EDITOR'S LETTER

THE NEW REALITY ISSUE

text by **Ishita Nirbhavne**
illustrations by **AD Kashyap**

PULSE is where tomorrow is realized. It is the essential source of information and ideas that make sense of a world in constant transformation. The PULSE conversation illuminates how technology is changing every aspect of our lives—from culture to business, science to design. The breakthroughs and innovations that we uncover lead to new ways of thinking, new connections, and new industries.

The 2020 issue brings to light the realities of a newer time, and the necessity to let go of what no longer holds relevance. The cover story 'Virtual Reality Is Frightening' serves us an informative reminder that despite the digitization of the mid-pandemic world, some technology is better at a distance - at least for now. When there is appropriate technology to regulate VR and it's many consequences, only then shall we embrace it with open arms and an open mind. In this issue, we also bring to you features that highlight the achievements of two women in STEM who won the Nobel for pathbreaking achievements in the world of Chemistry.
Learn more about food robotics, and how it is more or less normalized in the modern world. The future of food robotics, however, doesn't seem stale or dull with a lot more to be achieved in the field. 'Food Robotics changes Everything' highlights the process of ensuring the success of a machine designed to assist culinary needs. Surprisingly, it's functioning in the hospitality and service sector is virtually impossible without simple, basic, and ancient ideas. Self driving cars have been the talk of STEM town for decades with Tesla's Elon Musk headlining the movement, followed by Larry Page of Google. However, the ration of regular and self driving cars on regular roads across the world is not quite where pioneers in the field would like it to be. Explore all the many factors preventing it's rise around the globe, and when you can expect an impactful change in the sector.

The brief stories in this issue aim to be actively informative and in touch with science and technology. 'Facial Recgonition Is Stealing From Us' decodes the process of facial recognition and all that it is robbing off humans and humanity. 'What Is A Snack' is a 'light' hearted guide that outlines the approach that Generation Z, one with the shortest attention span, has to snacking. Industry and advertising inadvertantly impact us and our approach to the 'art' of snacking. Ever so often a pop culture phenomenon comes along that offers its hot take on the reality of technological progressions. Black Mirror, this generation's favourite critique of technology, has introduced many fictional yet viable technological concepts to the world of cinema. In doing so, these viable concepts could actually improve the wordl as we know it today. This may sound paradoxical to the idea of the show - to portray the less than appealing consequences of mindless new tech. Regardless, these ideas are worth noting. At the end, our most awaited chart of the best and worst technology is ranked - in terms of its use, cost, value, sustainability and impact on the planet. Finally, the final features and trivias within this issue may be the most relevant to our present. We unfold the current status of the workplace and its pertinence to industry today. Will we go back to the office? Should we? Must we? Can we? We don't answer all of these questions, but by the time you close this issue, you should be able to.

PULSE

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Editor in chief

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Contributing photographers ALYSSA GREENBERG, AMY HARRITY, JASON HENRY, JACOB KEPLER, JASON LECRAS, TIMOTHY SCHUTSY, GRAHAM WALZER
Contributing illustrators MATHEW ASGARI, NICHOLAS SMITH

Contact for Subscription: Chronicle India, +91 8080280802, pulse@chronicle.in.
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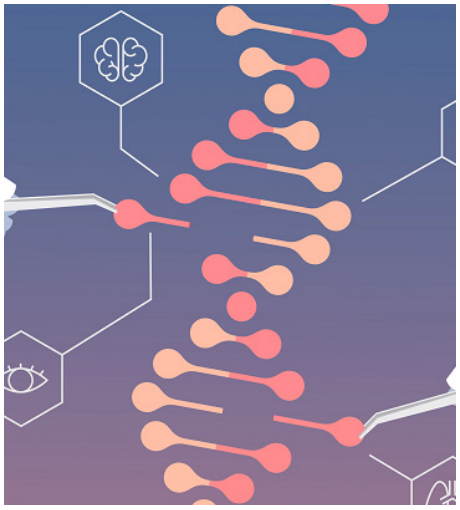

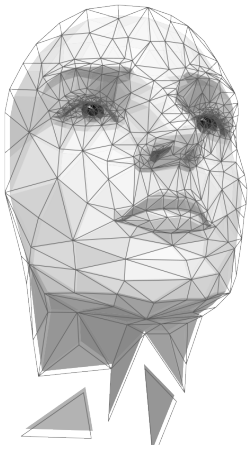

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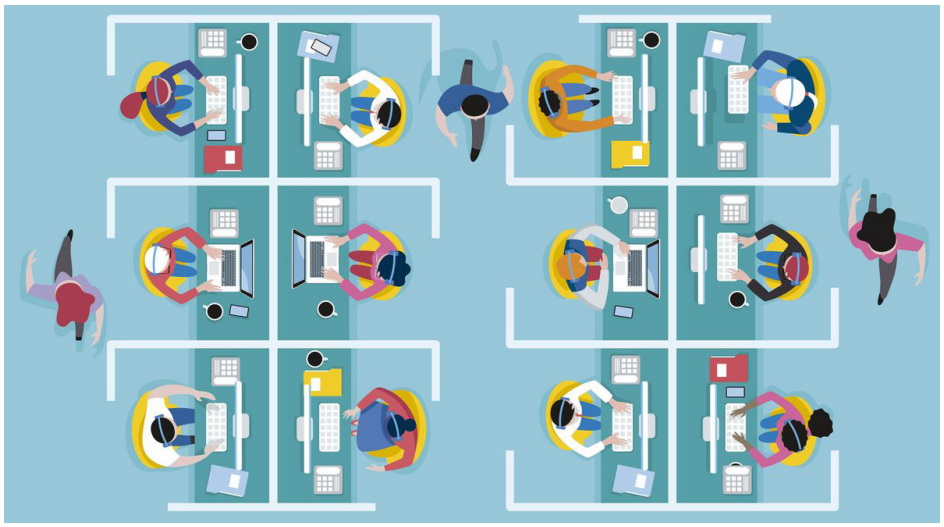

VIRTUAL REALITY IS FRIGHTENI

ILLUSTRATION BY ADITYA KASHYAP

ILLUSTRATION BY ADITYA KASHYAP

We Love Virtual Reality, But We're Also Afraid of It

No one needs a virtual Toyota. We need to give users good reasons to leave their reality behind and immerse themselves in a new one.

BY ISHITA NIRBHAVNE

Could virtual reality be dangerous? John Hanke worries that it could. And he should know: Hanke is the CEO of Niantic, the company primarily responsible for the Pokémon Go phenomenon that struck last summer.

"I'm afraid [virtual reality] can be too good, in the sense of being an experience that people want to spend a huge amount of time in," said Hanke at an industry conference last month, as reported by GamesIndustry. "I mean I already have concerns about my kids playing too much Minecraft, and that's a wonderful game." Hanke continued: "We're human beings and there's a lot of research out there that shows we're actually a lot happier when we get exercise, when we go outside – and outside in nature in particular. I think it's a problem for us as a society if we forgo that and spend all of time in a Ready Player One-style VR universe."

As somebody profiting from virtual reality (and its cousin, augmented reality), Hanke's comments may come off as hypocritical. But I believe he's on to something. If you've played with a high-end VR headset like the Oculus Rift, HTC Vive or PlayStation VR, you know how immersive the experience can be. Once inside a virtual world, it's all too easy to become captivated. For some players, video games have long offered an escape from reality. Today's VR technology can take that even further.

Let me be clear that I am in no way opposed to VR or its world-changing potential. The technology will find use in gaming, of course, but also in medicine, heavy industry, aviation, the military and more. But users would be wise to make sure their relationship with the technology is a healthy one. As Niantic's Hanke suggested, getting caught up in a virtual world can keep a person from socializing in the real world, an important part of the human experience. (Yes, friendships have been forged in games like World of Warcraft, but we are still social beings at heart). We've already seen examples of people getting sucked into "regular" games to extreme and even dangerous degrees. Spending massive amounts of time in VR could similarly present real dangers.

I also have concerns about virtual reality's impact on a person's physical health. We already know that spending too much time staring at a screen can harm our vision over the long term. VR headsets are essentially a digital display mounted directly in a user's face, raising real questions about the effects over time. Some people are also prone to nausea, dizziness and vertigo after just a little time spent in VR. For the industry, that motion sickness issue remains a largely unsolved problem.

From Apple to Microsoft, pretty much every major technology company is pursuing or is rumored to be pursuing virtual reality in some fashion. All would do well to give serious thought to these issues as the technology enters the mainstream. While I'm bullish on VR overall, I believe the industry needs to do more to grapple with the potential pitfalls before pushing the technology to the masses.

Tim Bajarin is recognized as one of the leading industry consultants, analysts and futurists, covering the field of personal computers and consumer technology. Mr. Bajarin is the President of Creative Strategies, Inc and has been with the company since 1981 where he has served as a consultant providing analysis to most of the leading hardware and software vendors in the industry.

SOCIAL IMPACT

There is high level of concern over the negative influences of interactive VR environments towards social implications. The users who are engage in violence VR video games and television in the virtual world may become desensitized to their their violent virtual actions and mimic that behavior in real world. There are other issues like people turning their backs on the real world and wander around the synthetic worlds that fulfill their whims. As of now, violence in VR is nearly inevitable but it is still important to address social issues before they result in crisis or harm.

HUMAN SENSORY LIMITATIONS

For a virtual environment systems to be compatible with their users, it is vital for designers to understand design constraints imposed by human sensory and motor physiology. The physiological and perceptual issues that directly impact the design of virtual environment systems are visual perception, auditory perception, and haptic and kinesthetic perception. The human visual system is very sensitive to any anomalies in perceived imagery and becomes prominent when motion is introduced into a virtual reality. In auditory perception, there is challenge for audio localization to obtain realistic auditory environment. Localization is helps differentiating sound sources and their direction. In VR, localization is determined by intensity differences and temporal or phase differences between signals at the ears.

The mechanical contact with the skin is called a haptic sensation (touch). The sensations of the skin adapts with the exposure to a stimuli. The sensation decreases in sensitivity to a continued stimulus and may disappear completely in long run. It also varies on receptor type, whether to rapidly adapt and relate to pressure, touch and smell or not. Therefore, it is very important to incorporate haptic feedback in virtual environments. Whereas, Kinesthesia is an awareness of the movements and relative position of body parts and is determined by the rate and direction of movement of the limbs. The challenge of kinesthesia in VR include the fact that a small rate of movement of a joint can be too small for perception and certain kinesthetic effects are not well understood.

DIRECT MICROSCOPIC EFFECT

Ensuring Health and safety of users are important and challenging issues for VR systems to avoid discomfort, harm or even injury. Developers should ensure that advancement in technology do not come at the expense of human well-being. When experiencing VR, the brain tends to work harder to integrate the unusual stimuli being presented to the different senses. Therefore, VR has power to affect the senses and brain of a user, leading to fatigue or sickness such as dizziness and nausea unlike any other simpler media. It is due to the problems in hardware, low-level software or carelessness of a VR developer who disregards the side effects of the experience on the user. Prolonged repetitive VR movements can lead to fatigue as the interference requires large amounts of muscular effort.

VR users has high chances of affecting their tissues. The HMDs and other visual displays are closely coupled with eyes can harm user's eyes by the electromagnetic field (emf) and laser lights from VR systems if the exposure is prolonged. Even the poor adjustments of HMD can cause eye strains and head, neck and spine could be harmed by the weight or position of HMDs. Imbalance of body position due to VR systems could make the user fall or trip resulting bumps and bruises.

CYBER SICKNESS

Cybersickness is a form of motion sickness that occurs as a result of exposure to VR. It can range from slight headache to an emetic response. Several factors has been identified that may contribute to cybersickness such as vection, lag, field of view but it is still an undergoing research to identify the specific causes of cybersickness and to develop methods to alleviate this ailment. Vection is illusion of self-movement in VR which causes conflicts between the visual and vestibular system in the body because the motion is just illusion. Lag occurs when a user perceives a delay between the time a physical motion is made and the time the computer responds with a corresponding change in the display because of spatial distortions and rearrangements using mirrors and prisms. Other indirect consequences of VR exposure such as head spinning, postural ataxia, reduced eye-hand coordination, vestibular disturbances and etc.

One problem discussed at the symposium is the fact that VR experiences often cause health-related issues including headaches, eye strain, dizziness, and nausea. Developers can partially deal with these issues at the hardware level by delivering balanced experiences with high refresh and frame rates. But many developers are ignoring usability guidelines in the pursuit of exciting content. Gaming industry guidelines issued by Epic, Oculus, Marvel, and Intel recommend that games completely avoid any use of induced motion, acceleration, or "fake motion," which are often the main cause of discomfort and motion sickness. Yet the vast majority of available VR experiences feature some kind of induced motion, either in the form of animation or by basing the experience on user movement and exploration of the virtual environment. I have met many first-time VR users who generally enjoyed the experience but also reported "feeling wrong"—similar to enjoying the clarity of sound in noise-canceling headphones but also having a "strange sensation" in their ears.

While we hope VR is on its way to becoming more mainstream, more exciting, and less underwhelming. But we scientists can only present new technological solutions, to help make VR a more comfortable and enjoyable experience. Ultimately it is down to VR developers to learn from existing success stories and start delivering those "killer apps." The possibilities are limited only by imagination. ■

"It is due to the problems in hardware, low-level software or carelessness of a VR developer who disregards the side effects of the experience on the user."

ILLUSTRATION BY ADITYA KASHYAP

Bold espresso
BLENDED WITH
Sweet Caramel AND Creamy Milk.
A café favorite, crafted FOR Home.

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Iced Café Favorites™

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Pioneers of revolutionary CRISPR gene editing win chemistry Nobel

Emmanuelle Charpentier and Jennifer Doudna share the award for developing the precise genome-editing technology.

Sioban Roy

"I am overwhelmed and deeply honoured to receive a prize of such high distinction and look forward to video-celebrating this exceptional award with my team members, colleagues, family and friends," commented **Emmanuelle Charpentier**.

Jennifer Doudna and Emmanuelle Charpentier share the 2020 Nobel chemistry prize for their game-changing gene-editing technique. PHOTO: ALEXANDER HEINEL/PICTURE ALLIANCE/DPA

"I know so many wonderful scientists who will never receive this, for reasons that have nothing to do with the fact that they are wonderful scientists," **Jennifer Doudna** says. "I am really kind of humbled."

discovery of a

Ricki Lewis: Why is CRISPR-Cas9 taking off right now?
Jennifer Doudna (JD): I watched a video by Bill Gates and Steve Wozniac from the beginning of the personal computer age 25 years ago. When they were asked when they realized the PC was going to take off, they said it was serendipitous, because society was at a point where people were ready and eager to adopt that technology. That's a very interesting parallel to CRISPR-Cas9. We had the first bacterial genome in 1995, that's 20 years ago. And with all the genome-wide association studies and human genome sequencing since 2000, we've built up an appreciation for the kinds of mutations that cause disease and the desire to be able to manipulate genes beyond systems like yeast and worms. We're seeing the convergence of those technologies with an efficient and easy way to manipulate genes. If this had happened 10 years ago we might have seen a different trajectory. In PubMed (for the 2012 paper) it's exponential: 120 citations the first year, 400 in 2013, 600 in 2014, and more than 1200 as of October 2015. There was a pent-up need for the technology to manipulate genomes to be easy, and that's what we're seeing now.

RL: How did your research paths converge?
Emmanuelle Charpentier (EC): I was trying to understand how bacteria cause infectious diseases, from the pathogen and the human sides, particularly Streptococcus pyogenes. It causes necrotizing fascilitis, toxic shock syndrome, myositis, tonsillitis, pharyngitis, impetigo, cellulitis, scarlet fever, rheumatic fever, reactive arthritis, and rheumatic fever. I was also interested in infection of bacteria by invading genomes. Mobile genetic elements (bacteriophage) attack a bacterial host, and the host has a defense against the invaders that is considered the innate immune system of bacteria.
JD: Precision-editing a genome isn't a new idea, it's been around for decades. In the 1980s, as a grad student, I was working on double strand DNA break repair. The field of genetics has long appreciated that the ability to make changes in DNA would be an incredibly useful tool. The 2007 Nobel Prize in Physiology or Medicine (to Mario Capecchi, Martin Evans, and Oliver Smithies) was for harnessing homologous recombination, one of two DNA repair pathways activated by double strand breaks, to create the knockout mice that have since served as models for many human genetic diseases.
EC: I started to work on this in 2006, using bioinformatics, then more seriously in 2009, with this paper in 2011.

RL: How Does CRISPR-Cas9 Work? The short version, that is.
EC: The enzyme Cas9, an endonuclease, is programmed with a guide RNA to target and cleave a specific DNA sequence at two strands. The manipulator just needs to engineer the guide RNA according to the sequence of the gene to be modified.
JD: Bacteria defend against viral infection by acquiring little bits of DNA from viruses into their genomes, making RNA copies of viral sequences, and incorporating them into one or more proteins used to target the viral DNA. Then the RNA-protein complex finds double-stranded regions, unwinds them, and positions itself so two active sites can cut the double-stranded DNA at a precise, targeted sequence. Cells recognize double strand breaks and repair them using two pathways that add new sequence or heal the old. It is a remarkable molecular machine that can search through large slots of DNA to find a particular sequence.

EC: The idea was relatively simple: genome editing with sequence-specific nucleases inducing a double strand DNA break at a specific site. The RNA-programmable CRISPR-Cas9 allows precise surgery in the cells of many organisms, including mice, plants, monkeys, and humans.
JD: Bacteria use CRISPR-Cas9 to cut a viral DNA sequence, but scientists harness it to make double strand breaks where we might like to introduce a small change in the genome.

RL: The ease of deploying CRISPR-Cas9 has raised concerns that it will be used to alter the genome of a fertilized ovum. In April, researchers from Sun Yat-sen University published that they've already done this. Why the concern over germline modification?
JD: When I saw the publication in early 2014 of germline editing in monkeys, it came home to me that there's no reason to think it couldn't also be used in humans. Why not? That raises ethical questions as well as considerations about the utility for applications where it's easy to employ, yet we as scientists should take a step back and say "should be go there?" Those thoughts are what launched me on the path I'm currently on in bringing colleagues on board to discuss the bioethics openly. Doing somatic (body) cell editing in adults has inherently more immediate applications because we don't have to think about the ethics of passing on heritable mutations. On the other hand, in some ways it will be harder to do because we have to deliver to adult tissues. Ironically, germline application is a lot easier to deliver. If we know there is an inborn genetic error, it could be more efficient and safer to correct it at an early stage of embryonic development than if we wait to do it in an adult patient.

RL: What are some non-medical uses of gene and genome editing?
JD: Gene drive technology is an approach using CRISPR-Cas9 that could lead to elimination of species by changing organisms in ways that make them sterile, such as mosquitoes. It's not science fiction anymore, it's here right now. (A recent paper details using CRISPR-Cas9 to create malaria-resistant Aedes aegypti mosquitoes.)
Four-toes-jerboaA researcher is using CRISPR-Cas9 to study the genetic changes in going from a mouse to a jerboa, a hopping desert rodent. It has huge hind legs and is bipedal. A jerboa is genetically very similar to a mouse, but clearly different in phenotype. Until using CRISPR-Cas9 to interrogate the genome of this organism, it was completely intractable genetically. We can now introduce changes to that organism and possibly reconstruct evolution.
EC: There's an interesting debate about using CRISPR-Cas9 on plants to create GMOs. That's very restrictive in Europe. There they may not accept CRISPR-Cas9 in any plant, because they may not consider plants that have deleted genes to be non-GMOs. Decisions will be made in Europe by the end of the year.
JD: The US Department of Agriculture ruled that if a genetic manipulation results in a knockout, it's not a GMO.

RL: I hope Tabitha Powledge, at her terrific PLOS blog "On Science Blogs," will follow the media interpretation of this week's conference on gene editing in her post tomorrow.

(The interview was done before Charpentier and Doudna won the Nobel Prize for their contribution to the world of chemistry.) ■

Almost Spilled the Almost Milk!

FACIAL RECOGNITION IS STEALING FROM US

A piece of technology that's changing the meaning of the human face

PHOTO: WIRED

The result of that research is that your face isn't just a unique part of your body anymore, it's biometric data

Human faces evolved to be highly distinctive; it's helpful to be able to recognize individual members of one's social group and quickly identify strangers, and that hasn't changed for hundreds of thousands of years.

But, in just the past five years, the meaning of the human face has quietly but seismically shifted. That's because researchers at Facebook, Google, and other institutions have nearly perfected techniques for automated facial recognition.

This development rested on two major trends that enabled the recent explosion in machine learning: the exponential improvement in computing power and growth of digital imagery, including labeled photos of human faces. In most cases, those images weren't created in order to train facial recognition algorithms, but they were borrowed for that purpose. The result of that research is that your face isn't just a unique part of your body anymore, it's biometric data that can be copied an infinite number of times and stored forever. Now that facial recognition algorithms exist, they can be effectively linked to any digital camera and any database of labeled faces to surveil any given population of people.

In a video on our PULSEs Youtube channel we explain how facial recognition technology works, where it came from, and what's at stake. You can find this video and all of PULSEs videos on YouTube. And join the Open Sourced Reporting Network help report the real consequences of data, privacy, algorithms, and AI.

HOW IT WORKS

You might be good at recognizing faces. You probably find it a cinch to identify the face of a family member, friend, or acquaintance. You're familiar with their facial features — their eyes, nose, mouth — and how they come together.

That's how a facial recognition system works, but on a grand, algorithmic scale. Where you see a face, recognition technology sees data. That data can be stored and accessed. For instance, half of all American adults have their images stored in one or more facial-recognition databases that law enforcement agencies can search, according to a Georgetown University study.

Technologies vary, but here are the basic steps:

Step 1. A picture of your face is captured from a photo or video. Your face might appear alone or in a crowd. Your image may show you looking straight ahead or nearly in profile.

Step 2. Facial recognition software reads the geometry of your face. Key factors include the distance between your eyes and the distance from forehead to chin. The software identifies facial landmarks — one system identifies 68 of them — that are key to distinguishing your face. The result: your facial signature.

Step 3. Your facial signature — a mathematical formula — is compared to a database of known faces. And consider this: at least 117 million Americans have images of their faces in one or more police databases. According to a May 2018 report, the FBI has had access to 412 million facial images for searches.

Step 4. A determination is made. Your faceprint may match that of an image in a facial recognition system database.■

FOOD VALLEY

Food Robotics changes Everything

Every link in the food supply chain is affected by robotics. Robots introduce new ways in which food is processed and packaged to improve food safety and sanitation — and provide an opportunity for job delegations that are ergonomically difficult and harmful to human workers. Here are six ways the industry is changing.

LOGAN PIERCE

PHOTO: TASTEMADE

Agriculture

Farming is the beginning of the food journey. By 2022, the agricultural precision industry is expected to cost $7.87 billion. Robotics is an enormous part of it. The value of agricultural drones alone is forecast to be 3.9 billion dollars by the same year. Robotic applications include seedlings seedling, identification and sorting. Autonomous tractors, weeding robots and harvesting robots are also available. To monitor and analyze crops, drones and autonomous ground vehicles are used. A recent Harvard research project aims to solve a major problem in global agriculture–the decrease in bee populations. The researchers propose to pollinate crops with a swarm of small drones. Robotics are also introduced in the dairy, poultry and beef farms for non-plant agriculture. Autonomous feeding and milking, egg collection and sorting and autonomous cleaning are the applications.

Food Manufacture

Autonomous food production can be the key to addressing rising demand for food. In the next five years, the value of the global food automation industry is expected to double to 2.5 billion dollars by 2022. The Asia-Pacific market is a big driver in this part of the world because of the popularity of ready-to-eat foods. Food production can be divided into two stages: Primary processing — Raw food products are cleaned, sorted, transported and blended. Robotic applications include butchery, and fruit and vegetable sorting. Secondary processing — Ingredients are combined to form new food products by cooking, baking, chilling etc. Robotic applications include product sorting, defect removal, and mixing. Robotics applications tend to be better suited to secondary processing, as the food is more standardized by then. However, we are starting to see more primary processing robots.

Food Packaging

For some time now, robots for food packaging have been incorporated into the food supply chain. However, the latest development is that it is possible to automate the entire packaging process. It seems likely that robotic packaging will continue to be one of the main applications in the food industry.

Food Safety

Although the interest in robot technology is partly driven by labor costs, more companies focus on food safety. Technavio forecasts that use of robot materials in the food industry will grow by 29% in 2019, driven mainly by clean and non-contaminating production areas. According to the CDC, an estimated 48 million Americans (1 in 6) are sick, 128,000 are hospitalized and three thousand die each year of foodborne disease. Robots reduce the risk of contamination leading to foodborne diseases by limiting human contact with foodstuffs. Food also damages the reputation of a company while costing millions or more in sales and production loss. The Food Safety Modernization Act (FSMA) has further barred many of these packagers and processors with regard to their sanitary requirements. You've got these two major megatrends, work and FSMA. Companies are simultaneously trying to solve for both. It's an area in which automation can lend a hand.

Food Delivery

Recently, the delivery of robotic food has been getting a lot of news. Earlier this year, Dominos pizza announced that it would supply autonomous ground vehicles after their first (and extremely noisy) successful drone delivery at the end of last year. Although autonomous food supply may look like "the latest fad," this actually addresses an increasing trend in the market. Over the last few years, demand for restaurant quality, home-grown ready-to-eat food has grown enormously. It is debatable whether or not autonomous delivery will become widespread, but our taste for the food industry definitely changes.

Cookery

Cooking is the final stage of the food supply chain. In the 2015 article Modern Cooking: Are robotic chefs Really Here?, we discussed cookery robots. The robotic kitchen of Moley and other robotic chefs were introduced to this. To date, the website of Moley still classifies the project as in development, but they say the robot is ready for marketing by the end of this year. A similar invention is the MIT Spyce robotic kitchen, which independently combines pre-cut ingredients to make them cook in heated rotating drums— a kind of cement mixer. In April 2016, Spyce cooked food for university cantine students, but was not yet a commercial product. Cookery automation, however, does not necessarily mean on-demand cooking. For example, the APRIL robot aims to bring restaurant quality into mass foods. Traditional methods of mass manufacture reduce food quality partly because of large batch sizes. The inventors claim that food quality is better by using a KUKA robot to cook in smaller lots. Cookery and delivery robots are still in their infancy compared to other stages in the food supply chain. It is undeniable, however, that the robotics industry is changing. Robots provide additional advantages in food production, such as: Improving food quality – Robots work in harsh environments so that robots can handle this process sufficiently where food needs to be handled at freezing temperatures. Robots are also constructed to operate in different harsh environments, like extreme cold conditions. A harsh human environment or even the absence of oxygen for robots is not a problem.
Improving product consistency – The use of food robots reduces waste and increases overall yield because measures such as cutting are more consistent. Robots are estimated to help manufacturers benefit from an improvement of around 3 percent in situations where accurate cuts are the difference between contaminated meat and labeling products. Adding functionality – Robots can make changes beyond an operator's ability. R Improving worker safety – Robots can use sharp, dangerous equipment to eliminate the need to involve workers and to make the work environment safer. Improving productivity – When workers are in short supply, robots can be brought in to carry out repetitive, physically intensive work in a disagreeable environment in which workers will find it difficult to carry out. Robots work in repetitive environments where employees often get bored or tired. More convenience – In order to meet their changing lifestyles, consumers are also looking for smaller, more comfortable packaging; and the producers are looking for more flexible means of packing mixed or multiple orders on one line. ■

"Robots can use sharp, dangerous equipment to eliminate the need to involve workers and to make the work environment safer"

"Traditional methods of mass manufacture reduce food quality partly because of large batch sizes"

(This story is syndicated from Tastemade. Tastemade is set to bring their operation to India by January 2021)

PHOTO: TASTEMADE

Be a Well Being

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The K2's connected to the calcium

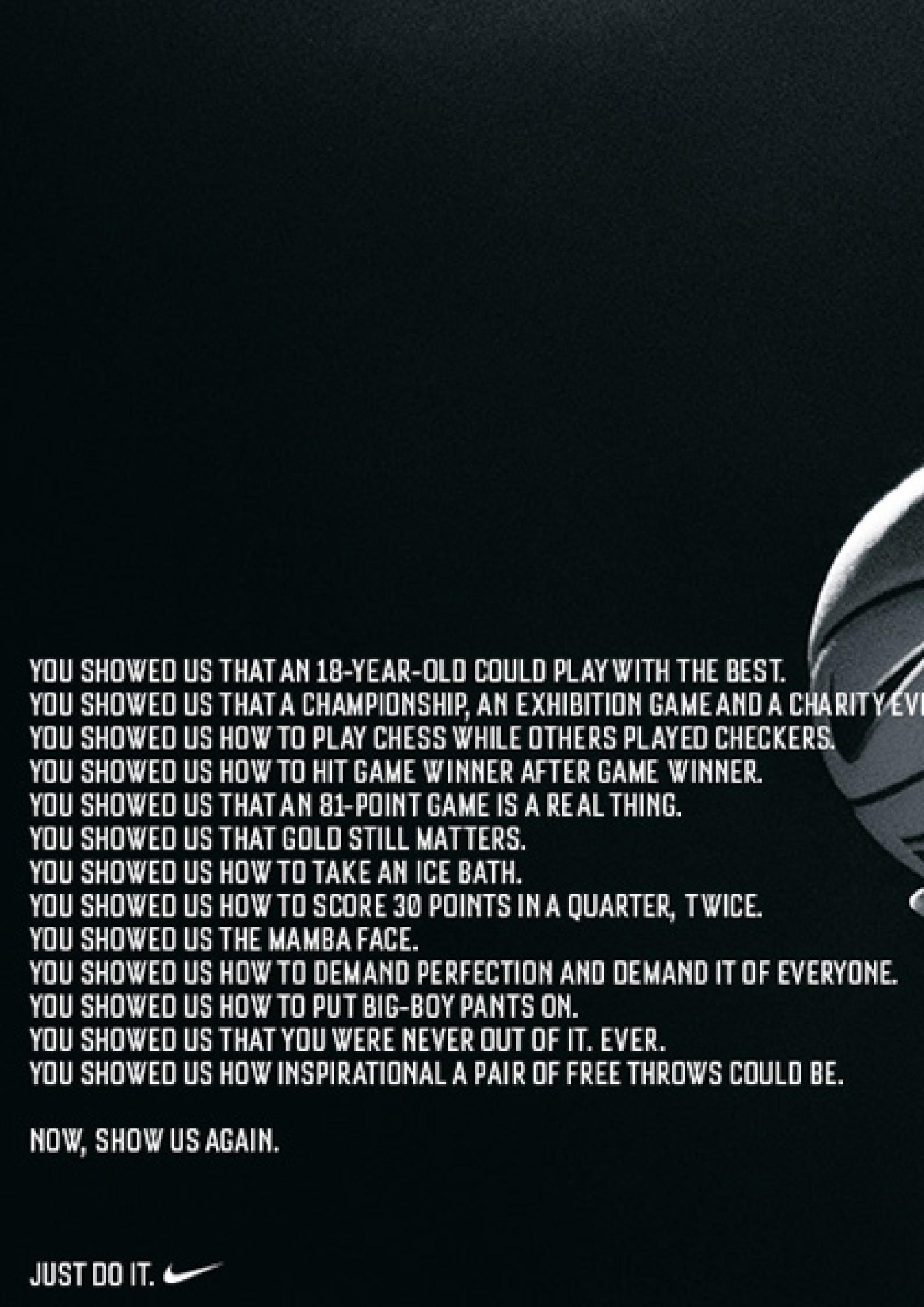
Get calcium to where it's needed most with Blackmores Triple Action Bone Formula. It contains a clinically-trialled daily dose of vitamin K2 to support bone health in post-menopausal women. Vitamin K2 supports the deposit of calcium into bones.

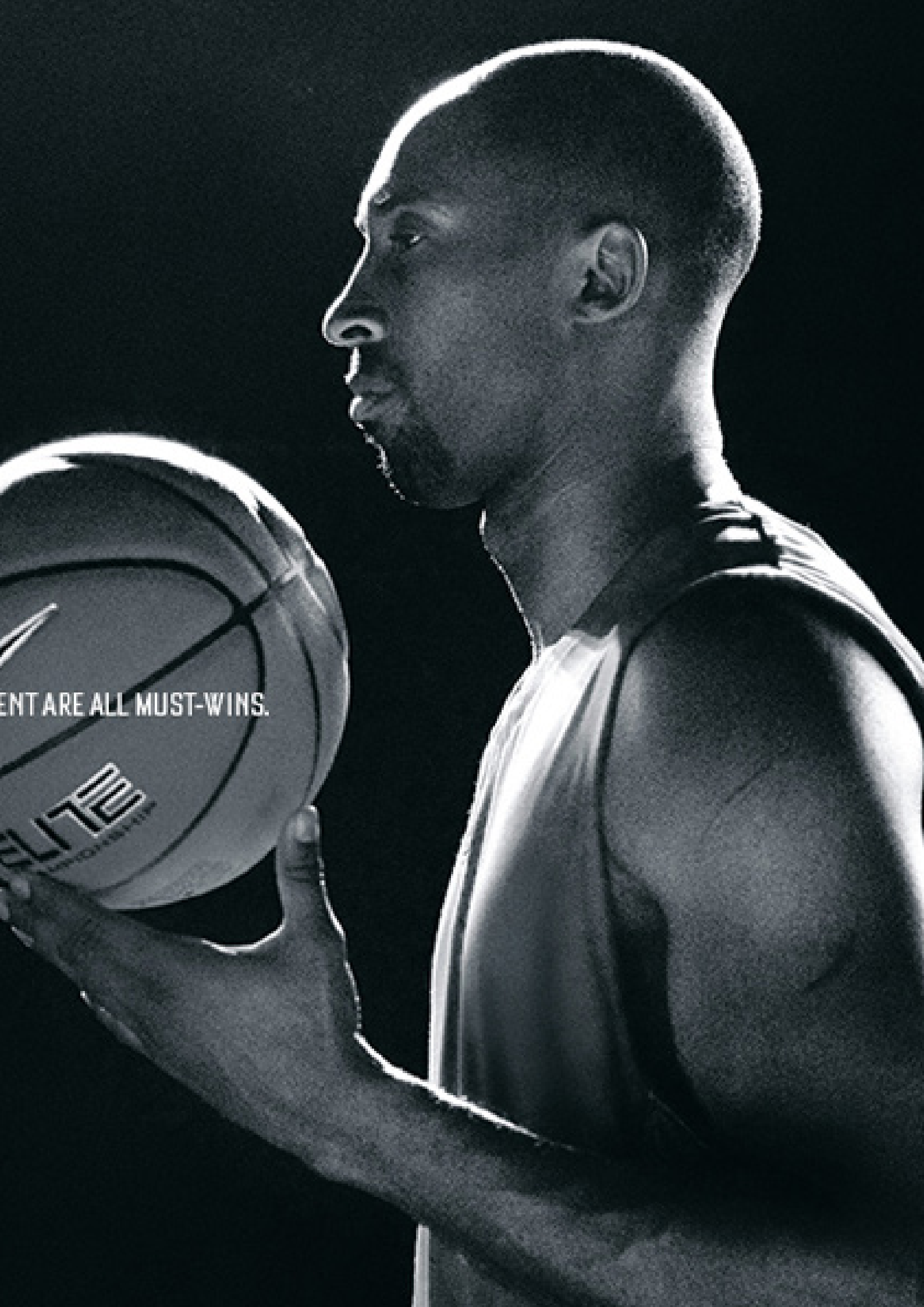
What Is A Snack, Really?

More people snack than eat full meals, a trend driven by (wait for it) millennials.

What is a snack? It's one of those questions that doesn't seem like it should be a question. Everyone knows what a snack is: It's that thing that happens between meals, that thing you didn't have to prep or cook or otherwise expend any meaningful effort to propel into your mouth. It's that thing that came out of a bag. Unless it didn't: Maybe it came out of a deep fryer, or a tub of Betty Crocker Rainbow Chip frosting, or even, god forbid, from a box of Sun-Maid raisins. Maybe it's an anchovy impaled on a toothpick with an olive and a guindilla pepper.

The idea that snacking is so closely tied to who we are is one with broad implications, both for armchair philosophers and the processed-food conglomerates that have significant investments in appealing to our sense of self through calculated product placement. On its website, Herr's International, the potato chip manufacturer, states that its purpose is to satisfy the tastes of "the snacking community," a term that is both meaningless and bald-faced in its attempt to pander to the human need for connection — and, moreover, connection through food. But Herr's is hardly unique in equating snacking with community: Kellogg's touts the "physical, emotional, and societal interconnections" that can be found in its Pringles and Cheez-Its, while the Frito-Lay's website emphasizes the presence of its snacks "at tailgates and in lunchboxes, at picnics and in pantries," selling, again, the notion that snacks mean togetherness. And yet the snack companies may be onto something. Last November, Mondelez International, the corporation behind such snacking stalwarts as Sour Patch Kids, Oreos, and Ritz crackers, released its loftily titled State of Snacking™ report. Conducted across 12 "markets" (or "countries"), it analyzed snacking behaviors worldwide, and found that more people snack than eat full meals, a trend driven by (wait for it) millennials. Although the report is a hellscape of marketing speak — its summary is titled "the Global Citizens of Snacking," and its research reveals "the rise of the $1.2 trillion snacking opportunity" — it, too, is grounded in the language of connection and wellness. The majority of millennials, it tells us, "use their snacking moments as an opportunity to slow down and find moments of quiet, mindful reflection," while across the world, snacking is a way for people "to connect to their culture and share their sense of identity with their communities and families." The jokes come prepackaged: Who hasn't encountered mental and emotional well-being in a pint of Ben & Jerry's? But setting aside for a moment the inherent absurdities of corporate consumer trend reports, what emerges is, again, the idea that how we choose to snack is tied to some larger idea of how we live our lives, or want to. Brands want to sell us on this idea, but even so, plenty of people are willing to believe it, whether because a love of certain snack foods actually is part of their identity, or because it's true that what we eat is part of how we see ourselves. Perhaps you are a box of Sun-Maid raisins. Perhaps you are the void left in a tub of Rainbow Chip frosting that has been scraped clean. What is a snack? It's whatever we want it — and ourselves — to be.


YOU SHOWED US THAT AN 18-YEAR-OLD COULD PLAY WITH THE BEST.
YOU SHOWED US THAT A CHAMPIONSHIP, AN EXHIBITION GAME AND A CHARITY EVE
YOU SHOWED US HOW TO PLAY CHESS WHILE OTHERS PLAYED CHECKERS.
YOU SHOWED US HOW TO HIT GAME WINNER AFTER GAME WINNER.
YOU SHOWED US THAT AN 81-POINT GAME IS A REAL THING.
YOU SHOWED US THAT GOLD STILL MATTERS.
YOU SHOWED US HOW TO TAKE AN ICE BATH.
YOU SHOWED US HOW TO SCORE 30 POINTS IN A QUARTER, TWICE.
YOU SHOWED US THE MAMBA FACE.
YOU SHOWED US HOW TO DEMAND PERFECTION AND DEMAND IT OF EVERYONE.
YOU SHOWED US HOW TO PUT BIG-BOY PANTS ON.
YOU SHOWED US THAT YOU WERE NEVER OUT OF IT. EVER.
YOU SHOWED US HOW INSPIRATIONAL A PAIR OF FREE THROWS COULD BE.
NOW, SHOW US AGAIN.
JUST DO IT.


ENT ARE ALL MUST-WINS.

We're still years away from SELF-DRIVING CARS

Self-driving cars were expected to roll out by 2021. Here is what we need to solve and build first.

ERIC ADAMS

For the last five years, all anybody in the car world has talked about — well, apart from electrification — is autonomous driving. Carmakers began dropping the terms "self-driving" and "mobility" at car shows, Uber and its competitors poached engineers from university robotics labs en masse, and Tesla fans began squabbling on Twitter about whether the company's Autopilot system can be called "autonomous." (It can't.) Meanwhile, Cadillac, Mercedes, Volvo, and others rolled out similarly equipped vehicles that aren't quite autonomous but are more or less capable of driving themselves down highways, as long as drivers maintain a persistent vigil and nothing too weird happens along the way. Meanwhile, visionary urban planners began rethinking city designs to envision what was sure to be a future uncluttered by automotive detritus — no more traffic signs or stoplights, no more cars parked by the side of the road. Vehicles would simply drop you off at your destination and vanish … somewhere. We were told cars would chat with each other and the roads themselves to modulate traffic flow, and that car accidents would no longer be a thing. In fact, the world was so optimistic about this future that then-US Secretary of Transportation Anthony Foxx declared in 2016 that we'd have fully autonomous cars everywhere by 2021.

Flash forward to today, and precious little has changed about our daily driving. You probably hear a lot less about self-driving cars than you did a few years ago, and the prospect of safely dozing off behind the wheel on long drives remains a distant fantasy, even if old-school carmakers are working with startups like Waymo, Cruise, Argo, and Zoox on the technology. Why the radio silence? There are a lot of knotty problems to solve that are conspiring to delay the arrival of the technology — in fact, answers to these problems may redefine how self-driving cars will work.

Everything from programming vehicles to follow the rules of the road to getting them to communicate with human drivers and pedestrians — forever ending, for instance, that infuriating indecisiveness we all encounter when trying to determine who should go first at a four-way stop — is giving engineers fits. Even further in the weeds: developing sensors that can work flawlessly in all kinds of weather and visibility conditions, and teaching cars how to respond to all the so-called "edge cases" they'll encounter on the road, such as comprehending the difference between a flock of birds dashing across the road or wind-blown leaves that are fine to run down. Also, cars don't drive in a vacuum — the roads and infrastructure, as well as federal, state, and local regulations, have to accommodate fleets of robocars, and the public has to be on board, too. Many puzzle pieces must fall perfectly into place. To put it more simply: Five years ago, as companies developing this tech talked a big game to lure talent and investment dollars, we were all more optimistic than realistic about the timeline for rolling out autonomous cars that are predictable, reliable, and as safe as possible.

"Those early estimates with really aggressive timelines for rolling out the- services have turned into having a few research vehicles on the road by 2020," notes Jeremy Ca-rlson, an autonomy analyst with auto-industry research firm IHS Markit. "Even that might have been optimistic in some cases." The reality is that while roads themselves are generally orderly and well-known environments, what actually happens on them is anything but. Humans are proficient behind the wheel, but they're also imprecise and occasionally wayward. So until 100 percent of the vehicles on the road are fully autonomous — something many analysts think is actually highly unlikely — every autonomous vehicle will have to be able to respond to the edge cases plus countless quirks and tics exhibited by human drivers on a daily basis. It's the stuff we're able to swat away without missing a beat while driving ourselves, but getting computers to try to manage it is a really big deal. Pittsburgh-based Argo and the Bay Area's Waymo, both frontrunners in the race to perfect self-driving tech, are solving for this challenge by training their autonomous-drive systems to rely as much on precisely scanned basemaps of the road as on sensors used to "paint" the environment around them.

ILLUSTRATION: SANSKRIR ZAMBRE

To put it more simply: Five years ago, as companies developing this tech talked a big game to lure talent and investment dollars, we were all more optimistic than realistic about the timeline for rolling out autonomous cars that are predictable, reliable, and as safe as possible.

Limitations preventing their spread

Creating (and maintaining) maps for self-driving cars is difficult work:

First, a quick clarification: Lots of car companies, from GM to BMW to Tesla to Uber, are working on various species of autonomous technology. Some of this is partial autonomy, as with Honda's Civic LX, a car now on the market that can stay within its lane. But I'm mostly going to focus on full autonomy — cars that don't need drivers at all. And right now, Google seems to be the furthest along with that technology. Google's self-driving cars work by relying on a combination of detailed pre-made maps as well as sensors that "see" obstacles on the road in real time. Both systems are crucial and they work in tandem. Before Google can test a self-driving car in any new city or town, its employees first manually drive the vehicles all over the streets and build a rich, detailed 3-D map of the area using the rotating Lidar camera on the car's roof. The camera sends out laser pulses to gauge its surroundings, and the people on Google's mapping team then pore over the data to categorize different features such as intersections, driveways, or fire hydrants. Google is confident it can pull this off — mapping, after all, is something the company is extremely good at. As more and more self-driving cars hit the road, they will constantly be encountering new objects and obstacles that they can relay to the mapping team and update other cars. Still, it's an incredibly daunting and potentially costly undertaking. Over at MIT Technology Review, Will Knight recently argued that driverless technology might advance more quickly if all the companies testing such vehicles shared the data that their sensors were collecting. By the way, some car companies don't seem to think that Google's precise mapping is the way to go. Tesla is hoping to build self-driving cars that rely more prominently on imaging and sensor processing. We'll see which approach wins out.

Driving requires many complex social interactions — which are still tough for robots:

A far more difficult hurdle, meanwhile, is the fact that driving is an intensely social process that frequently involves intricate interactions with other drivers, cyclists, and pedestrians. In many of those situations, humans rely on generalized intelligence and common sense that robots still very much lack. Much of the testing that Google has been doing over the years has involved "training" the cars' software to recognize various thorny situations that pop up on the roads. For example, the company says its cars can now recognize cyclists and interpret their hand signals — slowing down, say, if the cyclist intends to turn. So far, so nifty. But Olson points out that there are thousands and thousands of other challenges that pop up, many of them quite subtle and unpredictable. Just imagine, for instance, that you're a driver coming up on a crosswalk and there's a pedestrian standing on the curb looking down at his smartphone. A human driver will use her judgment to figure out whether that person is standing in place or absent-mindedly about to cross the street while absorbed in his phone. A computer can't (yet) make that call. Or think of all the different driving situations that involve eye contact and subtle communication, like navigating four-way intersections, or a cop waving cars around an accident scene. Easy for us. Still hard for a robot. As Harvard's Sam Anthony points out, AI cars are incredibly easy to troll.Olson explains that fully self-driving cars will ultimately need to be adept at four key tasks: 1) understanding the environment around them; 2) understanding why the people they encounter on the road are behaving the way they are; 3) deciding how to respond (it's tough to come up with a rule of thumb for four-way stop signs that works every single time); and 4) communicating with other people.

Bad weather makes everything trickier:

Compounding these challenges is the fact that weather still poses a major challenge for self-driving vehicles. Much like our eyes, car sensors don't work as well in fog or rain or snow. What's more, companies are currently testing cars in locations with benign climates, like Mountain View, California — and not, say, up in the Colorado Rockies.

Olson classifies this as a real, but lesser, hurdle. "Weather adds to the difficulty, but it's not a fundamental challenge," he says. "Also, even if you had a car that only worked in fair weather, that's still enormously valuable. I suspect it might take longer to overcome weather challenges, but I don't think this will derail the technology."

We may have to design regulations before we know how safe self-driving cars really are:

Kalra laid this all out in a recent paper for RAND. As noted above, drivers in the US currently get into fatal accidents at a rate of about one for every 100 million miles driven. Before self-driving cars can hit the roads, regulators are going to have to approve them for use. "My hunch is that by the time automakers are ready to sell these things, we still won't know how safe they are," says Kalra. "We're going to have to make these decisions under uncertainty." What might that look like? Regulators could come up with alternative testing procedures — such as modeling or simulations or even pilot programs in volunteer cities. We might also look to other technologies that get approved even when their safety is uncertain, such as personalized medicine. But this is going to be something to think hard about. We probably won't know!

Similarly, it wouldn't be surprising to see self-driving buses along fixed routes to platoon and save fuel on highways. The technology is advancing rapidly, and it's likely to become useful in all sorts of unexpected places. Google's Urmson took a similar view in his SXSW presentation. ■


/the social dilemma_
the technology that connects us
also controls us.
20
KYLE V. JAMES
NETFLIX
SEPT 9

BEST TECH BLACK MIRROR

Black Mirror promises a tech–raven, morally questionable future. Here are some not so morally corrupt fictional tech devices featured in the sci-fi drama.

Walter White

Comatose Communication

This machine gets hooked up to a comatose patient. It allows them to give yes or no answers, despite the fact that they're unconscious. It blinks green for "yes" and red for "no"

Autonomous Fences Pizza Van

Fences pizza delivery van which allows you to get your hot pizza without having to deal with an unreliable delivery driver (though it doesn't always slow for pedestrians)

Infinity

The virtual reality game Infinity uses a device to take a player's consciousness into the virtual gameworld, but it's not implanted. You log in with a button on your temple.

The System

The System is a next-level dating app. It uses an algorithm to determine compatibility with a new partner by completing 2,000 relationship simulations. It's Tinder of the not-so-distant future.

Cloud Computing For The Soul

People upload their brains into computers, and live out their fantasies in the virtual city of San Junipero. Dying people can upload themselves to the cloud and live forever in the programmed paradise.

Sympathetic Diagnoser

An experimental device transfers a physical sensation felt by one person to another, whether it's excruciating pain or endorphin-fueled ecstasy. Its primary use is in emergency room treatment.

The future of the office

For those who have gone back to the office, not much has really changed.

So far, the office of the future looks a lot like the office you left seven months ago — though you probably haven't seen it. Most of those who have been able to work at home during the pandemic haven't gone back to the office and don't want to go back until there's a vaccine.

It's not clear when, if ever, offices will return to their previous level of activity. As of mid-October, less than 15 percent of office workers have returned in New York City, the largest office market in the United States, according to Partnership for New York City. In big cities nationwide, office building occupancy rates are hovering around 25 percent on average as many of the country's workers remain stuck in limbo. It's not yet safe to return to full capacity, and it's not clear if offices operating at partial capacity are a better solution than people working from home.

Real estate leasing has also slowed to a crawl as the office class has taken more permanently to working in their living rooms and bedrooms. Tech juggernauts like Facebook and Microsoft are offering employees the opportunity to work remotely forever. Meanwhile, even less digitally savvy companies are weighing the future of their real estate and the location of their workers.

The entire landscape of office work has shifted, but the physical workspaces themselves have yet to change much. The open floor plan still predominates the office landscape, and germ-killing robots are still mostly the stuff of science reporters' dreams. Instead, to goad workers back into offices, employers have enacted a raft of minor precautions to make their offices safer — or to give the appearance of safety — but most have put off major, expensive alterations to their office space until there's more certainty about a coronavirus vaccine, and, in turn, more certainty about the future of the office.

Those who have returned to their offices have only been able to do so because so many others haven't. Most businesses are adopting a hybrid work model, which lets people work at home and in the office. And since the majority of people are choosing to work from home most of the time, that frees up space in the offices for those who want or need to come in to have adequate social distancing.

In a way, this hybrid model represents the situation overall. Offices and office workers are in a holding pattern, not ready to commit to working from home or the office. And the future of the office, if it's going to be substantially different, has yet to be realized for many reasons that have nothing to do with the office itself. A whole spate of other issues — transportation, child care, trust in society and coworkers — is informing employees' decisions not to go back just yet.

Of those who responded to our recent survey about returning to work in an office, about half said they feel safe there and think their employers have done a good job. But for the most part, employers aren't forcing employees back, perhaps as a nod to the difficulty of those issues or as an acknowledgment that they can't guarantee their safety.

Still, many employers want workers back in the office, and many employees want to be back. Both employers and employees, however, say the availability of a vaccine is a main consideration before returning to the office. A widely available vaccine may not be a reality until the middle of next year.

In the meantime, employers are doing what they can — without expending excess cash in a recession — to make the space feel safer for their workers.

If you're one of the few returning to the office soon, here's what you might expect. Back in the early days of the coronavirus, when legions of office workers were sent to work from home for the first time, many were making ambitious predictions about the future of work. (I declared the end of the office as we know it.) They thought the future of the office would bring touchless entry, completely remodeled office spaces, state-of-the-art filtration systems, and, of course, those germ-killing robots.

The reality has been more mundane. So far, the changes to offices have largely been superficial and temporary.

"To reconfigure a space takes money," Julie Whelan, head of occupier research for the Americas at CBRE, told Recode. "Not a lot of organizations are willing to deploy capital right now because of the uncertainty of what the future of office space is."Juliana Beauvais, research manager in IDC's enterprise applications practice, put it another way.

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Juliana Beauvais, research manager in IDC's enterprise applications practice, put it another way. "It's still hard for companies to

has been put on hold

BY RANI MOLLA

"Do companies really need to spend money right now, when people don't feel safe or comfortable coming back to the office anyway?"

make the ROI argument for a lot of these more sophisticated technologies, especially if they involve hardware or equipment investments," Beauvais said. "Do companies really need to spend money right now, when people don't feel safe or comfortable coming back to the office anyway?"

In their existing spaces, many employers have mostly forgone major construction in exchange for simpler, less expensive, and more temporary fixes that capitalize on the fact that fewer people are coming in. "These are table stakes to manage a building in the Covid environment," according to Kevin Smith, executive managing director of asset services at Cushman & Wakefield.

Instead of building more walled-in private offices, for instance, desks have been taped off or chairs removed in order to ensure at least 6 feet of space between employees. Common areas are off-limits and bulk bins of office snacks have gone by the wayside. Most offices don't have sophisticated hospital-grade HVAC systems that can handle filtering viruses out of the air, though Smith says some of the wealthier landlords are looking into it. Rather than complete overhauls of air conditioning systems, building managers are opting to upgrade their filters and change them more regularly. Many have also placed smaller air filtration devices around the office.

Plexiglass dividers have popped up to create physical divisions between workspaces and colleagues, though it's not clear how effective these shields actually are. Indeed, many post-coronavirus measures amount to little more than hygiene theater, an effort to make people feel safe rather than actually making them so.

Nonetheless, plexiglass dividers and other types of lightweight barriers are seeing a spike in demand, according to office furniture company Steelcase, which has also seen a growth in demand for mobile office equipment like tables and carts with wheels. Such requests represent employees' wanting to be able to construct the space around them and respond to the changing situation.

"All the things we thought in March and April changed in May and June and seem to be shifting again right now," Steelcase's VP of workplace innovation Gale Moutrey told Recode, referring to the ways in which our understanding of the virus and how it spreads have changed drastically since this spring.

Getting into and moving around offices is more complicated

Many of the changes to offices have manifested less in the physical space than they have in how we behave in that space. Signage is everywhere, cautioning people to stay 6 feet apart, instructing them in which direction to walk, and reminding them to wear masks.

Mask-wearing, which is often required by law these days, is ubiquitous in many offices, but the degree to which individuals comply with the law varies from job to job. Other less visible changes to office space include cleaning, health checks, and scheduling protocols.

But one thing's for sure: Offices are much cleaner than they used to be.

What the future of work looks like

While the wide variety of solutions to improving the office space in a pandemic may seem slipshod, CBRE's Whelan thinks of them as all part of a larger effort to build up "multiple lines of defense." She added, "No one solution we know is going to be perfect."

As for any big changes — either in the vein of what we thought about this spring or something entirely new — they aren't off the table yet. "Real estate is historically an industry that takes a long time to change," Whelan said. "We can talk about all the great things that are coming, but it's going to take time to really unfold and show itself in the physical portfolio."

And those changes might not have much to do with the coronavirus at all; they could represent jumps forward in trends that were already underway.

"When people thought it was going to be tamer — when we thought we could go back in June and September with precautions — we saw more 6-foot gaps and one-way traffic and plexiglass," Cuningham Group's Broadhurst said. "The more they haven't made that leap, the more they're starting to look forward rather than make adjustments for a temporary situation."

Broadhurst and others see the future of the office as a place of collaboration, where people come in to work together and to maintain an office culture. They see a future in which fewer people go into the office all of the time, while the vast majority still want office space they can go to some of the time. When they do, they want to be able to work with others. The coronavirus made working from home more widely acceptable, but it also made being together more important than ever.

In the office of the future, the decades-long push toward fitting as many people into the office as possible may finally reverse. But also expect more flexible seating as well as larger and more robust and more numerous conference and other group spaces.

Whelan estimates that offices of the future will have more common space than personal space. Traditional offices are approximately 80 percent cubicles and offices and 20 percent common space; she expects that ratio could flip.

It's notable that some of these trends feel antithetical to coronavirus precautions. Instead, they could represent what offices will look like after a coronavirus vaccine. The pandemic could effectively be, as Broadhurst put it, "an opportunity to maybe reset how we go about working when we start again."

"Some of these trends were already underway. Coronavirus has just accelerated them and made people start to really consider them," Broadhurst said. "People always say, 'don't waste a good crisis.'"

Mask-wearing, which is often required by law these days, is ubiquitous in many offices, but the degree to which individuals comply with the law varies from job to job. Other less visible changes to office space include cleaning, health checks, and scheduling protocols. Offices are being cleaned much more frequently than they used to be. (This includes notifying people that the space has been cleaned.) Hand sanitizer — once an impossible-to-find item — is being placed everywhere. ■

In the office of the future, the decades-long push toward fitting as many people into the office as possible may finally reverse. But also expect more flexible seating as well as larger and more robust and more numerous conference and other group spaces.


Dettol
INSTANT

Pixel Buds
Google
13,242 INR

Osmo Pocket
DJI
22,860 INR

Era Pro
PAX
5,178 INR

Fillup
FLUID STANCE
9,173 INR

Hypervolt Cordless Vibration Massager
HYPERICE
25,888 INR

LOVE IT

LEAVE IT

MarsCat
KickStarter
32,000 INR

Segway S-Pod
Segway
2,56,000 INR

BellaBot
PuduTech
4,32,000 INR