to verify the authenticity of currency or industrial parts and can create models for verifying passports. It's clear that AI is increasingly providing consumers with more transparency than ever before.

At CES, ForwardX Robotics demonstrated a travel suitcase that follows users around the airport and uses cameras and AI to avoid crashes. It's an application that highlights how AI could change how we live. Executives need to see that AI is enabling services to become more intuitive as they become more personalized to the individual. In the past, companies designed products for mass markets. AI enables companies to think about individuals as viable, addressable markets. Companies can leverage AI to bring to market products and services that shift over time in subtle and personal ways. Some of the biggest trends in the tech industry impacting tomorrow have AI behind them and we saw them first at CES.

VOICE IS THE NEXT COMPUTING INTERFACE

At CES 2018, we saw voice interfaces across a wide assortment of technologies. Google Assistant, Amazon Alexa, Samsung's Bixby, LG's ThinkQ, Baidu's DuerOS and Roku Entertainment Assistant were just some of the voice interfaces showing up at CES. Voice is the next computing interface, and it's important to understand why this is far more important than simply enabling users to speak commands.

LG

The lines between our physical world and our digital world are more fully converging. The way we access and interact with technology is changing. Every time there has been a shift in the interface between humans and how we access digital technologies or digital platforms, there have been fundamental changes in use cases and consequently fundamental changes in society.

In many instances, speech recognition is giving us easier access to richer AI functionality. Speech recognition is a specific form of AI and also a gateway to other forms. Speech recognition is being integrated across a swath of industries. It binds hardware, software and services together. The voice recognition components enhance the hardware and complement the service.

When Amazon launched the Alexa-controlled Echo smart speaker in 2015, adoption and use of a voice interface began its ascent. But CES 2018 made clear that voice is exploding on the scene in ways not previously seen. It started with a speaker, and we certainly saw that trend continue at CES where dozens of smart speakers were launched from companies including Altec-Lansing, Klipsch, LG, Onkyo, Panasonic, Sony and Vivitar. Companies, like Libratone, announced some of its existing speakers would receive free firmware upgrades for voice functionality in the coming months. Polk announced its Command Bar, the first voice-controlled soundbar with Alexa. We also saw companies build in additional features, which might hint at how use cases will evolve over time. Onkyo's Alexa-enabled tall tube VC-FLX1 is equipped with a wide-angle HD camera for video calling and room monitoring, along with built-in temperature, audio, motion, light and humidity sensors.

Lenovo

The smart speaker category together with the broader integration of voice control exploded at CES 2018. No new product category has gone from near zero to ubiquitous at CES in recent memory like voice-controlled devices

Daimler AG

did this year. Starting last fall, a flood of smart speakers hit the market, precipitating a hockey stick in U.S. sales to just under 28 million units for 2017–a 279 percent growth, according to CTA. Echoed by other research firms, the number of smart speakers introduced at CES could quadruple the number of available units, and CTA believes U.S. sales will zoom to 43.6 million units this year. Further, according to a CTA survey conducted just before CES, 44 percent of U.S. online adults plan to purchase one.

Voice platforms are combining with existing technologies to create entirely new categories. For example, Google has partnered with JBL, Lenovo, LG and Sony to produce Smart Displays with Google Assistant. Smart Displays are tablet-like devices that offer both a voice interface and a touchscreen. The addition of screen real estate can aid a voice experience by not only giving information verbally but also showing how-to photos and videos or other visual information. Smart Displays offer huge potential for marketers and advertisers seeking to leverage digital assistant platforms.

Voice is the next user interface for home control and is helping usher in entirely new smart home applications. In addition to voice-controlled smart speakers and Smart Displays, we saw home appliances, televisions and a myriad of technologies that use voice interfaces to leverage AI. For example, at CES, LG introduced nine 4K UHD AI OLED televisions and seven AI 4K UHD televisions. Users will be able to use voice commands to search for specific content or control other aspects of the entertainment experience. At CES 2018, Whirlpool integrated Amazon Alexa and Google Assistant into a number of its appliances. Using voice a user can now change the temperature in their refrigerator, start the dishwasher or get an update on the time remaining time on the washing machine cycle.

Hisense announced its HiSmart Portable Air Conditioner and HiSmart Dehumidifier can be upgraded to be voice-controlled via Alexa. Voxx's Project Nursery Smart Baby Monitor System with Alexa lets parents control the nursery ecosystem, track activities, play lullabies or read stories and access baby-oriented information. The Cauldryn Fyre V2, the industry's first vacuum-sealed water bottle to boil water from a rechargeable battery, is adding Google Assistant so users can order the bottle to turn on, turn and change temperature to heat a beverage. We'll take a look at a few more examples from CES 2018 in the IoT & the Smart Home section.

Speech recognition and AI is also enhancing the in-vehicle experience.. Mercedes-Benz premiered their new Mercedes-Benz User Experience (MBUX). The infotainment system uses

Hyundai

AI to understand voice commands and will become standard on its next compact car lineup being revealed later this year. Toyota announced it will introduce Amazon Alexa into some Toyota and Lexus vehicles in 2018 and 2019, and Kia announced its UVO Agent, which integrates Google Assistant and will be available in some models this year.

Hyundai teamed with SoundHound to announce a voice assistant that will debut in 2019. The system can prompt a user about upcoming meetings or offer alternative routes to their destination. It can also be used to control things like locks and air conditioning and handle multiple commands at once. Being able to parse multiple commands will be an important area of expansion for digital assistants. For example, “add eggs and bacon to my shopping list,” or “turn off the lights in the living room and lock the front door.” At CES, Google announced Google Assistant would be integrated with Android Auto and offer yet another way to bring a voice interface into the vehicle.

Voice assistant platforms are continuously improving in conversational and contextual capabilities and the convenience that voice control adds to search and controlling other devices is luring millions of consumers to adopt the technology. Companies continue to integrate voice interfaces into a variety of devices, which in turn will likely spur consumers to buy other connected devices that can be controlled via smart speakers.

Most smart speakers adhere to a particular voice-control ecosystem, many smart home products are compatible with a variety of voice and app control platforms, and many voice systems are compatible with more-or-less open smart home control platforms such as ZigBee, Z-Wave and IFTTT (If This, Then That). It’s easy to see how a connected ecosystem quickly comes together.

Speech recognition was everywhere at CES, but this is just a building block of things to come. Voice interfaces are changing how consumers interact with technology and as a result are changing how brands will interact with consumers and undoubtedly create new marketing opportunities. New consideration will be given to user interface, search, relevant consumer data and privacy. Voice interfaces are also opening up new service models for industries as diverse as hospitality, advertising, food services and healthcare. The next big thrust is developing use cases that change how we use technology and ultimately change how we live our lives.

SMARTENING UP OUR CITIES, REDEFINING MOBILITY AND CHANGING HOW WE LIVE

As a result of massive global urban migration, cities are facing new challenges that strain resources and impact the quality of life of its residents. The American Society of Civil Engineers estimates U.S. cities will need $3.6 trillion in basic infrastructure investment over the next 20 years to cover updates of existing infrastructure alone. This doesn't begin to take into account the growing needs of cities as their populations balloon and the demands on their infrastructure explode.

The smartest cities are using technology to service the growing and evolving needs of these urban environments. Smart cities are leveraging information and communication technologies to generate and aggregate data. They are using analytical tools to drive data-enabled decisions and solve the biggest public problems through innovative approaches.

These cities are using technology and digitized information to design city services with clear intent, leveraging a depth of knowledge that was previously unobtainable. That depth of knowledge comes from digitizing large swaths of information and monitoring service use in real time. Smart cities are learning to deliver public services and use scarce resources such as real estate and energy more efficiently. Innovation in solar energy, fuel cells, smart grids and green infrastructure offer adaptability.

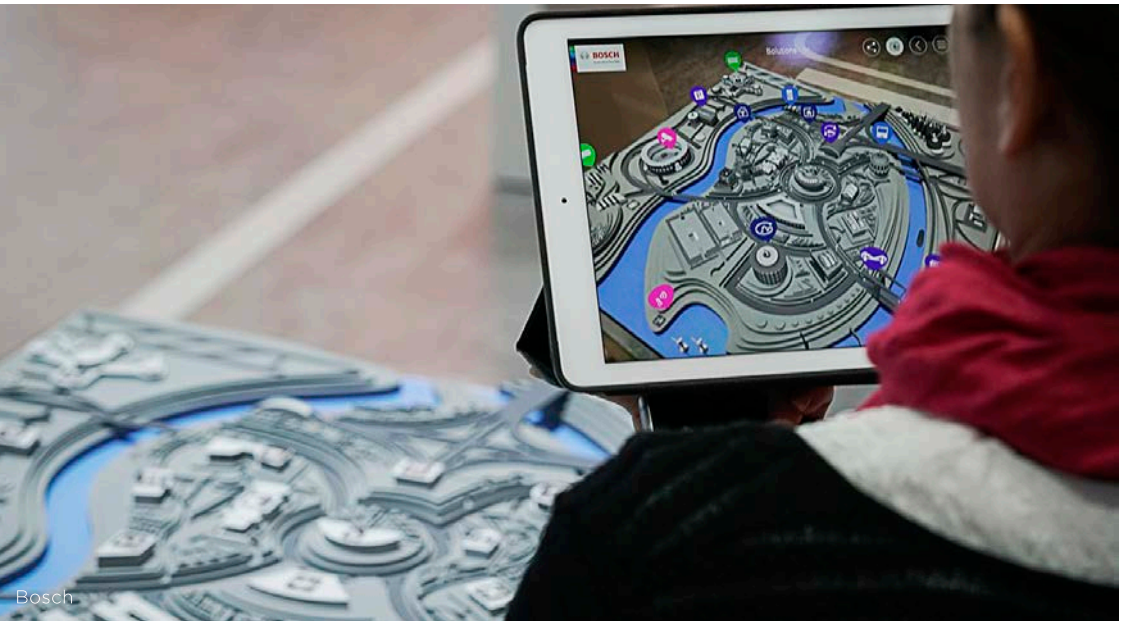
Ford

Not only are municipalities using sensors for continuous monitoring, but they are also increasingly able to respond in near real time. Smart city technologies employ infrastructure that is resilient and redundant. Smart cities will be able to provide continuing levels of essential services to communities during, and after, weather events.

Smart cities will use diverse power sources, including a combination of solar, fuel cells, gas turbines and hydroelectric systems. Smart grids will have built-in redundancies to improve recovery times. Rooftops will be fitted with solar panels and will provide electricity to the grid beyond the building's own use. Automated management systems will optimize heating, cooling and lighting systems. Smart cities will integrate water systems with urban elements such as green spaces.


Bosch

Smart cities use innovation to both centralize and decentralize services. Cities are changing the way they think about infrastructure. Smart cities are a system of integrated structures and services rather than isolated, individual elements. These structures work independently but also collectively as a whole by interacting with other structures and services in the city. These elements are designed to address multiple objectives.


Bosch

Smart cities are enhancing situational awareness through improved communication, connectivity and data analytics. Smart cities will be contextually aware to adjust to services such as emergency response. Traffic lights, elevators and doors might all auto-respond to an emergency.

CES is uniquely positioned to pull together entire ecosystems. Nowhere is that more important than around the future of cities. The diverse components of smart cities include IoT, 5G connectivity, transportation, energy and utilities and health and public safety. CTA estimates global spending on smart cities will reach $34.35 billion by 2020.

The proliferation of intelligent devices will drive cross-communication and collaboration as devices begin to feed each other digitized information, coordinate and work together. Smart city deployment has broad ramifications for energy grids, data analytics, governance and policies, healthcare, public safety and transportation.


Bosch

At CES 2018, we saw smart city technologies across the entirety of the show floor. Wi-Fiber introduced its new "Intelli-Platform," an advanced modular surveillance system that integrates urban lighting, communications and a surveillance platform that grows and evolves with a city and its needs. Bosch showed a new system for monitoring rivers and guarding against floods. Honda announced Safe Swarm to enable cars to pass information using vehicle-to-vehicle communication. And Ford announced a collaboration with Qualcomm on Cellular Vehicle-to-Everything (C-V2X) to ensure connected objects in a city–from stoplights to signs to bikes–can share information and speak to each other. Ford also launched a cloud-based platform called The Transportation Mobility Cloud to facilitate information flow so any form of transportation in a connected city can work together more effectively.

5G CHARGES CONNECTIVITY

Advances in cellular technologies, such as the expansion and development of 5G, are a catalyst of growth and the glue that is binding together our physical and digital worlds. The availability of 5G connectivity in the coming years will be a massive accelerant for innovation and will introduce a variety of completely new use-cases for both consumers and diverse industries.

In the days leading up to CES, the first specification for 5G was signed off by the 3GPP—the organization that governs cellular standards. While it is still early in the 5G standards process, many carriers plan to begin large-scale trials and commercial deployment in 2018 and 2019. ZTE announced at CES 2018 that they plan to sell 5G-enabled smartphones in the U.S. near the end of 2018 or by early 2019. Qualcomm president Cristiano Amon expects 5G-enabled smartphones and other devices to be ready by early 2019. By 2020, the International Telecommunication Union (ITU) should finalize 5G standards.

The naming convention of cellular technology suggests a linear progression. We've moved from 2G to 3G to 4G, and now 5G. But the change between each isn't linear; it is exponential. Each progression brought greater data throughput capacity, faster speeds and lower latency. 5G networks will be up to 100 times faster and five times more responsive than today's network. A 2-hour movie would take 26 hours to download over a 3G connection—a speed so slow and an experience so unenjoyable that we never did it. As we moved from 3G to 4G, this same activity of downloading a 2-hour movie went from a 26-hour ordeal to a 6-minute experience. As a result, we consumed significantly more videos and engaged in more data-rich activities on our mobile devices. The use-case scenarios of devices began to evolve as we migrated from 3G to 4G connectivity. In a 5G paradigm, that same 2-hour movie can be downloaded in 3.6 seconds. That is the exponential reality of migrating across these cellular services. As a result of this shift, use-case scenarios are getting ready to change drastically.

5G will allow businesses to control equipment in distant locales in near real time. 5G will also support business processes like data analytics and edge computing. The coming years will bring colossal change.

TRANSPORTATION TRANSFORMATION

A staple of the American lifestyle for many, the car is undergoing more fundamental change than at any point in its history. While the embrace of electric vehicles is teeing up the shift to self-driving vehicles, there are advances that are happening now. CES 2018 brought together a mix of what's just around the corner and what may be possible in the future.

This year, vehicle technology occupied nearly 300,000 net square feet of exhibit space. The automotive footprint at CES would make it the fifth largest stand-alone auto show in the U.S. Nine OEMs exhibited at CES 2018 including BMW, FCA, Ford, Honda, Hyundai, Kia, Mercedes, Nissan and Toyota. Moreover, 11 self-driving exhibitors occupied over 35,000 net square feet of exhibit space.

First-time CES exhibitor BYTON used CES to unveil an electric-powered concept car. They are calling the SUV crossover an SIV or "smart intuitive vehicle (SIV)," and believe it will launch an entirely new category of vehicles. Another first time CES exhibitor, Bell Helicopter, used CES 2018 to introduce its design for an urban air taxi cabin that challenges the traditional view of aviation and offers an on-demand mobility solution. CES has become a launching pad for a myriad of technology systems, solutions and services across every industry.

One task companies must master to fully replace driven cars is reliability in any kinds of conditions. Drawing on its expertise in construction vehicles and heavy machinery, Torc Robotics' Asimov software helps self-driving cars deal with aggressive lane-cutters, confused drivers signaling the wrong turn and inclement weather by striving for the safest decision in any instance. TuSimple used CES to show its Level 4 autonomous truck technology on a Class 8 truck. Collaborating with Nvidia and Peterbilt, TuSimple is propelling self-driving technologies into new value chains and hopes to introduce self-driving

trucking services into the market by next year.

At CES 2018, we also saw new ways of thinking about human and digital connectivity. Nissan, for example, touted what it calls “Brain-to-Vehicle” technology, which is designed to speed up reaction times for drivers by continuously monitoring brain waves to anticipate driver actions like turning the steering wheel or accelerating. Toyota’s Concept-i is powered by AI and attempts to read a driver’s emotions. The service can map out alternative routes or offer to take the wheel in low-visibility conditions in order to lower a user’s stress level.

Even in an era of self-driving cars, we’ll probably want to tap into content on our smartphones. That’s the idea behind systems such as Android Auto, but it has required a cable connection between the phone and the car. JVC Kenwood is removing that step with wireless Android Auto systems. The Kenwood line of add-ons offers a higher-end experience with capacitive touch displays and input for front and rear cameras. Panasonic expanded its Panasonic Skip Generation Platform in connected cars to work with Amazon’s Alexa. Customers can use voice to control what music is played, get directions, interface with connected objects in their house or even order a pizza on their way home.

CES also took us beyond traditional vehicle transportation. Virgin Hyperloop One showed a trip planning app and the aeroshell hyperloop pod that recently completed testing. When successfully deployed, these levitating pods will travel through vacuum tubes at up to 700 miles an hour. The transportation technology is cheaper than airlines and faster than traditional rail travel. It can reduce the time and cost of long-distance travel. This technology has the potential to change business travel and improve logistic networks.

CES highlighted technologies that improve our transportation experience and make us safer. Hitachi Automotive Systems and Clarion showcased parking technologies that enable self-driving vehicles to identify viable parking spaces and park themselves after dropping a rider at the front door of their destination. Companies like Aptiv and Car & Driver had driver fatigue and distraction monitoring systems on display at CES. Nvidia showed how AI together with image sensors could recognize the owner of a vehicle and open the truck for them autonomously.

At CES 2018 we also saw how the transportation transformation is challenging adjacent industries outside of transportation. Toyota unveiled e-Palette, a multi-mode self-driving concept vehicle that features an open interior design that can be customized for a myriad of use cases. Toyota also announced launch partners including Amazon, DiDi, Mazda, Pizza Hut and Uber. In a similar vein, Robomart, on display in the startup area of Eureka Park, is a Level 5 autonomous vehicle that could be used by retailers to make home delivery and bring the convenience of retail pop-ups to the driveway.

The future mobile ecosystem won't be controlled by a single force. Companies will have to come together and work collectively on achieving their shared goals. CES showed us the extent of the transportation transformation.

These two vehicles highlight how self-driving vehicles will intersect with a variety of industries.

Driving all of these advances together, Ford showed that transportation has a bigger role to play as part of an increasingly connected city. The future mobile ecosystem won't be controlled by a single force. Companies will have to come together and work collectively on achieving their shared goals. It's one of the reasons partnership announcements have become such a big part of CES. At CES 2018 there was more focus on V2X communication and the partnerships needed to ensure data can be easily shared and quickly translated into insights and decisions. CES showed us that transportation is transforming and in the process it is changing far more than how we travel from point A to B.

CES FLYOVER

In the following section we'll take a quick look across CES 2018 and highlight key advancements in a number of core areas, beginning each with a few key developments and overarching highlights for the category.

VR, AR & MIXED REALITY

- VR solutions get democratized
- 360 degree camera market expands
- New AR applications are redefining the mobile experience

CES 2018 clarified how disruptive augmented reality (AR) and virtual reality (VR) will become and brought us steps closer to clarifying how and where these enhanced reality technologies will evolve. In the United States, unit sales of AR and VR hardware are expected to grow by 25 percent and revenue by almost 10 percent over last year, according to CTA. CTA forecasts that 4.9 million AR and VR headsets and eyewear will be sold in the U.S. in 2018, with revenues growing to $1.2 billion. There is clearly industry excitement over AR and VR, demonstrated by the record sizes of the Augmented Reality Marketplace, 10 percent larger than in 2017, and the Gaming & Virtual Reality Marketplace, 18 percent larger than last year, with dozens of other hardware, software and content vendors scattered around the CES show floors.

AR and VR are evolving in the short term as two distinct technologies and markets, but they may merge down the road. AR is more software-centric than hardware, while the opposite is true of VR. Experiencing AR entails only a smartphone while VR requires wearing a head-mounted display (HMD)—essentially a helmet or goggles—that immerses users entirely in a virtual experience.

A variety of hardware exhibitors used CES 2018 to launch HMDs, accessories to add control and tactile feedback and 360-degree cameras to enable consumers to create their own content. The launch of new VR HMDs reflects the experimentation in the VR market. Looxid Labs


Vuzix


Realmax

VIRTUAL REALITY
$1.2 billion in revenue (+18%)
4.9 million units (+25%)

used Eureka Park to introduce LooxidVR, the world's first mobile VR headset that monitors eye and brain activity to enable developers to create unique experiences. Merge showed off its Merge Mini, a small, lightweight and inexpensive VR/AR headset designed for children. Pico Interactive introduced the Pico Neo, the world's first mass-produced stand alone VR device with six degrees of freedom (6DoF) for both head and controllers. Zeiss highlighted its VR One Connect, a Steam VR-compatible HMD.

One sign of a healthy new sector is how many accessory vendors flock to create add-on products. CES was full of innovative VR accessories such as the 3dRudder Blackhawk foot motion controller, the Merge 6DoF Blaster gun, Go Touch VR's VRtouch fingertip haptic wearable, the BeBop haptic Forte Wireless Data Glove and the Titanium Falcon Talon smart motion controller ring. All of these seek to enrich the traditional VR experience. The launch of diverse VR accessories at CES 2018 shows that VR will likely open up new consumer experiences and business opportunities.

CREATING COMPELLING VR CONTENT

As VR continues to mature, consumers are creating their own content. CES was awash with 360-degree cameras to feed this growing user creation market, including a growing number of 4K-capable cameras and even the first trickle with 8K recording capabilities including the Insta360 Pro, the Detu F4 Plus and the Pisofttech Pilot.

To help potential software and hardware VR developers, the Virtual Reality Industry Forum (VRIF), which includes more than 40 member organizations, used CES to introduce its first set of guidelines. Additionally, CTA's AR/VR Working Group under the association's Technology & Standards Program–accredited by the American National Standards Institute–is due to complete its work on technical definitions covering a broad spectrum of the AR/VR industry.

At CES 2018, Intel highlighted the potential for VR and 5G to create new experiences and new opportunities. Shared experiences like virtually attending a birthday party, wedding, holiday celebration, or even a sporting event, when physical attendance isn't possible, are seen as one of the ultimate VR killer applications.

Go Touch VR

AR POSITIONING FOR SUCCESS

While VR is still evolving and maturing, AR seems to be on the verge of a mainstream breakthrough. A variety of marketers and retailers have begun making practical use of AR, thanks to the recent releases of Google and Apple's respective ARCore and ARKit AR software development kits (SDK). AR apps, for instance, can enable mobile shoppers to virtually place prospective furnishing purchases in their actual homes, in the correct size proportion, before buying. Amazon, and to lesser effect Target, have launched similar see-it-first AR shopping apps, and these will likely be followed en masse by every other e-retailer desiring to overcome the "how will it look" e-commerce hurdles.

Battling back, brick and mortar retailers are adding AR signage for their stores, allowing shoppers to more easily locate specific product sections and sales items. Malls and even cities are adding AR directional guidance. Product and event marketers have been equally busy, creating experiential AR campaigns such as Walmart's and Kraft's summer AR promotional partnership and Coca-Cola's AR Magic app that allowed consumers to locate surprises on soda bottles, bus stops and malls in New York City during the recent holiday season.

On the hardware side, vendors used CES to launch AR glasses to provide a more consistent and enhanced AR experience via added contextual information, such as the Vuzix Blade 1, designed to enable users to present location-aware content connected through a user's phone. An important AR hardware breakthrough at CES came from Hong Kong–based Realmax, which showed an AR prototype with a field-of-view of 100 degrees. Many AR headsets today have fields-of-view closer to 35 degrees. A wider field-of-view enables virtual objects to be placed at the edge of where users' peripheral vision starts. The prototype also uses a Leap Motion module for motion and gesture control, which means users can interact with virtual objects in an AR scene. This could prove to be an incredible tool for marketers looking for new ways of engaging consumers.

2018 will likely be a breakout year for AR, while the VR market will likely continue to develop and mature. Both reality-shifting technologies, either separately in the short term but likely combined in the long term, represent expansive new media frontiers as disruptive as radio, TV and the internet. One thing became clear at CES 2018: reality as we know it is being redefined.

ROBOTICS

- Companion robots in myriad forms and with varied applications
- Robots leveraging voice interfaces and embedding AI
- Robots becoming increasingly adept at non-routine activities

Be they companions, assistants or servants, robots have always been a showcase for new technology. As we start to see incredible improvements in AI, the potential for robots to become a more prominent and useful presence in our lives will only grow.

When it comes to the kinds of robots actually in most consumers' homes today, the robotic vacuum cleaner paved the way. One of the makers of those devices, Ecovacs, released a number of robots to take on an even more onerous household chore: washing windows. Of course, moving across windows means that Ecovacs has had to consider situations where the Winbot would be far from an outlet. The Winbot X is the first model from the company to take on its task entirely on battery power. Ecovacs also showed off robots that mop in addition to vacuum. The Deebot Ozmo 930 model even uses Smart Navi laser scan mapping, the same technology used in self-driving vehicles, to map out the most efficient and effective way to clean the room. Like so many categories at CES 2018, these robots are increasingly tying into voice recognition platforms like Amazon Alexa and Google Assistant.

Of the many robots released at CES, Blue Frog Robotics' BUDDY was among those that come the closest to fulfilling the kinds of tasks people associate with robotic helpers. With a friendly face on its display, it helps with calendar reminders, can travel to those who want to start a video chat, interact with kids with educational games and even suggest recipes. The French robot designers behind BUDDY plan to add even more capabilities through apps.

Sony's robotic educational pets resembling dogs and puppies from the 1990s had remarkable capabilities for their time, but Sony's Aibo features modern advances. These include OLED displays for its eyes and cellular and Wi-Fi capabilities to connect to the camera in its nose, making it a (pretty timid) guard dog. As noted earlier in this report, Sony's Aibo is full of embedded sensors including touch zones across its surface to ensure it responds well to petting. It also uses AI to develop its own personality as it learns, just like its biological inspiration.

Robots are well on their way to helping us behind the scenes and in our professional lives. While robot adoption in 2018 will be driven overwhelmingly by businesses, more applications are emerging in the consumer world, particularly as robots develop advanced AI skills. With the proliferation of inexpensive and high-quality connected cameras, surveillance and security promise to be an emerging application for home robots, which can extend the perspective of any video feed to virtually anywhere in the home.

Toys have long been fertile ground for robotics, and modern offerings have begun to focus more on using robotics to prove programming

concepts in a more tangible way. Another promising application is companionship and assistance for the homebound. At CES 2018 the Intuition Robotics ElliQ was a CES Innovation Award honoree. ElliQ is an active aging companion that has voice and touchscreen interfaces to keep seniors engaged, remind them of calendar events and suggest personalized activities and digital content.

At CES we also saw the My Special Aflac Duck. This companion robot is made for children fighting cancer and was a CES Innovation Award honoree. It responds to interactions and can be a vehicle to communicate emotions when words are difficult to come by. The companion robot can also receive pretend chemotherapy through a tube attached to the duck's chest and share the hardships a young cancer patient is going through.

Several robots showed the tremendous strides robotics has made in the last year and point to the shifts coming for enterprise and industrial robotic use. In the past we've been able to automate highly routine tasks, but automating non-routine tasks has thus far evaded us. Advances seen at CES 2018 suggest this might be changing and with it comes colossal implications for the future of work. One example is Omron's FORPHEUS Ping Pong Robot, which was more about functionality than specific application. The robot swings a paddle with a robotic arm to return a ping pong ball hit by a human player. The robot uses three cameras to track the ball and its opponent and uses AI in lightning fashion to determine where the ball will end up and how to return the ball so it remains in play. AI is also used to judge the skill of the opponent and adjust its skill accordingly in order to maximize the potential for a high series of hits between human and robot.

VIDEO

- Volumetric video changing the entertainment experience
- 8K televisions enter the market
- Flexible TVs change the form factor of televisions

For decades, improvements in televisions have been a highlight of CES as TV brings together the rich audio and video experience that is a hallmark of consumer technology. Consumers now have unprecedented access to an incredible array of video programming coming from any number of providers. Many demonstrations at CES proved the video experience is poised to improve in the coming years.

TV manufacturers continue to provide meaningful picture quality improvements at affordable prices. 4K UHD TVs, which offer four times the resolution of high-definition TVs, have entered mainstream price points. At the same time, high dynamic range (HDR) TVs are delivering wider color gamuts and greater contrast. While two main standards exist for HDR, more TVs and video products are supporting both.

The higher resolution and color range are also being supported by a range of content on physical media and from leading streaming providers. 4K UHD and HDR content from Netflix ramped up dramatically as the company expanded its original programming. Blu-ray discs stepped into the 4K era with Ultra HD Blu-ray, and several companies released 4K-capable smart TV add-on boxes. While average broadband and cellular speeds continue to improve, new compression standards have eased requirements and made it more efficient to distribute these high-quality video files.

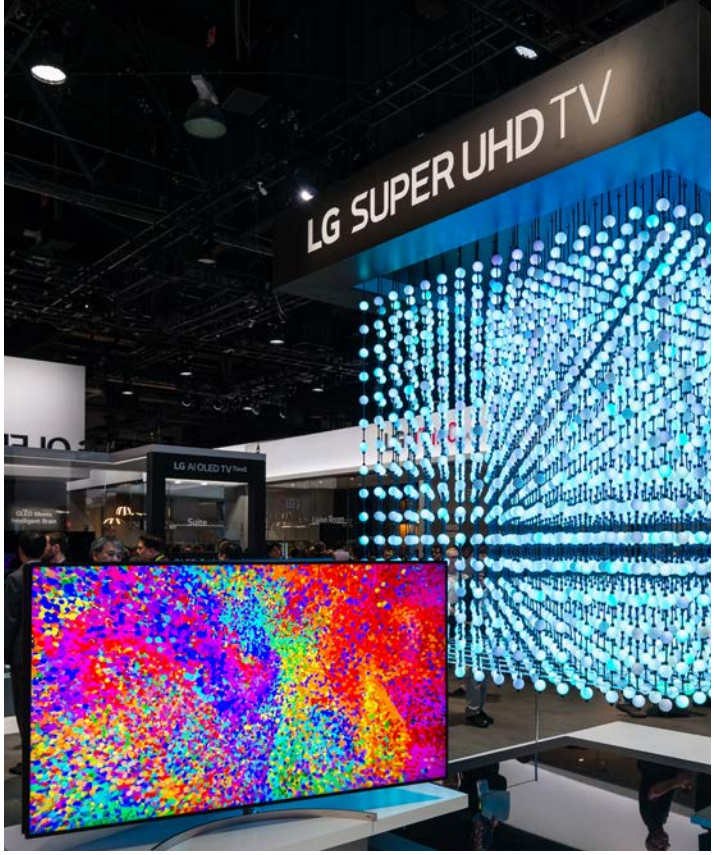
At the same time, TV manufacturers continued to push the envelope of display contrast with technologies such as OLED and quantum dot (QLED)-based televisions. With the electronics hidden away in a base unit or soundbar, these TVs have the potential to be so thin that several manufacturers have likened them to wallpaper or a picture frame. At CES we saw the introduction of televisions so thin that they rival picture frames hung on the wall. That thinness is enabled by a technology called OLED. But OLED has other benefits, including the ability to be used in curved displays. At CES 2018, LG showed off a 65” TV concept in which the entire display rolls into a base, providing a large-screen entertainment

experience without taking up wall space when not in use. For many of us, the television marks the center of our living spaces, but that could change with the ability to hide the television by rolling it away when not in use.

While many companies at CES rolled out improvements in TV picture quality and others enhanced broadband services that greatly expand content choice, announcements were also made in multi-perspective experiences. Intel announced at CES 2018 a new approach called volumetric video that uses cameras to capture height, width and depth data within a scene to produce voxels. This information is used to render a virtual environment that provides a multi-perspective 3D experience. Imagine watching a football game and being able to replay a catch from a different angle. Directors can now imagine scenes from the outside in and viewers can experience a captured scene from any perspective. Viewers can zoom in and out of the frame and even change the point of view of the scene to place themselves in the middle of the action. Having created a 25,000 square foot studio to create volumetric scenes, Intel is testing the technology together with Paramount Pictures.

All things being equal, the more dots that are on a display, the sharper that display. In the past few years, TVs have jumped from high-definition to 4K ultra high definition with many broadband video services now supporting select 4K UHD programming. But at CES 2018, we've started to see what looks like the next leap in resolution with Samsung showing off an 85" 8K television, which would again quadruple the resolution. Just as with previous resolution jumps, some of the early usage will be improving the perceived quality of lower-resolution content. Samsung also used CES to introduce the world's first modular self-emitting MicroLED television. It can transform into any size which will allow consumers to customize their television size and shape to fit their needs.

All of these advances are combining to change not only the form factor of televisions but also the entire entertainment experience.



TELEVISIONS

4K Ultra HD:
$15.9 billion in revenue (+14%)
22 million units (+27%)

Total Digital Displays:
$22 billion (+1%), 44 million units (+2%)

AUDIO

- Wireless earbuds abound
- Assistive hearing coming to earbuds
- Active noise cancelling pervasive
- Digital signal processing moving into new soundbars

Products in today's market use advantages of old and new technology to achieve the goals of any audiophile: great, clean, compelling sound. A topic that inspires passion in many, these products reflect how far we've come and the potential of what's next.

At CES 2018 we saw a strong collection of wireless earbuds come to market with diverse use cases. Sony used CES to debut the WF-SP700N, the first total wireless water-resistant sport earbuds to also have active noise cancellation. Assistive hearing was also a trend emerging at CES 2018. Bragi used CES to announce Project Ears, an initiative with Mimi Hearing Technologies to use algorithms to map one's hearing, account for hearing loss or tinnitus, and create personalized hearing enhancement. Nuheara used CES to introduce its IQBuds Boost wireless earbuds, which evaluate an individual's hearing and create a personal listening profile.

Smartphones provide amazing access to a range of music, but often they can't produce the richest audio experience. With a form factor inspired by ice cubes in a glass of whisky, Qoobi promises the convenience of a Bluetooth 5.0 wireless connection from a phone with the rich sound of an analog output. Using a vacuum tube preamp, it takes the compressed digital audio from a phone and converts it to a rich analog output and is also compatible with any home audio system.

The past few years have seen a wave of companies entering the headphone category, but companies known for their headphones can branch out as well. For its first entry in the market, Sennheiser has taken on solving the issue of compact soundbars that produce a flat sound. The company created a soundbar that uses a digital signal processor and Dolby Atmos to produce the output of nine main speakers and one subwoofer, creating the 3D sound of a full multi-speaker surround setup.

Qualcomm is perhaps best known for developing the chips that power many smartphones and their connections to cellular networks, but the company is also active in the Wi-Fi and Bluetooth markets. The Qualcomm QCC5100 Bluetooth audio system on a chip aims to not only bring down prices of wireless earbuds, but also increase the processing speed and reduce battery consumption. Its support of the company's TruWireless technology is designed to improve reliability of stand-alone earbuds that don't have a wire connecting them.

IOT & THE SMART HOME

- Digital assistant platforms and other voice interfaces embed across the home
- Connectivity expands to new facets of the home
- New use-case scenarios materialize

At CES 2018, a wide range of new products and new platforms were on display led by the growing number of products and services working with and embedding either Amazon's Alexa platform, Google Assistant or both. In addition, CES attendees saw new and next-generation versions of more traditional smart home products such as security sensors, cameras, smart locks, smart doorbells and smart lighting.

The smart home market still has plenty of room to grow, with plenty of room for new players, new innovators and new innovations. At CES 2018, both Samsung and LG vastly expanded the scope and quantity of their smart appliances under their respective SmartThings/Bixby and ThinQ smart home ecosystems. And both companies have enabled their 2018 model 4K UHD TVs to act as a voice-controlled center for their whole home smart systems.

Connectivity in the home may have started with basics like lights, locks and the thermostat, but it is now spreading into many new facets of the home. The coming years should usher in even more options as lower-power wireless standards enable more connected devices to last years around the home away from an outlet. CES 2018 showed how advanced connectivity is driving new functionality around the home.

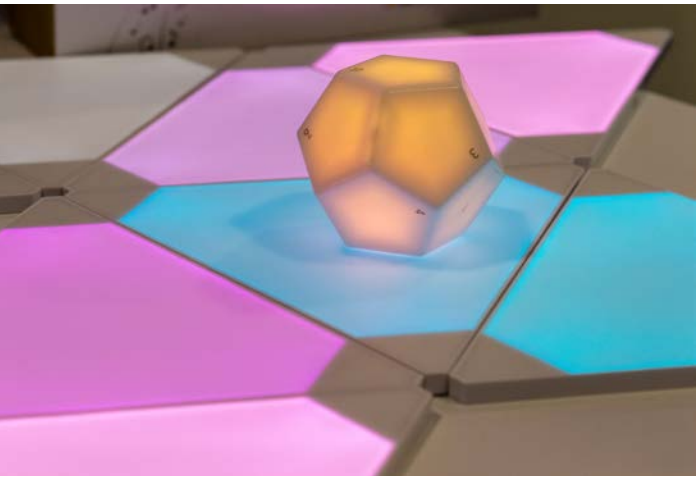
A bathroom routine is an important step to get out of the door, and in the middle of it, there's a pretty significant tool: the mirror. But now, a self-reflective morning pep talk may result in a response. Kohler's Verdera smart mirror is the Alexa-powered centerpiece of its smart bathroom offering. The Alexa-compatible device can accept


Moen


LG

SMART HOME PRODUCTS

$4.5 billion in revenue (+34%)
40.8 million units (+41%)



requests to adjust the lighting of the mirror. At CES, Kohler also introduced Kohler Konnect, a platform that enables users to extend voice commands, hands-free motion control and personalized presets to operate kitchen faucets, intelligent toilets or other connected products. A user can start a shower personalized to the temperature and spray type they want or fill a bath to a desired depth and temperature through voice commands. Moen also added voice support for its U by Moen cloud-based shower system.

Last year, Nest made a big move into home security after expanding out from thermostats into security cameras. It's now teamed up with long-established lock brand Yale to create a keyless deadbolt that includes a full touchscreen display. It has passcode options that can include time of day limits, and it can be unlocked with a flash of the phone. Given the need to avoid a lockout in case low-battery warnings are ignored, there's a pair of contacts on the unit for battery power, and the lock doesn't stop working if the home Wi-Fi is offline. Nanoleaf attracted attention for its modular, triangular multicolor lighting systems. Like any modern connected home device, it can be controlled by a smartphone. However, the company intends to have controlling its lights as luminous an experience as the lights themselves. To that end, it has designed a dodecahedron-shaped device, which is slightly larger than a baseball. Each of its 12 sides can be attached to a different smart home action via a smartphone app, showing how even such a basic function as lighting can take on new twists in the digital home of tomorrow.

Samsung's Family Hub smart refrigerator will recommend recipes based upon a family's preferences, allergies and dietary restrictions and even the ingredients on hand, which can be determined without opening the door using the camera inside. Users can also access the live camera feed when away from home to confirm what is on hand and what might need to be picked up at the store.

That's the current state of smart home. Everything is being connected, and increasingly using AI to deliver a unique and customized experience that users can take advantage of whether they are in their homes or away.

DRONES

- Expanding commercial and industrial use-cases
- Widening diversity of form-factors and improving technical capabilities
- Combining with AI to create entirely new experiences

Drones have captured the imaginations and the minds in the world of tech. It's not news that unmanned aerial vehicles (UAVs) will have a significant impact on society, but 2017 laid the groundwork for the upcoming future full of convenient, connected and intelligent work done by drones.

Once primarily the domain of military applications, autonomous quadcopters have great potential for both commercial and consumer applications. Drones are being used for a range of tasks, including filming, land surveying, surveillance and search and rescue. Last year, drone technology was put to the test during the strong hurricane season on the east coast of the U.S. and the Caribbean. Drones were deployed to track where people needed the most amount of help. Many of the first views revealing the scale of destruction caused by Harvey, Irma and Maria were captured by drone.

And in far less life-threatening pursuits, an industry has also sprung up around drone racing, which is particularly well suited to the trend of spectator e-sports. Drone racing brings the thrill of other kinds of high-speed races with little danger to humans beyond sore thumbs.

Among more casual users, video capture has been the main driver of drone adoption. Features such as automatic following, self-landing and app control have catered to those using higher-end products to record outdoor sports exploits. However, the trend has been toward smaller drones with folding, collapsible rotor extensions, some of which are not much bigger than a smartphone.

Drones are becoming increasingly versatile and CES 2018 showed off flying devices that run the gamut of sizes and functionality. Drones that are used by professionals for overhead video need to be large and powerful enough to withstand some amount of wind while remaining stable. But drones with more

personal photography duties can be far more portable and useful tools. Like a transforming toy robot, the Aee Selfy can be carried and used discreetly as a phone case. Then, when it is unfolded into drone form, it can hover a relatively short distance from its owner and snap the perfect selfie, a more versatile and less cumbersome version of the selfie stick.

One way to figure out new uses for the drones of tomorrow is to put them in the hands of students today. Such is the goal of the Tello, an inexpensive drone that supports the introductory programming language Scratch with which one can program flight patterns. Slated to launch first in China, it features a 360-degree camera, live video streaming, flight stabilization, easy control and a price of under $100.

Drones are generally thought of as things we carry (at least until they take off), but some companies are thinking of them as things that carry us. The product of a partnership between Intel and a German manufacturer, the Volopter functions as a small helicopter that uses 18 powerful rotors to transport up to two people. It is still in prototype but offers a perspective on just how big the drone category could become.

Drones continue to grow in sophistication and applicability. No longer simple novelties, drones are beginning to show the full range of their potential use. Drones are becoming important tools for certain industries and that will likely continue to expand to other industries in the coming years.

Nima

DIGITAL HEALTH AND WEARABLES

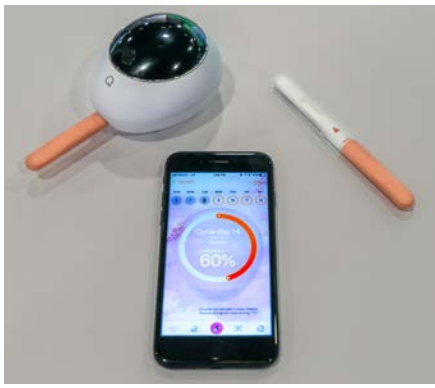
- The democratization of healthcare continues to unfold
- Wearables move into new realms and become more agile
- A broadening of healthcare-related applications address new areas

Three core health-related shifts continue to unfold at CES. First, a broadening of healthcare-related applications expanded over a wider array of needs. Secondly, the democratization of healthcare continues as medical-grade technologies become available to all consumers. Finally, wearables expanded into entirely new realms. These three forces combine to create entire new hardware and service offerings.

Wearables have the capability to enrich our lives by providing us ready access to information. Consider Faurecia's Active Wellness Express, a connected seat cover for driving professionals. The technology integrates sensors to monitor metrics like heart rate, heart rate variation and breathing rate. It's just one more example of how technology is being used to improve safety and well-being. At CES we also saw medical-grade technologies like Omron's Heart Guide, a smartwatch with a medical-grade blood pressure tracker. What was one available primarily through physicians is becoming available to everyone.

At CES 2018 we saw a strong expansion of digital health and wearable technology into the maternity and infant arenas. Two fertility tracking solutions include Mira's fertility platform and EarlySense's Perception, a contact-free fertility monitoring system placed under the mattress. It measures things like breathing, motion, heart rate variability and sleep quality and predicts a six-day fertility window. The Freemie Liberty is a hands-free breast pump with programmable sleep timer. The HiMirror Mini is a smart mirror that uses built-in cameras to analyze skin, track skin goals over time and record results for products used by consumers.

We also saw technology aimed at helping form healthy habits or aid in the care of a sick child. The Kolibree Magic smart toothbrush uses computer vision technology together with motion tracking and a smartphone to deliver an AR gaming experience to encourage kids to brush their teeth. Blue Spark Technologies introduced TempTraq, the first wearable, Bluetooth temperature monitor, which continuously measures, records and transmits body temperature for up to 48 hours to a mobile device–the perfect product for a parent who wants to track the temperature of a sick child without having to disturb them.



Wearables also are addressing niche, but extremely important, health issues. For example, Nima introduced the Nima peanut sensor, which detects traces

Omron

of peanuts in food to help those with peanut allergies test food before eating it. Another product positioned to improve our lives is Sensio Air, an allergen detector that tracks grass, mold, pollen and dust particles.

Wearables are getting smaller and more flexible. They are increasingly becoming agile and designed so they can be worn in different places and different ways. Take, for example, L'Oreal's UV Sense. Announced at CES, it is a wearable electronic UV sensor that affixes to a thumbnail. The small dot measures exposure to UV, and can be worn for up to two weeks.

At CES we saw technologies to combat health issues as diverse as weight and chronic pain. Modius released a headset to tackle some of the core issues around weight loss: metabolism and appetite control. The headset connects to the back of one's ears and uses electrical stimulation to activate the hypothalamus to regulate body fat. Oska made its first appearance at CES to promote Pulse, its pain-reducing wearable. The Pulsed Electromagnetic Field (PEMF) device straps onto the patient wherever they are feeling chronic pain. By realigning the electrical field around damaged cells, the device helps release toxins and attract nutrients by increasing blood flow and expediting healing.

Scientific research continues to highlight the importance of sleep, and several new products were launched at CES to help monitor and improve sleep quality. The Dreamlight sleep mask is a connected sleep mask that dims and illuminates light to match breathing. It also plays ambient sounds to block out noise. It is held against the chest to induce relaxation and regulate breathing. Nokia Sleep is a connected mat that sits under a mattress and gathers metrics and offers recommendations to improve sleep.

In other related areas we saw the NeoMano robotic glove, which helps individuals with spinal cord injuries perform everyday tasks using their hands. And at CES 2018 we even saw a horse wearable. French saddle maker CWD showed the first smart saddle designed for equestrian sport jumping. The saddle measures and records data on stride, approach, recovery and more and pairs the information with video so the rider can assess and improve their performance.

SPORTS TECH

- The datafication of sports is changing how we experience fitness
- AI is changing how professional and amateur sports are played
- AI is empowering personalization and changing the fan experience

The digitization of our physical world is changing how we engage in sports—from how athletes play sports to how spectators enjoy professional events. CES 2018 featured the latest in digital products to enhance athletic performance, develop state-of-the-art venues, and usher in next-gen sponsorship and advertising models. CES had everything from connected sports equipment to technologies that are changing the fan and stadium experience.

At CES 2018 Hisense announced a partnership with Fox Sports to create a 2018 FIFA World Cup app for its smart TVs, which will allow viewers to choose from a variety of available live 4K UHD viewing angles during the game. Prevent Biometrics announced the commercial launch of its Head Impact Monitor Systems (HIMS), which provides real-time concussion detection through a sensorized mouthguard. And Peloton unveiled a high-tech treadmill with an interactive platform that delivers built-in live workouts to users.

CES 2018 also featured live productions of Inside the NBA, The Warm-up and ELEAGUE Street Fight V Celebrity Showdown. At CES 2018 Intel highlighted its extensive involvement in the 2018 Pyeongchang South Korea Winter Olympics. Intel announced it would partner with Olympics Broadcasting Services (OBS) to provide more than 50 hours of VR coverage via the NBC Sports VR app, the first time VR content will be available for the Winter Olympics. Intel also used CES 2018 to announce a three-year partnership with Ferrari North America, which will involve using drones combined with AI technology to enhance the fan viewing experience by enabling broadcasters to analyze races in real time and provider deeper insights. Drivers will also benefit from the drone footage and AI capabilities because they will be able to perform real-time analysis that can be employed to improve lap time. AI will also be used to break human analysts from the inertia of checking the same metrics by identifying subtle variations that might have been missed.

THE STARTUP SCENE OF EUREKA PARK

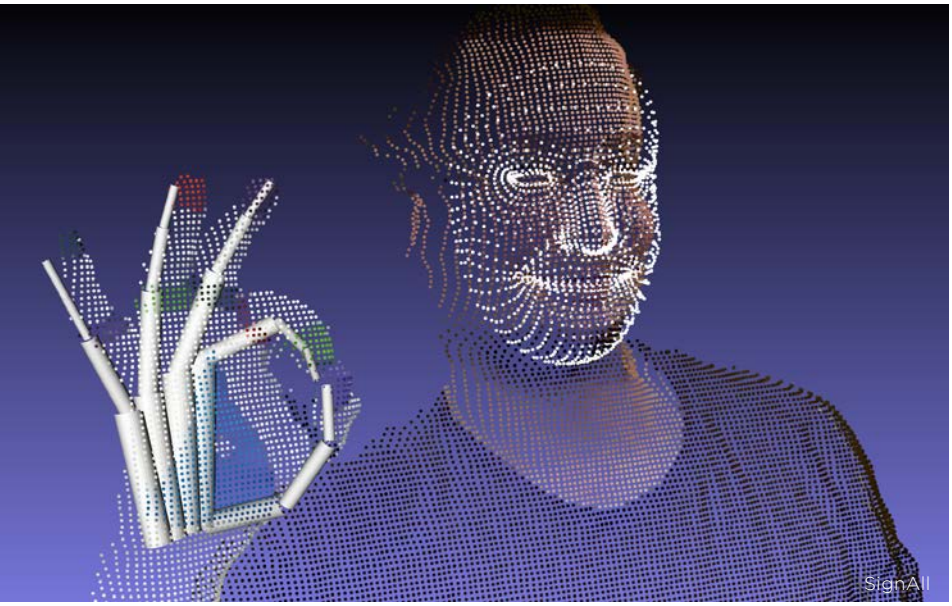
Eureka Park is the home of startups at CES and in many ways has become the largest startup event in the world, with the number of startups exhibiting at CES growing 50 percent over last year. CES 2018 featured over 900 exhibitors from 42 different countries. Eureka Park is a specialized area of CES that provides startups a unique exhibiting opportunity to launch a new product, service or idea. Companies must show technology that can be realized commercially within three years but has not already been in the marketplace for more than a year. The following are just a few of the innovations that were on display in Eureka Park this year.

Somnox is a Dutch company that designed a sleep robot to help reduce stress, help users fall asleep quickly and help them return to sleep quickly if awaked. It producing breathing rhythms that influence breathing while users snuggle with the pillow-sized object. The Somnox sleep robot also plays sounds including white noise, guided meditation or anything a user might record.

At CES 2018 France's Euveka introduced a shape-shifting mannequin designed for clothing designers who often have to use a multitude of mannequins to design customized, well-fitting clothing for different body types. By changing shape, Euveka's mannequin can replace the stack of traditional mannequins.

Montréal based Soundskrit used Eureka Park to highlight its directional microphone that can measure the velocity of incoming sound and separate sounds coming from multiple directions without compromising the quality being captured. Today's voice-enabled devices need to pick up sounds from farther distances while ignoring background noise and therefore use an array of microphones. Soundskrit's approach could replace the many microphones used in these applications with one, which could in turn help improve speech recognition and sound localization.

Eureka Park featured a variety of innovations with self-explanatory use cases and clear implications.



Startups are the lifeblood of the tech industry, and CES showed us the dynamism and energy at the biggest startup event on the planet. Brilliant minds are working on real world problems and in the process improving not only our lives but also broader society.

Israel-based Lishtot, which means "drink" in Hebrew, showed its TestDrop at Eureka Park. TestDrop tests water instantly and detects the presence of contaminants or signals that the water is safe to drink. LifeDoor is a simple device that closes doors it's attached to when it's triggered by the sounds of a smoke alarm going off. SignAll uses a camera setup to translate sign language in real time. Another Dutch startup, Travis the Translator, produces a small handheld device that can translate 80 languages in real time.

Israel-based ICI Vision showed its Enhanced Vision Engine (EVE) smart glasses. EVE is positioned to help individuals with vision impairment improve their navigation. The glasses are equipped with AI and cameras that monitor pupil movement that work together to fill in gaps in vision and project the images to the healthy parts of retina. Pebby's Pebby Ball is the world's first smart robotic pet sitting system. Users can control the Pebby Ball remotely with a smartphone.

With 900 startups exhibiting, Eureka Park has become one of the most energetic gatherings on the planet.

CES INNOVATION AWARD HONOREES

CES's annual Innovation Awards program recognizes two levels of honorees among 28 award categories. Here are some of the many honorees from CES 2018 and the themes that emerged.

360-DEGREE CAMERAS DRIVE NEXT-GEN DIGITAL CAMERA INNOVATIONS

VR was one of the most visible new technologies at CES and one of the potentially most disruptive media technologies in a generation. But VR content, other than gaming, has come in fits and starts thanks to a fragmented hardware landscape. So it has been left to innovators to come up with 360-degree video recorders to help content creators develop the next wave of immersive entertainment and experiences. Another sign of the democratization that technology is playing.

For instance, the swiveling Kandao QooCam's three-lens design allows it to capture 360-degree videos and stereoscopic 180-degree 3D. When held vertically, the QooCam employs two fisheye lenses on opposite sides to capture 360-degree images, while shooting in 3D mode when held horizontally.

Similarly, TwoEyes VR is a simple binocular 360-degree camera/camcorder designed for mainstream consumer users, also capable of either 360-degree or 3D video and stills. It uses two pairs of fisheye lenses separated by an average retina distance of two human eyes. Held horizontally, TwoEyes records with all four lenses in 3D, held vertically; it uses two lenses in "One-eye Mode" to shoot standard 360-degree video or stills; and an embedded gyro automatically detects in what position the TwoEyes VR is being held.

The 4K HDR Insta360 ONE could be the most versatile 360-degree camera extant. Compact and intuitive, it offers stand-alone use, remote control use via Bluetooth and direct connection to a phone for 360-degree live streaming. Providing a unique amount of flexibility, however, is the Insta360 One's FreeCapture feature, which translates the original 360-degree footage into a standard 1080p fixed-frame video that can be shared from a smartphone.

All these innovative 360-cameras, however, are designed to be handheld or mounted, potentially limiting their usage. But a couple of spherical cameras coming to market have created more flexible wearable recorders.

Perhaps the most innovative 360-degree camera design is the Orbi Prime, the first 360-degree video recording glasses—in other words, a 360-degree camera built into sunglasses. Prime incorporates two 1080p cameras on the front corners of the polycarbonate frames and two more 1080p cameras on the rear tips of the temples to enable continuous 360-degree 4K video and still-photo capture around a person's head. Internal batteries supply 60 minutes of recording time, they've got built-in Wi-Fi and image stabilization, and are IP64 water-resistant.

CES 2018 INNOVATIONS AWARDS CHARGING UP ROUNDUP

As the world becomes more mobile, power becomes an increasingly important category. Consumers want to stay always connected and that requires having power on the go. Several CES 2018 Innovation Award honorees have served up unique solutions to feed consumers' varied lust for power.

The LinearFlux USA Graphene HyperCharger PRO. The slim 6 x 2.75 x 0.5-inch, 8000 mAh battery HyperCharger is Apple MFi approved, includes integrated Apple Lightning and USB Type-C connectors, incorporates Qi v1.2 wireless charging and is able to charge three devices at once. Users also get an "anti-gravity" NanoStik PRO pad, a nano-suction pad that sticks the HyperCharger to a smartphone sans adhesives.

For those with more expansive portable power needs, the Cygnett 20K ChargeUp Pro provides 20,000 mAh of juice—enough to refuel a smartphone up to 10 times, a tablet twice or a laptop up to one full charge—thanks to 63W total output, and a 45W USB-C port. With Qualcomm (QC 3.0) technology, the slim and light ChargeUp Pro delivers up to 75 percent faster charging than a standard 5W USB output, includes three USB ports—a USB-C and two USB-A jacks—can charge three devices simultaneously, and includes safety surge protection.

Powertech's versatile Magic Cube serves as a power bank, a wall charger and desktop charger. A top charger is a power bank wall charger that allows users to charge a smartphone on the go or on the wall. The bottom charger of the Magic Cube is a charging dock for the top charger and is equipped with two extra AC outlets and two USB chargers for desktop appliances. Magic Cube's detachable design makes it portable for travel and keeps performance at home.

CES 2018 INNOVATION AWARDS ASSISTIVE DEVICES ROUNDUP

Innovative technology has bubbled to the surface to better assist the hearing, vision and physically impaired, along with the sleep-deprived, seniors, and other impaired individuals to lead more productive and happier lives.

This wave of new non-medical assistive devices is exemplified by some of the 2018 CES Innovation Award honorees exhibited around CES. One of the leaders in the new over-the-counter hearing aid market has been ReSound, which has unveiled two new innovative devices: the LiNX 3D and the LiNX ENZO 3D. The LiNX 3D lets users stay in touch with their hearing care professional wherever they are, receiving hearing care and getting new settings securely via the cloud without having to schedule and travel for a clinic appointment. It also allows users to easily personalize and control their sound at any time on the go directly from the ReSound Smart 3D app.

ReSound's ENZO 3D takes the remote tuning benefits of the 3D and adds GN Hearing's third-generation binaural directionality, providing 60 percent more clarity of the sounds around them and 60 percent better speech understanding in noisy environments. These important improvements allow individuals with severe-to-profound hearing loss to experience sounds previously unavailable to them.

The OrCam MyEye 2.0 allows the vision-impaired to "see." About the size of a pack of gum and weighing less than an ounce, MyEye 2.0 attaches magnetically to the temple of nearly any pair of glasses. The user literally points a finger at what they want to read on paper, package or screen, and MyEye's camera sees the text, which is then softly dictated to the wearer via a small speaker at MyEye 2.0's ear end.

MyEye 2.0 also recognizes faces (once an image of the individual is captured and stored), can identify paper money denominations, can tell what color the user is looking at and recognizes when the wearer makes a looking-at-a-watch wrist turn and states the time. MyEye 2.0 is controlled via touch, and it will run for a couple of continual hours on a single recharge.

For the sleep-impaired, Metamason has announced Miia, the world's first precisely fit respiratory mask for the treatment of sleep-related breathing disorders, such as sleep apnea, which 30 million Americans suffer from. Metamason's software creates a 3D scan of each patient's face to ensure a precise fit and then 3D prints the custom mask.

Although technology has advanced far enough to enable the development of these innovative devices, participants in this assistive device market are still relatively few. As such, the market opportunities are virtually limitless to produce and deliver not just cool gadgets, but truly life-changing—and affordable—innovations to improve the lives of millions.

PARTNERSHIP ANNOUNCEMENTS

As CES becomes the proving ground for innovation ecosystems, it also becomes the platform from which partnerships form and are announced. Here are just a few of the partnerships touted at CES 2018:

- Nvidia is partnering with Uber, Volkswagen and China's Baidu on self-driving vehicles.
- Qualcomm announced partnerships with Jaguar Land Rover, Honda and China's BYD electric car maker to bring Snapdragon infotainment to its vehicles.
- Intel announced a partnership with Ferrari that will involve aerial footage captured via drones, which can then be mixed and curated to create personalized video feeds for both fans and drivers.
- Starry and Marvell announced a partnership to accelerate the deployment of 5G-based fixed wireless services.
- Panasonic announced it secured bipartisan approval to construct a 90-mile stretch of smart highway infrastructure in Colorado.
- Intel also announced new collaborations with SAIC Motor and NavInfo to extend crowdsourced map building to China. It also announced partnerships with the NFL, the Winter Olympics and Paramount Pictures.
- AMD announced it is partnering with Intel to create improved integrated graphics with its Vega architecture. Toyota announced it will partner with Amazon to bring Alexa into its vehicles.
- Ford announced a partnership with Postmates to test deliveries in its self-driving vehicles.
- Blackberry QNX announced a partnership with NVIDIA.
- Ford also unveiled a partnership with Autonomic on what they are calling the "Transportation Mobility Cloud." The project will allow cities to better manage traffic and commuter flow data.
- Samsung is partnering with Verizon to bring 5G connectivity to Sacramento.
- Aurora announced partnerships with Volkswagen and Hyundai.

CES BY THE NUMBERS

CES 2018 floored the largest show in its 51-year history. More than 3,900 exhibitors showcased world-changing technologies that spanned more than 2.75 million net square feet, equivalent to more than half the size of Vatican City. Among the 3,900 exhibitors were more than 900 startups participating in Eureka Park, which has become not only the home for startups at CES but one of the biggest startup gatherings on the planet. At CES 2018 there were startups exhibiting from 42 different countries.

CES 2018 was also home to both old and new faces. Hundreds of exhibitors were first-time exhibitors to CES. At the same time, 76 percent of the Fortune 100 list and 93 percent of the Interbrand 100 attended CES 2018. There were over 170,000 attendees at CES in 2018, and CTA estimates the average CES attendee conducts 33 meetings while at CES, saving a total of 3.4 billion miles of business travel and countless hours.

CES is not only a global gathering, it's also a global conversation.

There were 860,732 tweets about CES 2018, with 450,554 uses of the #CES2018 hashtag. And the conversation will continue in the weeks and months following the closing bell. CES 2018 included more than 200 sessions and over 900 thought leaders and visionaries as CES speakers. Twenty-five percent of speakers at CES 2018 were women, a 20 percent increase from last year. There were over 100 foreign delegations, including six international ministers attending CES 2018 together with several hundred government leaders, including U.S. Secretary of Transportation Elaine L. Chao and 10 members of Congress.

Across four days in the desert, CES 2018 introduced new technologies, showcased new services and even set new Guinness World Records. Intel's Shooting Star Mini Drone Show displayed a record-breaking 100 drones controlled without GPS by a single pilot. CES 2018 will be a CES all will long remember.