

COGNITIVE TIMES



PLUS

MICROLIVESTOCK COULD
FEED—AND SAVE—THE PLANET

WHO OWNS AN ALGORITHM'S ARTWORK?

INTERVIEWS WITH BOEING CIO TED COLBERT,
MHPS CEO PAUL BROWNING, AND MORE

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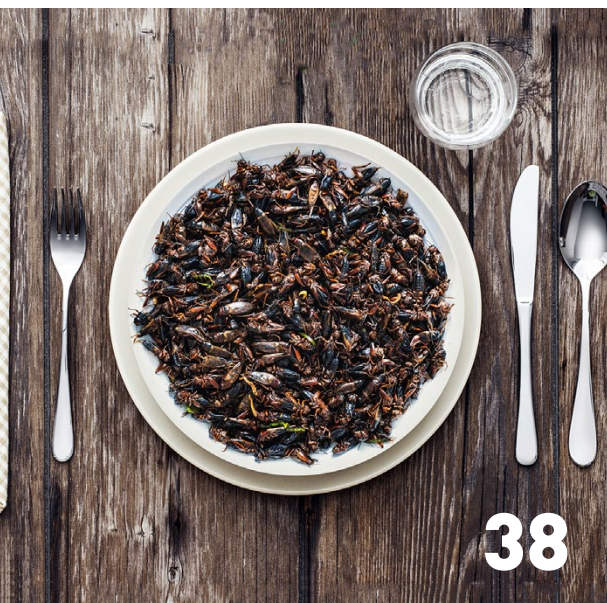




La Revolución Digital

Mexico is taking strategic steps to become a technological force in the coming years, and Global HITSS, run by the powerhouse Slim family, is leading the way.

BY AMY GUTHRIE



The Protein of the Future

Hint: It has six legs, two wings, and long, segmented antennae. One Austin company is pioneering new ways to raise this microlive-stock—and feed the world in the process.

BY ERIN RUSSELL



A Portrait of the Artist as an AI

The advancing capabilities of algorithms to create brings up a pivotal question for the field: Who owns AI-created art?

BY AUGUST COLE

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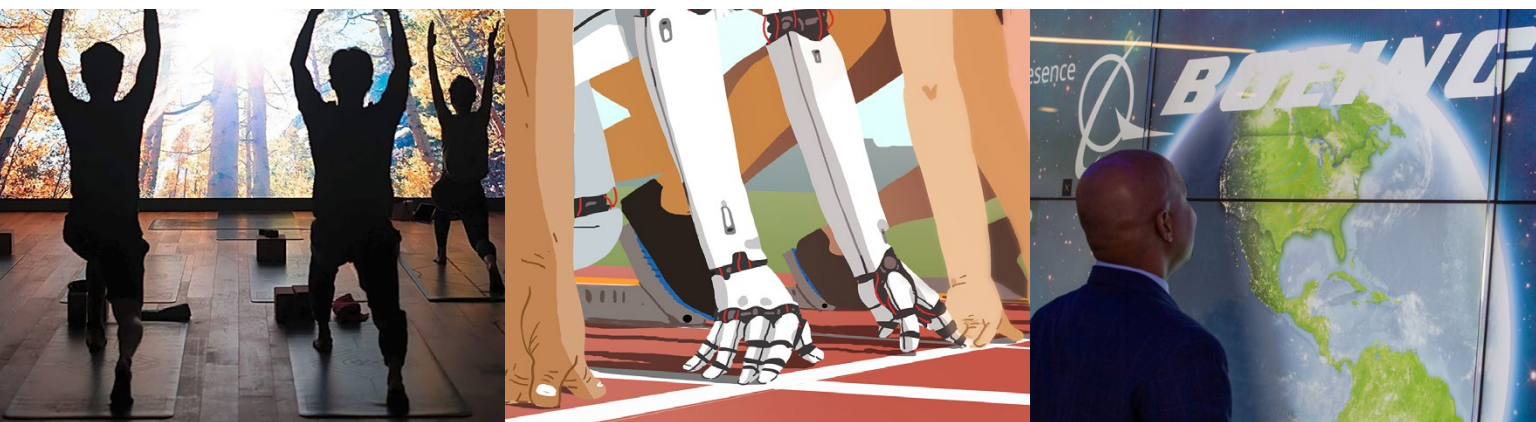
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BY AMIR HUSAIN

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BY JASON HEID



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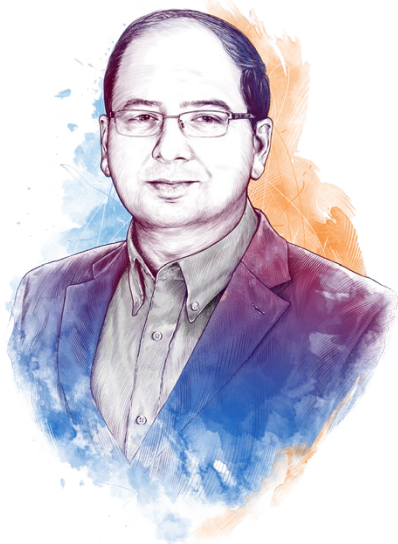
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FROM THE EDITOR

REDESIGNING OUR FUTURE

DID YOU NOTICE the new look for *Cognitive Times*? It's a transformation—both in print and online. And after months of work, it gives us great pleasure to reveal the redesigned magazine and its accompanying website, cognitivetimes.com.

The reorganized and reimagined Cognitive Times will continue to provide deep dives into matters regarding the tech industry and the artificial intelligence revolution in particular. The new format better allows us to share insights from business leaders who are at the forefront of our increasingly digital world. As waves of visitors from all over are descending upon our hometown of Austin, Texas, for the annual South by Southwest

conference, we thought it appropriate to include an international perspective for this issue. Our cover story explores how one company, Global HITSS, is preparing Mexico and the rest of Latin America for a digital future.

In addition, we sat down with Ted Colbert, chief information officer and senior vice president of the Boeing Company, to discuss his leadership style and favorite new technology (pg. 20); Paul Browning, President and CEO of Mitsubishi Hitachi Power Systems Americas, to talk about the future of power plants (pg. 18); and Lars Atle Andersen, a vice president at Norwegian oil and gas company Aker BP, who is embracing a startup mentality to turn innovation into action (pg. 9). Once these profiles pique your interest, visit cognitivetimes.com to view snippets of the interviews. We've also uploaded our complete archive of articles and videos, as well as some web-exclusive content, so plan to stay awhile.

This issue's long-form articles reflect the myriad ways AI is being incorporated into our lives. August Cole navigates the murky question of who owns art (or the IP for it) if the work is co-created by algorithms (pg. 44). We visit Aspire Food Group's robotic farm in Austin and learn how its unconventional herd of livestock may help countries around the world reduce carbon emissions and enjoy more plentiful and nutritious food (pg. 38). And we take a trip to Mexico, where powerful change is brewing.

Mexico is one of the few countries in the world to have a formalized plan regarding artificial intelligence, though there are still obstacles (relatively low digitalization rates and weaker public-sector support for innovation) that inhibit implementation. However, América Móvil, the major mobile-phone network operator in the Americas, has formed a new unit to usher in the digital era for its customers. Oscar Márquez, the chief technology officer of this unit, Global HITSS, lays out his vision for the region and the steps the company is taking to evolve business practices (pg. 32).

The companies featured within the pages of this magazine—Global HITSS, Mitsubishi Hitachi Power Systems, Boeing, and Aspire Food Group, among others—are taking strides to move themselves, and the world around them, into the future. At Cognitive Times, we're excited to continue to tell their stories in an effort to help advance our collective journey toward a better future, powered by technology.

Amir Husain

Founder & CEO of SparkCognition



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MEET THE MIND

BY ERIN RUSSELL

LARS ATLE ANDERSEN

VP of Operations, Technology and Digitalization
Aker BP

NOT MANY EXECUTIVES in the oil and gas industry visit Silicon Valley darlings like Google and Spotify for inspiration—but Aker BP is a company that wants to do things differently. Lars Atle Andersen is the vice president responsible for making sure the company stays true to those tech aspirations.

Created only in 2016 after a merger of Det Norske and BP Norge, Aker BP is challenging industry norms



/Run_Program/

with an innovative, startup-like mindset and a focus on digitization. “[Aker BP had] the opportunity to create a new company,” explains Andersen. “What kind of company do you want it to be?” For Andersen, technology is a major component of success, alongside a willingness to adapt and passion for what you do.

Andersen, who has a background as a safety consultant, came to Aker BP from the BP side, which he joined shortly after the 2010 Deepwater Horizon disaster. Formerly president of the Norwegian Guide and Scout Association (like a combined Girl Scouts and Boy Scouts), he felt a duty to improve the industry.

“I was called by BP asking me if I would like to join the company as a process safety technical authority,” Andersen says. “A lot of people around me said, ‘You shouldn’t do that, you shouldn’t go to that company.’ But in my world, they had to change. What an opportunity for a process safety guy going into that setting. They had a willingness to change and a willingness to do things differently, and that was a driver for me.”

While there has been talk of agile oil and gas companies since a 2016 McKinsey report, few are actually putting the methodology into practice like Aker BP. Andersen acts as the bridge between innovative ideas from staff and making the business case to top management—a significant responsibility, as every employee is encouraged to contribute to the company’s digitization journey.

In a move from the startup playbook, Aker BP created an agile lab called Eureka. The lab has five areas of focus: smart maintenance; production optimization; the digital worker; improved health, safety, and environmental performance; and subsurface data architecture.

Teams of about 10 people are taken out of their normal roles for a defined period of time (usually 16-18 weeks), then work in two-week sprints to deliver use cases for technology. At the end of each sprint, the teams present their work to stakeholders within the company for concrete feedback, whether that feedback is “This is helpful” or “That’s probably nice from an engineering point of view, but it won’t add anything for us.”

For example, an idea for a project for digital workers that used tablets

“The technology’s out there,” says Andersen. “It’s about daring to apply it and taking it into our framework.”

to show operators the location and route to equipment proved unnecessary, as the operators know where the equipment is. However, another one that connected workers to onshore production engineers via Skype condensed a multiday, bureaucratic repair process into a 15-minute video call.

“The first years we probably will not revolutionize daily work with the handheld tablets,” Andersen says. “But we will continue to add on with different programs that will really help them out there.”

Aker BP also takes a pioneering stance on the open sharing of data. The company got validation on this strategy while working with Framo, a pump company. Aker BP asked Framo to troubleshoot the most common failure causes, to which Framo responded that oil companies didn’t share that data. In fact, Framo didn’t know the normal failure modes of its own pumps.

“That was an eye-opener to us. We need to empower them so that they can actually help us,” Andersen says. “Then they can build better pumps, and they can optimize the maintenance of it, and there’s so many benefits from that.” After searching for an independent data platform and turning up empty, the company spun off its own, Cognite. Cognite enables Aker BP to “liberate data” and share it across applications.

Another way the group has found success is with rethinking KPIs. When drawing up a contract with Framo, Aker

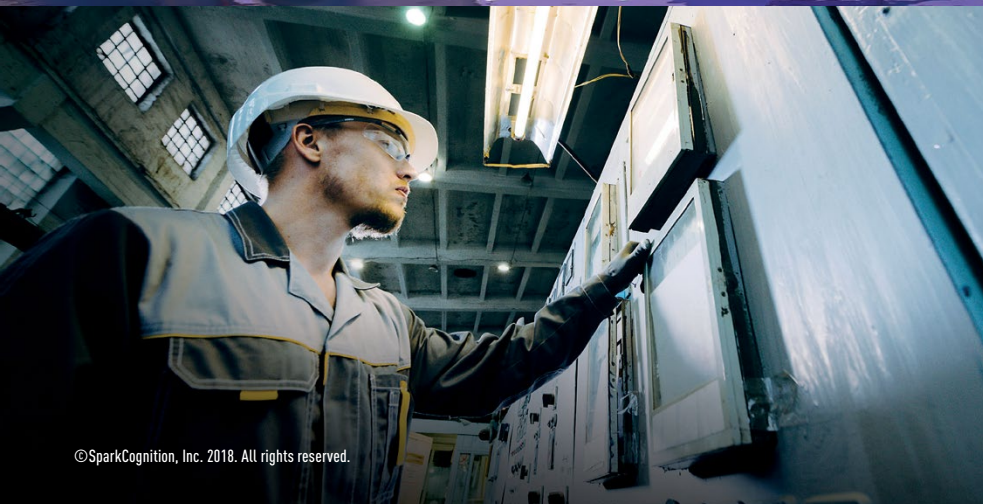
BP changed the language from paying for a set number of scheduled maintenance events to setting financial incentives based on how successful the maintenance is at keeping systems operational. “That’s where we make the big money, not on reducing costs but actually improving the uptime,”

Andersen says. “We need to create these win-win situations.”

These agile transitions haven’t come without challenges. Executives must adapt from the old mode of having decisions driven by a central VP to a more collaborative process. Yet Andersen finds the shift inspiring. Always the safety guy, he’s excited that the changes could lead to a future of remotely operated, unmanned situations that remove people from hazardous areas. He also sees Aker BP moving toward zero discharge power sources that reduce both dangerous rotating parts and the environmental impact of the installation.

“The technology’s out there,” says Andersen. “It’s about daring to apply it and taking it into our framework. So, it’s not about technology. To me it’s about courage and it’s about mindset, and we need to change that both internally at Aker BP and also when it comes to all the companies that we work with.”

Minimize downtime with AI-based analytics

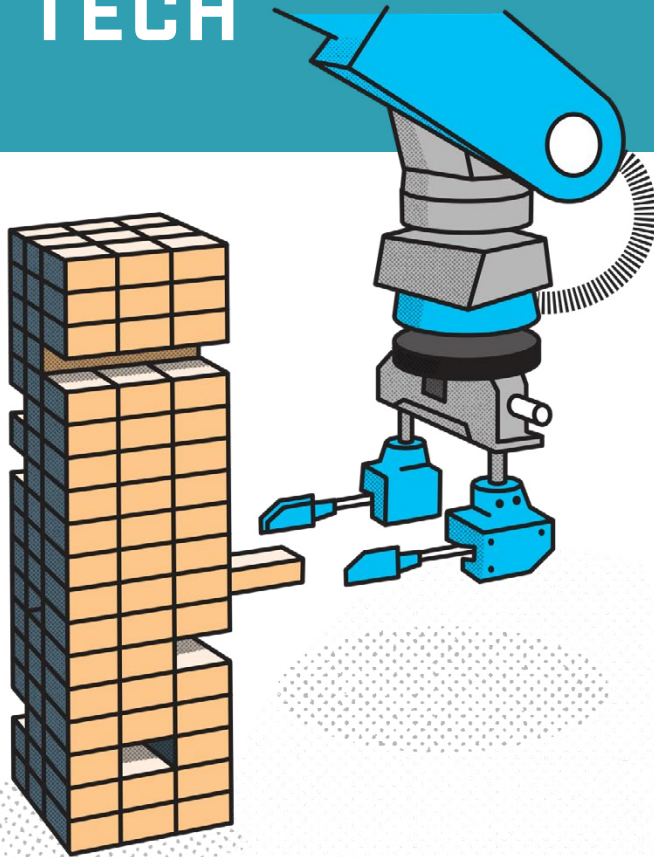


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WHAT'S HAPPENING IN TECH



23ANDLARGENY

Genealogy services that collect voluntary DNA samples to map out family trees, discover geographic ancestry, and create personalized health and trait reports are allowing the FBI to access their databases. Forensic investigators are able to input DNA from a crime scene to seek likely matches with at least one relative of a suspected perpetrator. While law enforcement agencies welcome this new tool, critics worry that it constitutes an invasion of privacy. *(New York Times)*

FACETIME FLAW

A 14-year-old boy discovered a major security bug that allowed people to eavesdrop on iPhone users before a FaceTime call was picked up. It was initially reported to Apple by the teen, but the bug was soon discovered by others. Along with sending out an iOS update to patch the bug, Apple will compensate the family of the 14-year-old for helping to catch the security flaw. *(TechCrunch)*

PENTAGON ANTES UP

Libratus, an AI trained to play poker, has a new gig working for the U.S. military. Poker requires thinking beyond the visible game pieces you would find in chess or Go: Cards are hidden and bluffs are made. The technologies that enable Libratus to win at Texas Hold 'Em could prove useful for military simulations, hence the new government contract. Unsurprisingly, details of the government's intended use for Libratus are being kept under wraps. *(Wired)*

IT'S ALIVE

After landing on the far side of the moon for the first time, the China National Space Administration lunar lander Chang'e 4 has achieved another historic milestone. A cotton seed carried aboard the Chang'e 4 has sprouted inside a biosphere, creating the first plant successfully grown on the moon. The experiment is a step toward the potential for future human survival in space, especially the ability of astronauts to harvest their own food. *(NPR)*

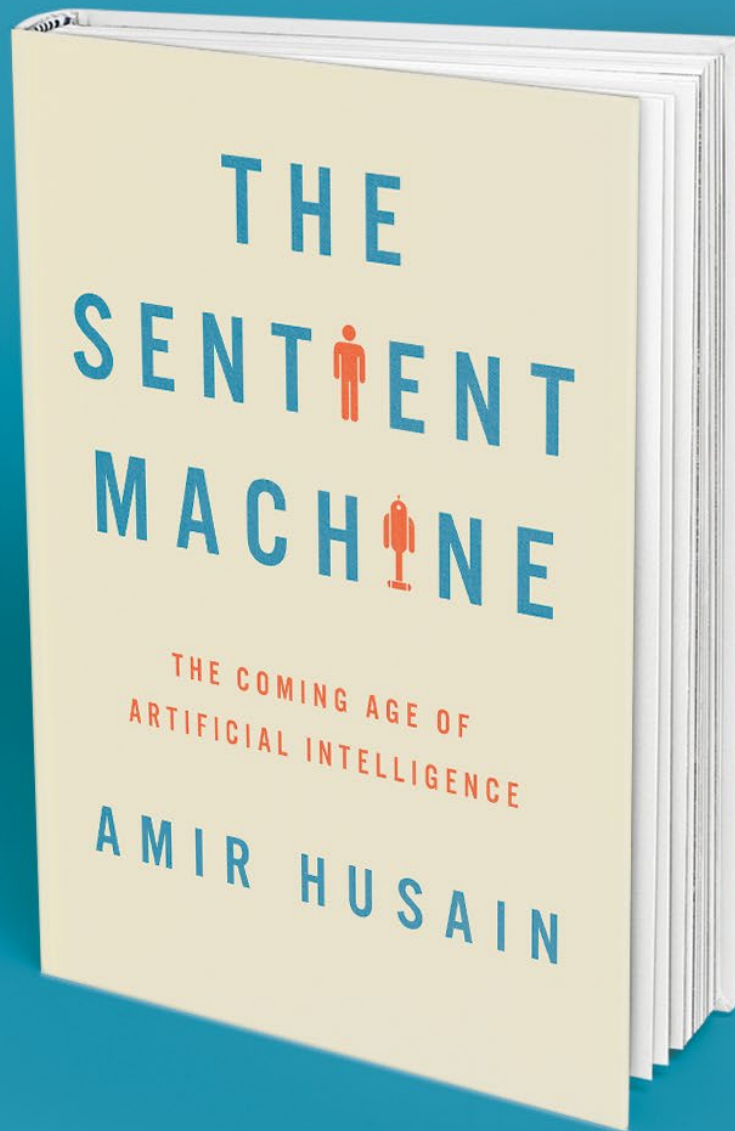
TOWERING ACHIEVEMENT



Researchers at MIT have built a robot that teaches itself to play Jenga. If the robot feels one of the game's wooden blocks resisting, it stops pushing and chooses another. This approach departs from traditional reinforcement learning, in which a machine would come to a necessary understanding of the laws of physics through the trial and error of more random movements. *(Wired)*

BY CARA SCHWARTZKOPF

Illustration by Pinch Studios



“By situating the conversation around opportunities for AI to improve or extend our lives, this book provides a rational argument and reassurance to general readers fearful of an increasingly AI-infused future.”

— LIBRARY JOURNAL

Acclaimed technologist and inventor Amir Husain answers the universal question of how we can live amidst the coming age of sentient machines and artificial intelligence—and not only survive, but thrive.

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BY MARLA ROSNER

NEW ADVENTURES IN AI

At SparkCognition's Time Machine conference, explorers of the last true frontier converge.



Questions both as grandly philosophical as the nature of self, and as nuts-and-bolts pragmatic as how automation will transform the energy industry, were considered by leading minds from across a host of industries gathered in Austin for two days last November. There, they discussed the myriad ways artificial intelligence is transforming business, culture, and the human condition.

"We are facing the last true frontier," said Charlie Burgoyne, CEO and head scientist of Valkyrie Intelligence, to the crowd of executives, academics, and engineers who convened for Time Machine, SparkCognition's second annual conference on AI and future technology. Learning to navigate that frontier will undoubtedly shape our world's future.

The impressive roster of speakers included Admiral Bobby R. Inman (USN, Ret.), former head of the National Security Agency and deputy director of the CIA; Ted Colbert, CIO of Boeing; and neuroscientist Heather Berlin of the Icahn School of Medicine at Mount Sinai, who opened the conference by detailing how the intersection of technology and neurology could be used to treat Parkinson's disease. These advances could lead to neural implants that enhance brain functions. Berlin argued that these developments are coming far sooner than we

might think, and while it promises great things for humanity, we need to grapple with its implications now. Who will have access to these implants, and how might uneven accessibility affect our society? How do we ensure these implants aren't hacked? And what do they mean for our personal identity and sense of self?

Theoretical physicist and novelist Tasneem Zehra Husain kicked off the second day of the conference on a similarly large-scale subject, stating that "Possible, to me, seems like a very elastic term." There is so much in the universe we are still discovering, she explained, right down to the nature of space-time, that our definition of "possible" must always be evolving. When it comes to the growth of technology and AI, we aren't even close to exhausting the possibilities.

Other speakers focused their discussions on specific industries. Paul Browning, president and CEO of Mitsubishi Hitachi Power Systems America, painted a picture of the autonomous power plant of the future. Jordan Hefferan, GE Aviation's director of digital services, shared his vision for using aircraft data to reach a point where unplanned failures or emergency maintenance are a thing of the past.

When it comes to the growth of technology and AI, we aren't even close to exhausting the possibilities.



National and international policy effects also got their due. Top minds from the Department of Defense, the Defense Innovation Unit, and the military all stepped up to lend their voices. Their consensus? AI will be used in warfare, whether we like it or not, and the time to prepare is now. “I would like to see the governments of the world write the next chapter of the Geneva convention for the era of AI,” said Bruce Porter, a computer science professor at the University of Texas at Austin.

The final keynote was SparkCognition’s founder and CEO, Amir Husain. He argued that AI is going to solve many of humanity’s problems, and is going to change the shape of society as we know it. To pretend otherwise is to be left behind.

Of course, these sweeping changes take time—which allows skepticism about AI to grow. “There’s the initial discourse that AI will solve every problem, and then the reaction that it’s a fraud. The truth is somewhere in the middle,” Husain said. We’ve arrived at what could well be the last true frontier, but there’s a journey ahead. “Therefore, the greatest discovery that man has ahead of himself is some patience.”



OVERHEARD

“The most fascinating piece of matter in the universe is the human brain.”

—**DR. HEATHER BERLIN**
Professor of Psychiatry
Icahn School of Medicine at
Mount Sinai

“Intellectual diversity is the most important component in innovation.”

—**AMIR HUSAIN**
Founder and CEO
SparkCognition

“If we’re not installing AI capabilities in infrastructure as it gets built, we’re missing an opportunity.”

—**PAUL BROWNING**
President and CEO
Mitsubishi Hitachi Power
Systems Americas

“I believe the future’s about survival of the fastest, not survival of the biggest.”

—**DARRYL WILLIS**
VP, Oil, Gas, and Energy
Google Cloud

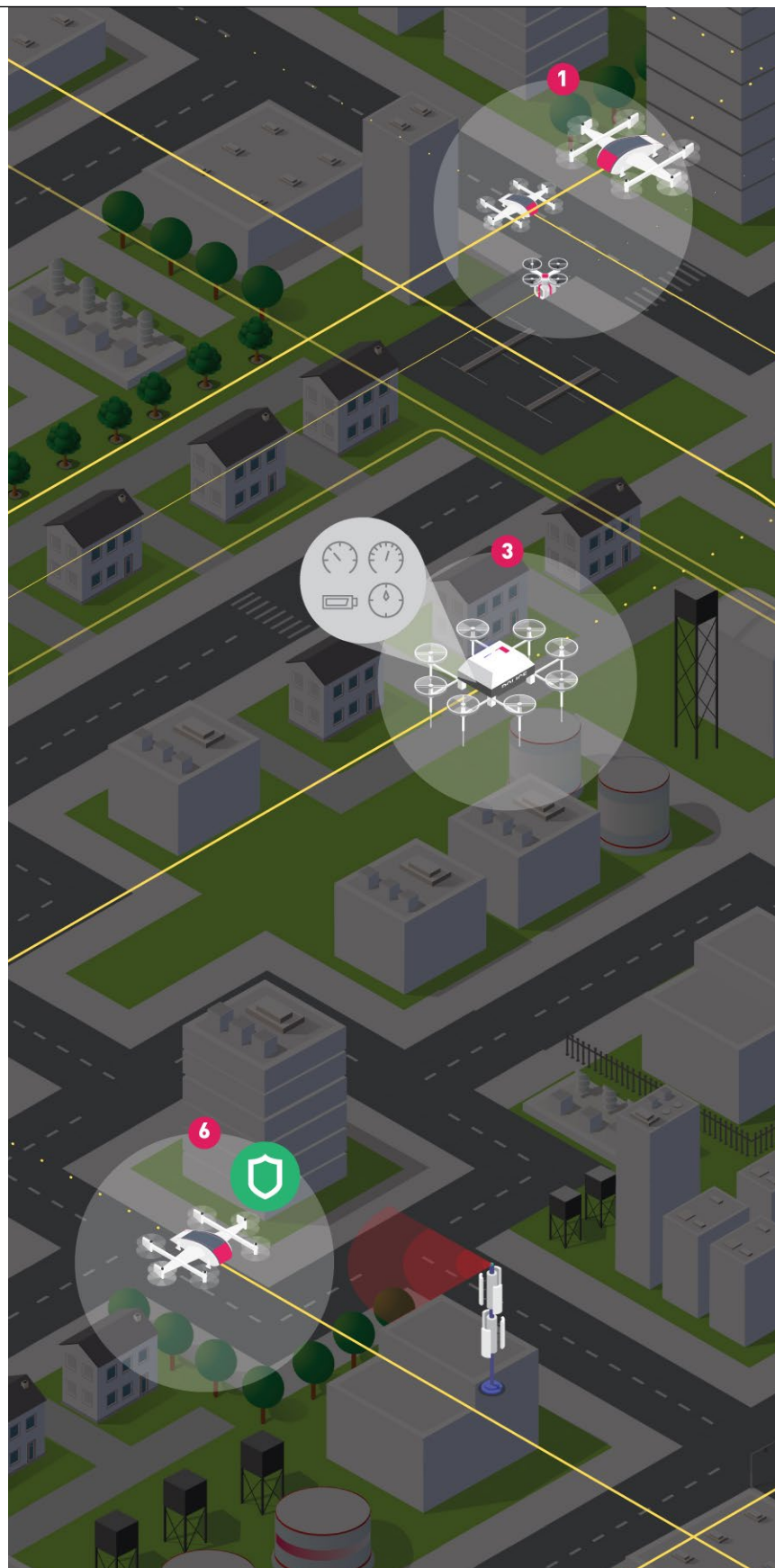
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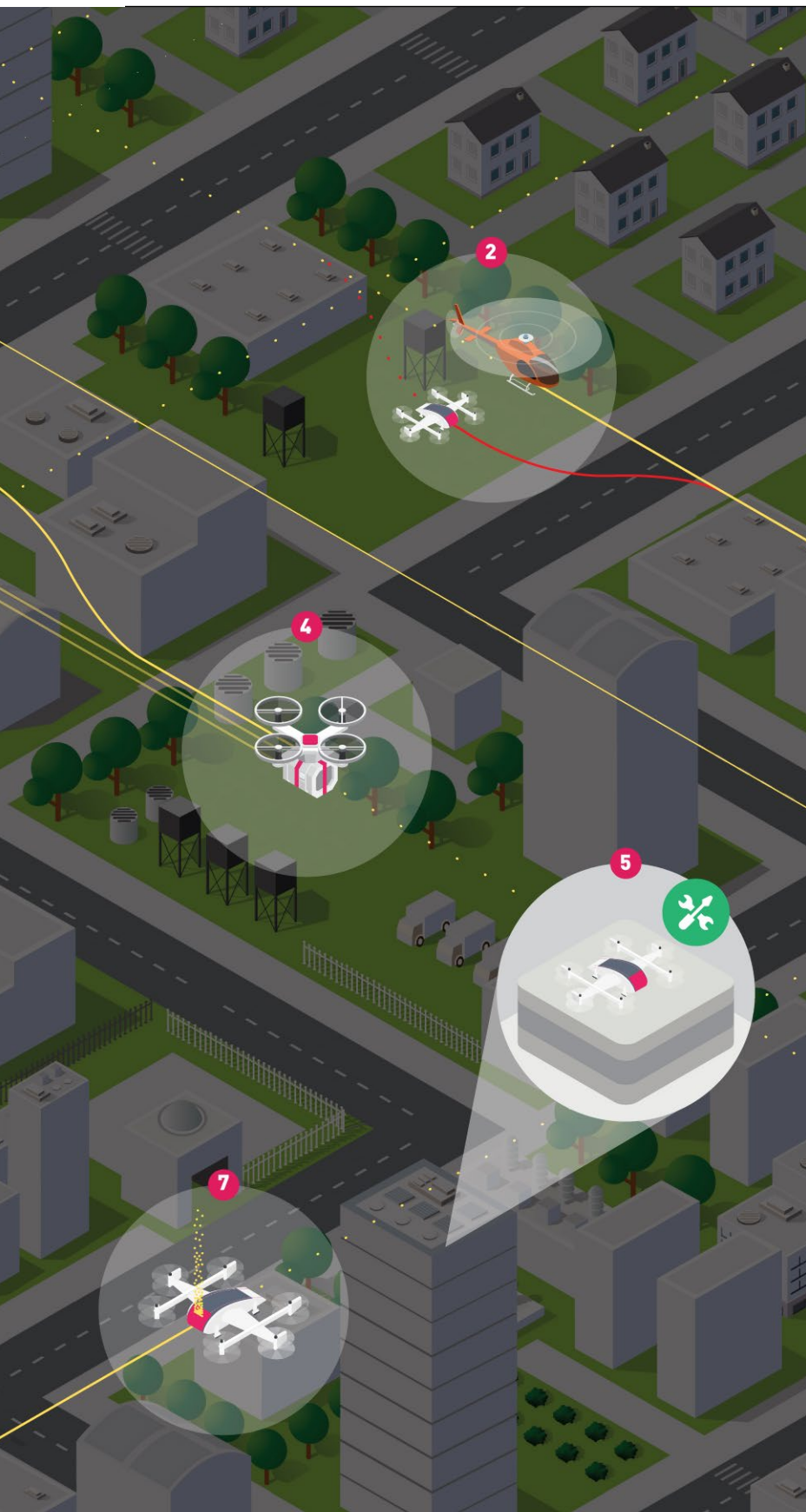
READY FOR TAKEOFF?

The SkyGrid platform enables safe and secure operations at scale.

IN THE NEAR FUTURE, unmanned aerial vehicles (UAVs) will connect people, goods, and services via highways in the sky. The number of commercial UAVs is projected to surpass 450,000 by 2022, nearly 20 times the 24,000 manned passenger and cargo aircraft currently in use worldwide. This surge in aerial traffic will disrupt existing infrastructure, so finding a safe and scalable approach to incorporating UAVs into the airspace is critical.

SkyGrid, a joint venture between Boeing and SparkCognition, seeks to ensure efficient, secure air transportation, from generating optimal routes to monitoring UAVs in flight. Artificial intelligence will scale existing air traffic control processes to allow for safe, seamless integration of UAVs into an ever-changing environment.





1 Optimal Route Generation

SkyGrid analyzes hundreds of data feeds (including microclimate patterns and signal strength) to identify the most efficient pathways.

2 Traffic Management Capabilities

By tracking all air traffic—not just UAVs—SkyGrid ensures safe and well-orchestrated airspace.

3 In-flight Monitoring

Watching over both UAV internal components and flight paths allows SkyGrid to spot unexpected problems and react quickly.

4 Autonomous Rerouting

The skies are constantly changing. To adapt, SkyGrid will alter paths as the need arises or as better routes become available.

5 Predictive Analytics

Internal components are monitored to identify and prevent possible mechanical failures before they occur.

6 Security at the Edge

Onboard AI-powered cybersecurity allows UAVs to address potential cyber threats while in flight.

7 Increased Data Integrity

Distributed ledger technology will ensure valuable information is stored as immutable records that enable auditing by regulatory agencies.



BY ERIN RUSSELL AND JASON HEID

POWERING THE FUTURE

The President and CEO of Mitsubishi Hitachi Power Systems Americas believes in the transformative potential of AI.

PAUL BROWNING FELL IN LOVE WITH gas turbines early in his career. Joining General Electric fresh out of Carnegie Mellon University, he was soon assigned to “one of the sexiest things that a materials engineer can work on.” Turbines got him interested in the power business, and all these years later he’s now president and CEO of Mitsubishi Hitachi Power Systems Americas. We sat down to hear how AI is reshaping his industry.

COGNITIVE TIMES: What’s your vision for the power plant of the future?

PAUL BROWNING: We actually have a pretty clear vision, because we just broke ground on it ... a power plant in Takasago, Japan, that’s going to be 65 percent fuel efficient. This is a natural gas power plant and is going to be capable of autonomous operation ... it’s going to be smart enough to self-diagnose any kind of issue it has. It’s going to be smart enough to schedule its own maintenance ... It’s going to be a power plant that doesn’t need to have the control room at the power plant. You can have it somewhere remote. Really, there’s not going to be a lot for people to do there because the power plant’s going to know how to operate itself.

CT: So what’s the role of humans going to be in that power plant of the future?

PB: In a billion-dollar natural gas power plant, there are only about 35 employees. So it’s not like coal and nuclear that have hundreds of employees. We don’t have a really big financial incentive to try to displace human labor in a natural gas power plant, and the same is true for renewable projects as well ... What we’re going after is much less unplanned maintenance, which is very expensive for customers. Also shorter maintenance intervals... less downtime and a more predictable operation of the power plant, better reliability. The other thing we get from our AI is a much more flexible power plant. That’s important in an age of intermittent renewables, where our natural gas power plants need to be the balance between supply and demand. When renewables are fluctuating due to the weather, the natural gas power plant fills that gap. So we can turn the power plants down to lower levels or we can ramp them at higher rates ... During those dynamic periods is when artificial intelligence and machine learning can really help us understand where the edge of the operating envelope really is and help us operate closer to that, but safely and reliably.

CT: What led you to this focus on AI?

PB: Energy is really fundamental to human prosperity. Think about what happened in Asia over the last two decades, where we lifted over a billion people out of extreme poverty into the global middle class. We also lifted a lot of people in the global middle class into higher levels of prosperity, and a

lot of that came on the back of coal and oil as our energy sources ... At a great benefit for humanity, however, we also created a lot of CO₂ emissions during those two decades, which are now creating a climate change challenge for the planet. We still have another billion people we have to lift out of extreme poverty, and several billion people that want to move from the global middle class up to higher levels of prosperity, and so we have to do something different in the next decade. What we think is going to happen is a combination of natural gas renewables and energy storage. We think, in order for that to happen, artificial intelligence is going to be critically important. Not just for the reasons I just explained—to make the gas turbines work better with renewables—but also because we’re going to have so many distributed resources in this new model ... That grid is going to be a lot more complex than today’s grid, and it’s going to require a lot more intelligent oversight than we have today and probably an oversight that humans are not going to be capable of.

CT: What challenges have you encountered going from strategy to implementation, especially with AI or automation?

PB: We had to go into this one without a tic-tac-toe game plan that we just executed. We knew where we were going to start, but we had to figure it out along the way. We were plowing new ground. When we do something that’s like something we’ve done before—so for example, we make a brand-new gas turbine that’s a lot more fuel efficient than the last one we did—well, we actually know how to do that, right? We’ve done that before. We’ve had prior generations of gas turbines where we developed a more fuel-efficient one. We know how that innovation process works. But when we’re trying to do something new, like develop an artificially intelligent autonomous power plant, we’ve never done that before and so we had to find our way there. Having a willingness to change your plan along the way, that’s not an indication that you had a bad plan. It’s just an indication that you’re doing something really ambitious and challenging. If you actually understood everything you had to do on day one, you probably weren’t pushing yourself enough, and you weren’t being ambitious enough.

CT: What are you most excited about right now that you’re working on?

PB: I get a lot of personal satisfaction just out of this idea that prosperity and climate change are two problems that we need to solve simultaneously, and we’re one of the energy companies that can actually help the world figure that out. I really do get excited about that. We sponsored Carnegie Mellon University to do a carbon intensity index for the U.S. power sector, and our plan is to, over time, expand that

“

Energy is really fundamental to human prosperity.

around the world. But keeping ourselves focused on the idea that affordable electricity is really important to human prosperity, but that at the same time, we’ve got this huge challenge of climate change. What’s going to solve it is markets and technology, and that means companies like ours. And, so, people like me.



EDITED BY JASON HEID

TED COLBERT

> Chief Information Officer and Sr. VP
Boeing

Education

Georgia Institute of Technology (BS),
Morehouse College (BS)

Previous Gigs

Ford Motor Company, Citi

His Leadership Philosophy

Everything that we do starts with the culture of the company, the organization we're trying to transform. You know, a colleague of mine in the industry and others have said many times, "Culture eats strategy for breakfast every single day," and I think that's true ... And so I think building a diverse team is so important, because when you have a team of diverse leaders that are focused on solving problems, then you have a broader spectrum of empathy at your arm.

One Surprising Fact About Him

I played the clarinet in high school.

Best Piece of Advice He's Ever Received

Focus on getting stuff done today really, really well, and the future will paint itself.

His Most Important Mentor

I saw my parents as a collective. My dad was a great human being and taught me a ton about people. And my mom is probably the most unselfish person I ever met in my life. Her sense of sharing and giving and selflessness, coupled with my dad's

focus on people and business and the like, helped mold me as a kid in big ways.

How Tech Will Transform the World

AI and a bunch of things emerging now will get us into this world that we can't even fathom ... I always joke about the Jetsons or Star Wars, right? We'll be in a world where there's going to be tons and tons of automation—tons and tons of assistance in everything that we do.

Favorite Tech Gadget

My Peloton. I just love riding Peloton. It is addictive ... You end up after 45 minutes not realizing you just burned 600 or 700 calories, but you've been listening to great music and having fun and just getting into it.

His Proudest Moment

My son just started his freshman year in college, and I think my proudest moment is him starting school and the excitement in his eyes about his future and the opportunities ahead of him.

On What Makes a Great Leader

Being a great listener ... The only way you can lead, and be a great servant-leader, is to know how to listen and have empathy for people.

If He Did Only One Thing For the Next Week...

I would spend time going site to site to our factories in the company and learning more about where we have opportunities to drive our digital transformation.

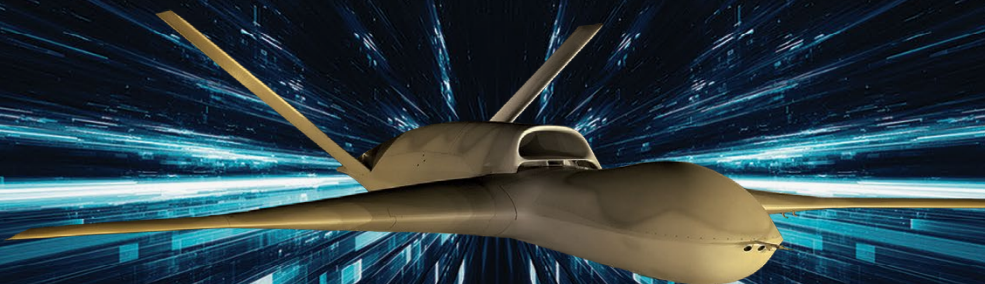
Best Book He's Read Recently

The Power of Habit [by New York Times reporter Charles Duhigg] ... By studying the psychology of people's habits, you understand how to help them see the opportunities of new technology, how to incentivize the evolution to new technologies, and how to change triggers and behaviors and outcomes relative to those changes that you want to make.



HYPERWAR

CONFLICT AND COMPETITION IN THE AI CENTURY



AMIR HUSAIN ■ JOHN R. ALLEN
ROBERT O. WORK ■ AUGUST COLE ■ PAUL SCHARRE
BRUCE PORTER ■ WENDY R. ANDERSON ■ JIM TOWNSEND

WHAT PEOPLE ARE SAYING ABOUT THE BOOK

"'Hyperwar' doesn't just admire the problem of AI-fueled warfare, it offers concrete approaches to help U.S. policymakers and our allies prepare. It is a 'must read' for all humans seeking to be 'in the loop or on the loop' before these technologies outpace our capacity to make ethical, strategic and secure decisions about our future."

—AMBASSADOR VICTORIA NULAND
CEO, Center for a New American Security



AVAILABLE NOW

BY LEE BELL

DIGITIZING YOGA

New tech is modernizing
the ancient practice.

Yoga has been around for thousands of years, but it's only in recent times that the ancient discipline has become popular among the masses. To put that in perspective, the number of Americans doing yoga grew by 50 percent between 2012 and 2016.

To many the appeal of yoga is in the unplugging from it all. Practitioners aim to quiet their minds as they disengage from the world around them. As such, taking yoga in a higher-tech direction—employing gadgets and electronics to aid the experience—seems almost like a contradiction in terms. Yet, in some ways, even this ancient practice is succumbing to the changes of our modern, ever-connected world.

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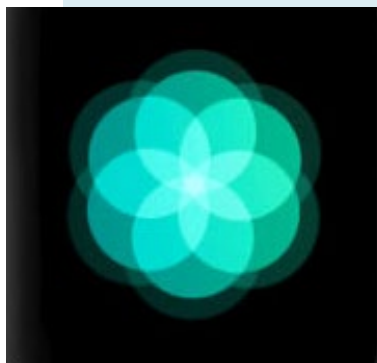


IMAGE SOURCE: **APPLE**

Wearables

When Apple unveiled the latest edition of its Watch last summer, it added yoga as a dedicated option for its fitness-tracking capabilities. And a startup called Pivot Yoga is developing a smart clothing line that provides feedback through small internal sensors that can indicate whether the user is posed correctly. The clothes maintain a wireless connection to the company's mobile app, through which you can take online yoga classes. The sensors will insert a "live avatar" of your body into the video so you can easily compare your movements with the teacher's.



IMAGE SOURCE: **FLY LDN**

Innovative spaces

Some boutique yoga studios are using video to enhance the experience. London's FLY LDN leads members through a vinyasa flow in front of a 20-foot 4K video display projects immersive and vibrant cinematic visuals, from Himalayan mountain ranges to crashing ocean swells. Alongside curated music playlists, the screens elevate the sense of escapism and relaxation.

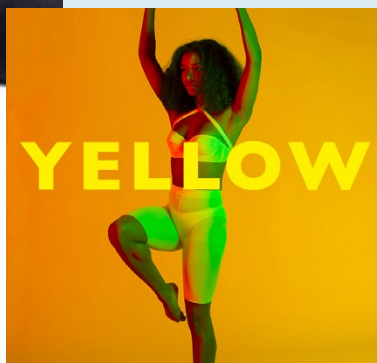
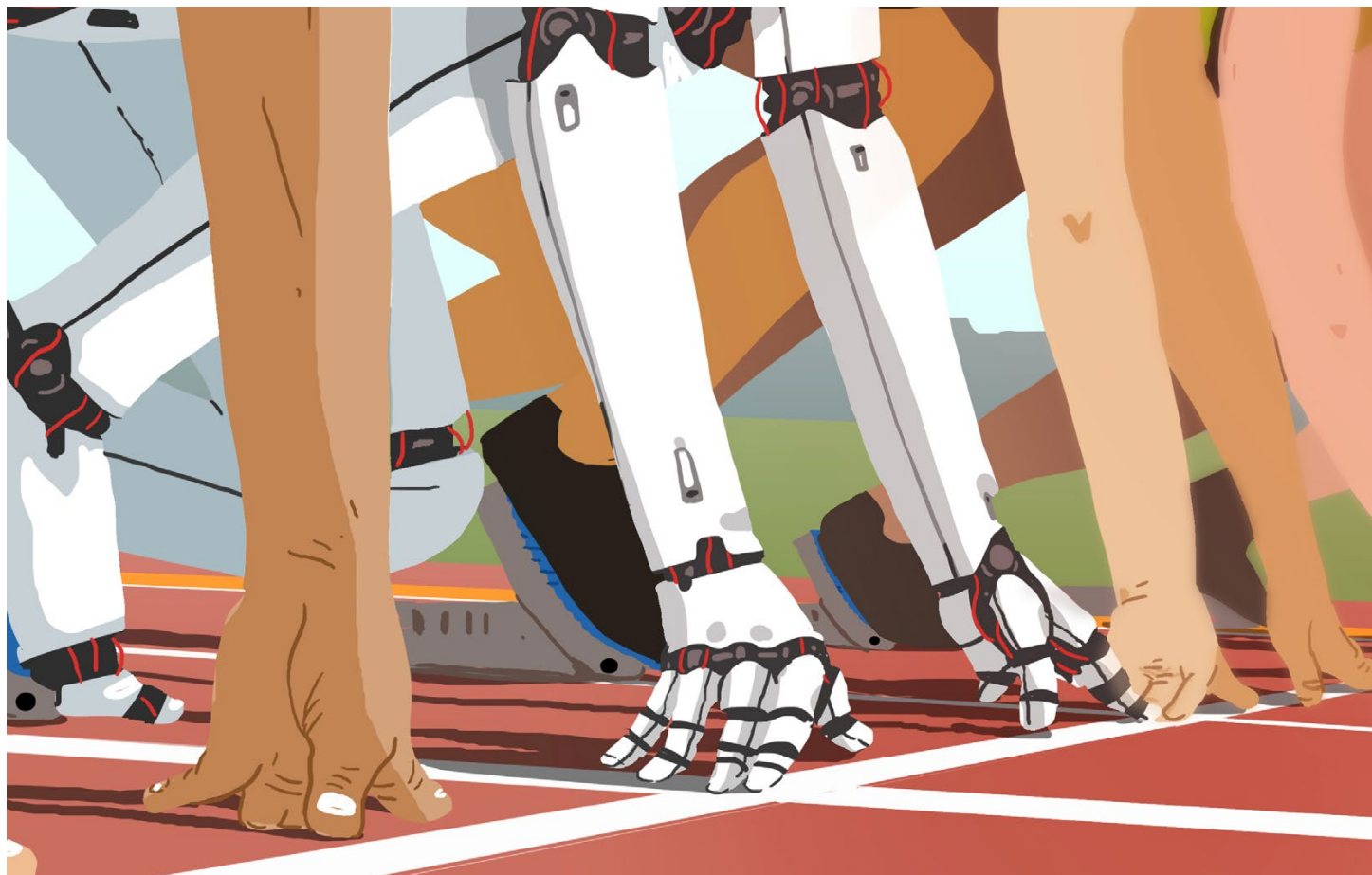


IMAGE SOURCE: **CHROMA**

Color and Light

Another cutting-edge yoga studio is ChromaYoga, also in London, where light and color therapy, brain-stimulating soundscapes, and natural scents are combined to create an immersive, multi-sensory experience. Using the latest scientific research on the effect that specific light frequencies have on our bodies, the studio's founder, Nina Ryner, believes that saturating ourselves in different hues during yoga can address "imbalances in our lives." Rooms are bathed in a specific color of light depending on the class, each with a teacher instructing sequences designed to correspond with the healing properties of that color. Take the yellow class, for example, and you'll experience a flow meant to aid digestion and mood swings.



BY NICK STOCKTON

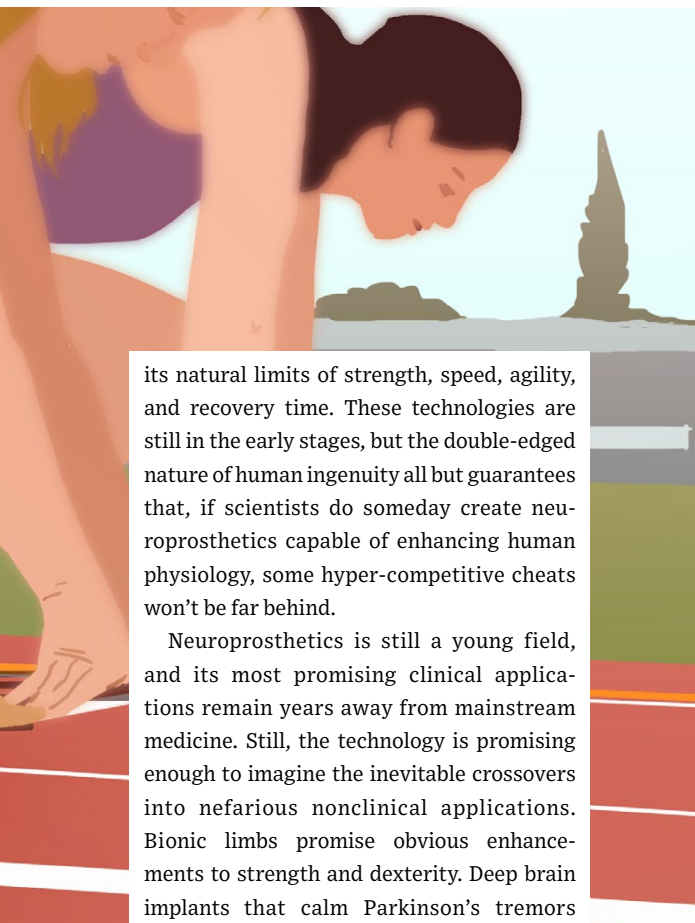
A LEAGUE OF THEIR OWN

As neuroprosthetics come to transform the nature of human performance, it's time to reckon with what that means for the future of athletics.

LET'S SAY IT'S the year 2048. Nairobi is hosting the summer Olympics. The feel-good story of the games is about a paraplegic runner who regained function thanks to a surgically implanted brain-computer interface—and dogged perseverance, of course. She goes on to win the gold.

Then the story takes a turn: Competitors allege that the neuroprosthetics that helped her recover the ability to run actually provided her an edge over the competition. Should the International Olympic Committee put an asterisk next to her record-breaking time? Strip her medal? Amend its bylaws to bar all future cyborgs?

This story of a bionic ringer isn't pure science fiction. In 2012, Oscar Pistorius ignited a similar scandal when some competitors alleged the prosthetic "blades" he ran on granted an unfair advantage. Pistorius didn't win any medals at those games, which is probably why nobody forced the issue. However, neuroprosthetics—devices that restore or enhance body or brain function by communicating with a person's nervous system—could push the human body far beyond



its natural limits of strength, speed, agility, and recovery time. These technologies are still in the early stages, but the double-edged nature of human ingenuity all but guarantees that, if scientists do someday create neuroprosthetics capable of enhancing human physiology, some hyper-competitive cheats won't be far behind.

Neuroprosthetics is still a young field, and its most promising clinical applications remain years away from mainstream medicine. Still, the technology is promising enough to imagine the inevitable crossovers into nefarious nonclinical applications. Bionic limbs promise obvious enhancements to strength and dexterity. Deep brain implants that calm Parkinson's tremors could evolve into stimulants that enhance an athlete's reaction time. Such fine-tuned control of the body's synapses could allow athletes to cheat in undreamt-of new ways. Regulations might seem like the solution for containing such abuses, but the drug scandals that rock sports every few years are testaments to prohibition's futility. Instead, let's give these nerve-jacked jocks of the future a league of their own.

The idea for separate, performance-enhanced leagues originated in response to sporting's never-ending doping saga. The most common protest against the notion is that it would encourage athletes to engage in risky behavior. Anti-doping purists often raise this argument to oppose similar ideas about freeing athletes to use performance-enhancing drugs: Misuse could damage vital organs, push bodies past the limits of recovery, and even result in overdoses.

However, this idea runs counter to evidence that prohibition itself is what encourages athletes to take dangerous risks. Confused? Well, first consider how easy it seems to be to not get caught doping in professional sports. In 2015, journalists were leaked blood testing data from the International Association of Athletics Federations that suggested nearly a third of all athletes who won Olympic medals between 2001 and 2012 were doping. A 2015 Dutch survey indicated that only about 2 percent of all athletes who dope get caught. Harvard University ethicists have argued that those two statistics explain why doping is actually a highly rational decision for any competitive athlete: If all your top competitors are cheating without consequence, why shouldn't you join in?

Performance-enhanced leagues render cheating moot. The reason is accountability. If society enjoys a transparent view of what augmented performance looks like, athletes who opt to cheat in so-called "natural" leagues would have less plausible deniability for their gains in strength, speed, agility, and recovery time. They'd be as easy to spot as a WWE wrestler on the Greco-Roman college circuit.

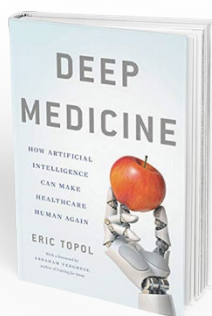
These leagues could actually prove safer for athletes. Trainers, physicians, and yes, regulators, would ensure performance enhancers are used responsibly. Neuroprosthetics present a different risk profile than drugs, beginning with the invasive surgery required to install most of the hardware. Many of the other risks aren't yet known, but could include exposing the body to radiation, infection, or physiological strain. The necessary medical oversight alone could make a compelling case in favor of augmented neuroprosthetic leagues.

Sports are hugely profitable enterprises, and some of the world's most talented physicians, engineers, and scientists help athletes perform at their peak. Enhanced leagues could lead to the accelerated refinement of neuroprosthetic devices that might help even non-athletic humans perform better in their daily lives. We could also see a Moore's Law-like effect reducing the cost of neuroprosthetic devices, making them more affordable for people without wealth or privilege.

The biggest challenge for enhanced leagues would be recruitment. After all, to realize any of the aforementioned benefits, the augmented athletes would have to believe they won't be ostracized. Society can begin by confronting its existing biases against augmentation. Athletes who compete in so-called "special" leagues are rarely recognized for their skill, drive, and spirit. In some ways, it is disabled athletes who represent the apotheosis of the sporting ideal—pushing themselves to perform the impossible. The fact that they, or any other athlete, might use technology to achieve their goals might seem unnatural, but it's the most human thing in the world.

BY CARA SCHWARTZKOPF

A TECH-SAVVY TO-DO LIST



Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again

RELEASE DATE **MARCH 12**

Leading physician Eric Topol discusses AI's potential to transform our broken medical system.



South by Southwest

MARCH 8-17

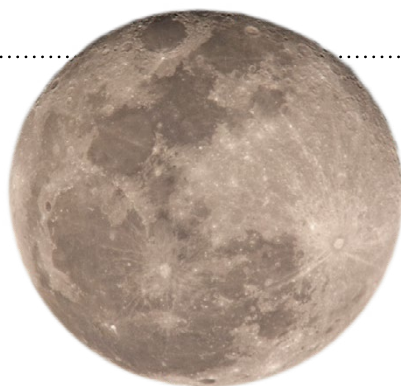
Highlights this year at the annual film, interactive media, and music festival in the burgeoning tech hub of Austin, Texas, include "Who Will Lead in the Race for AI in Defense" and "How AI Will Design the Human Future"—featuring SparkCognition's CEO and GM of Defense & National Security—in addition to panels such as "Watch Out Silicon Valley: Rising LATAM Tech Scene."



Supermoon

MARCH 21

Our last chance in 2019 to see the moon appear embiggened as it comes closer to Earth's orbit.



hackathonCLT

MARCH 22-23

This hackathon in Charlotte, North Carolina, isn't like the rest—it's an event for adult techies to come together and solve big problems, meet fellow nerds, and even grab a beer or two.



All Data Are Local

APRIL 23

Georgia Institute of Technology Assistant Professor Yanni Loukissas challenges the "myth of digital universalism," reminding us in today's data-driven world not to assume data is discrete or complete.



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BY AMIR HUSAIN

DAMN THE TORPEDOES

Why I'll never lose faith in American technology leading humanity to a brighter future.

SINCE THE RELEASE OF MY BOOK, *The Sentient Machine: The Coming Age of Artificial Intelligence*, I've had the privilege of addressing dozens of gatherings all around the world. Recently, I spoke to students and professors at a large public university in Shanghai on the topic of artificial intelligence, and at the conclusion of my talk, we began the obligatory question-and-answer session. But there was something different about this Q&A.

The questions would not cease.

It was almost certainly one of the longest sessions following my AI talks. This was all the more remarkable to me since not everyone in the audience was comfortable conversing in English. It takes quite a bit of courage for a young student to ask a question at a large venue such as this, and even more so in a language in which she or he is not fluent. Yet, the questions kept coming.

A few weeks prior to my Shanghai talk, I was in Beijing. There, too, I saw an intense level of engagement and a remarkably high percentage of attendees queued up outside the auditorium, waiting to have their book signed, taking the obligatory selfie, and asking additional questions. The eagerness was palpable in both places.

There was optimism. There was curiosity about what AI would do for them.

My mind went back to 2015, when I was speaking at the famous SXSW conference in my hometown of Austin, Texas. There was a small, albeit loud anti-AI protest that year, with the refrain "Stop the robots."

There was fear. There was anger over what AI would do to them.

I would not want to generalize about the U.S. and Chinese reactions to AI in an oversimplified manner, but in the interest of space, one is forced into these wanton acts of lossy data compression and must beg the more discerning reader's pardon.

The point is, fear slows you down. Optimism and curiosity accelerate you. The U.S. is becoming slower, and China is breathtakingly fast. While China

has a national AI policy, the U.S. has been unable to put one forth. Investments in AI by the Chinese government dwarf our own. China recognizes that algorithms emanate from brilliant minds, and thus, the number of foreign students in China is increasing, while the exact opposite trend has taken root in the U.S.

If the technology industry's hearings on Capitol Hill were not sufficient evidence of how disconnected our legislators are with technology and its consequences, perhaps our current attempts to regulate and control our software industry's ability to export AI are. We seem to think that these controls will ensure our lead. Walls to stop what's coming in. Barri-
cades to stop what's going out.

China is exporting all the technology it can because it realizes that exports bring revenue, and revenue means greater R&D investments. Exports drive more usage. Usage grows data, which in turn improves AI (or any product, for that matter).

Despite all these recent trends, there is no doubt in my mind that the United States is the best place to form the ideas and build the technologies that will lead to a better future for humanity. The America of the innovator, the builder, the writer, and the dreamer is alive.

And that brings me to the final point: What are we going to do to improve things?

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The America of the innovator,
the builder, the writer, and the
dreamer is alive.

Here is what I will do. I will continue to speak about AI and its promise to prove that technology can be a force for good so others approach the future with optimism.

I will continue to engage with our leaders in government, business, academia, and beyond to once more adopt the truly American attitude of damning the torpedoes and moving fast. We need to grease the skids of innovation and run through roadblocks.

I will continue to think about a better future and I will work overtime to make it real. I will foster global integration and alliances where I can, whether by sharing ideas with allied leaders in Europe or forming business partnerships in Asia.

And finally, I will not be hopeless. I will continue to believe in a better world. A world where everyone eats well, where health care is available instantly to those in need, and where people get from one place to the other without worrying about traffic and

pollution. A world where abundant, reliable energy powers our hospitals and homes and drives desalination plants that make fresh water plentiful. A world where technology is once more the great equalizer and where it is the basis for integration. And a world where competition is no longer about one country versus another, but instead about how humanity will be better off tomorrow than it was yesterday.

I don't know if I will ever live in a world like this, but I will continue to believe that it is just around the corner. I will continue to tell myself that the very next thing I do may make a meaningful difference. And so, I will keep working toward that next thing with all the vim and vigor I can muster.



A woman with blonde hair in a high ponytail is captured mid-air during a box jump. She is wearing a black sports bra, black leggings, and bright yellow sneakers. A black wrist tracker is visible on her left wrist. The background is a dark, industrial-style gym with metal racks. The text "THE ONLY TRACKER THAT LEARNS EVERY EXERCISE" is overlaid in white, bold, sans-serif font.

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LA REVOLUCIÓN DIGITAL

BY AMY GUTHRIE

In the heart of Mexico, Global HITSS is working to guide Latin America toward a technology-driven future.



photo by Jon Coyle

The chall IS DA

up an office tower in Plaza Carso—the sprawling retail, office, and residential space in Mexico City—Oscar Márquez is planning how to usher the Slim family empire (and, if possible, much of Latin America) safely through the Fourth Industrial Revolution.

MÁRQUEZ IS CHIEF technology officer for Global HITSS, a unit of América Móvil, the biggest mobile-phone operator in the Americas and the linchpin of the Slim fortune. Head of the family Carlos Slim is the richest person in Latin America, with enterprises that stretch across more than two dozen countries and multiple business lines, touching the lives of hundreds of millions of consumers in the region.

This business conglomerate was built on a backbone of telecommunications, an industry that is quickly evolving to require more technology and fewer humans. Leaner, faster companies are nipping at América Móvil's heels while young Latin Americans shun phone calls and texting to instead engage via WhatsApp and Facebook Messenger. The business needs to evolve.

The Engineer, as Slim is known in Mexico, and his progeny are also concerned about what lies ahead for Latin America's 644 million consumers as digital trends make some work obsolete and require more sophisticated skills for others. Rather than sit on their hands, the clan has tapped Global HITSS to guide their companies, and their customers, into the digital realm.

Márquez says the command from higher up is: *Hagan travesuras*. That literally translates as “make mischief.” In U.S. corporate-speak, it means push the envelope, get creative, and pull tricks out of a hat to promote new ways of doing business.

The idea is to get América Móvil into shape and then extend that knowledge to other industries—including retail, consumer goods, real estate, construction, and mining—through consult-

enge UNTING.



ing and partnerships, so that Mexico and Latin America don't get left behind as the world depends ever more on digital interactions and AI-driven automation.

The challenge is daunting. According to the World Bank, digital adoption (measured by internet and smartphone use) in Latin America and the Caribbean substantially lag behind that in East Asia and among Organization of Economic Cooperation and Development (OECD) countries. Productivity rises and economic growth is more inclusive with more widespread digital adoption, the World Bank argues.

Like in much of Latin America, the business culture in Mexico is bureaucratic and antiquated, with a heavy reliance on

paper documents. Confidence in digital transactions is weak. Cash remains king. In Oxford Insights' Government Artificial Intelligence Readiness Index, Mexico scores poorly in the areas of tech skills, digitalization, and public sector innovation—crucial preconditions for implementing AI technologies.

Yet change is certain. Oxford Insights predicts that one in five jobs in Mexico will be impacted by automation over the next two decades, ranging from tasks being made easier to jobs being fully replaced. The largest effects will be felt in the manufacturing and construction sectors.

"Mexico is not yet prepared [for automation]," Márquez says. "But we have to take these steps to prepare it in a realistic way."

WHEN GLOBAL HITSS turned its gaze inward on the Slim conglomerate, roughly a year ago, it found stubbornly old-fashioned habits. Some of the processes within América Móvil are relics of the 1990s, when Slim acquired a stodgy, government-run phone company called Teléfonos de México. As Telmex morphed into a multinational behemoth with 279 million wireless subscribers and operations in more than a dozen countries, it automated the manual way of doing things but didn't necessarily transform the way things are done. So each task has its own silo.

This means that an América Móvil customer service representative, for instance, may need to connect with six or



more systems to attend to a client. First the representative will verify the client's identity, through one system. Then the representative might check whether the client is current on payments through another system. Then she might scope available phone plans, via yet another system. And so on.

Since faith in digital transactions is generally low in Latin America, there are multiple authorizations with printouts and signatures required on physical documents to open accounts. One technology reporter complained via social media recently that he reached so far into the cobwebs of América Móvil to report a stolen phone that he was asked to file the report via fax. It took him hours to track down a fax machine in Mexico City.

Yet América Móvil and the Grupo Carso conglomerate of which it's a part are a world ahead of many businesses in the region. The small- and

medium-size companies that supply 90 percent of the jobs in Latin America are very much behind on digital adoption. It's like they're speaking another language. This threatens the consumer base that has been the Slim family's bread and butter for decades.

"ALL OF THE SOLUTIONS THAT ARE TODAY VERY LINKED TO BIG CORPORATIONS, THE IDEA IS THAT WE CAN BRING THEM TO PLATFORMS AND THEN MASSIFY THEM."

"All of the solutions that are today very linked to big corporations, the idea is that we can bring them to platforms and then massify them," Márquez says. "We at HITSS can't lose sight of the fact that the DNA of this group is mass market."

HITSS has pilot projects with applications in health, retail, smart cities, and public safety—to name just a few areas on its radar. Every sector is under consideration, and partnerships are welcome. The applications mirror Slim's business reach, while also encompassing philanthropic priorities such as public health and urban renewal.



PLAZA CARSO HAS four glass-encased office buildings, a Saks Fifth Avenue store, and a free museum that showcases some of the artwork that Slim has collected over the years, including Rodin sculptures as well as impressionist paintings.

The tower that houses Global HITSS sits above a marketplace where on a recent Thursday the lunch crowd was sipping sparkling wine and nibbling on Spanish-style tapas. The lobby is sun-drenched and rimmed with vehicles for sale from brands like Jeep and Alfa Romeo. On level nine, HITSS deploys an open floor plan with plush couches on which collaborators can gather to brainstorm.

It's an enviable work environment. Yet Global HITSS struggles to retain collaborators. The company hires 400 engineers each month, in part because HITSS is in expansion mode, but mostly because talent is often poached by competitors and clients.

"There is tremendous piracy between technology companies. Someone learns something,

becomes valuable to others, then gets taken away. There are not enough people," Márquez says.

Across Latin America, HITSS employs 8,000 people, 6,500 of whom are programmers who primarily work directly for clients. Around 300 employees are dedicated to product development.

Mexico's education system graduates the eighth-largest number of engineers and sixth-largest number of software engineers globally. Yet this talent pool still falls short of meeting needs. Hiring companies complain that at school, engineering students learn antiquated skills on antiquated equipment, and that once on board in the workforce, they require months of training.

According to Monica Flores, president for Latin America at ManpowerGroup, more than 40 percent of employers say that they don't find the right candidate at the right time in Mexico. The issue, she says, is that Mexico is focused on developing "operative" skills, when it needs to focus on teaching creativity, learnability, and complex problem-solving. This is especially true in technology fields, where textbook cases become obsolete within years.

NOT FAR FROM Global HITSS, on the penthouse level of a WeWork shared office space, economist Manuel Molano moves a potted plant to one end of a round table and places an empty water glass at the other. The potted plant represents Mexico's richest, while the water glass is the poorest, as he improvises with props to describe how the middle class in Latin America has grown in recent years.

Molano, deputy director of the nonprofit think tank Mexican Institute for Competitiveness, harbors grave concerns about the effects of automation on Latin America. By his estimation, the region has for too long leaned on commodities and the extraction of natural resources to generate economic growth, while failing to channel that wealth into a better-educated public that has the tools to adapt to shifts in technology. He worries also that companies won't see the full circle, that they will automate so much that they will kill off their own consumer base.

If he were the Engineer, Molano says, he would be doing exactly what Global HITSS has been tasked with doing: thinking about how to automate the Mexican economy; how to sell more services to the government and to big companies; and how to reduce costs for Grupo Carso.

The way Molano sees it, América Móvil is right to extend its digital reach through artificial intelligence, to educate Latin Americans, bring them communications services, and make them more productive. These moves likely ensure the company continues to have clients. But more than that, Global HITSS is stepping in where governments have failed, to harness the region's potential.

"That's having your head in the future," Molano says.

The Protein





of the Future

Insects, already eaten by much of the world, are an eco-friendly, nutrient-dense, and, many say, delicious source of protein. Aspire Food Group is bringing this microlivestock to the countries that need it most.

■ BY ERIN RUSSELL

THE FIRST TIME

Mohammed Ashour ate a cricket was on live TV. He was on air that morning in 2013 to represent his company, Aspire Food Group, whose model for farming bugs (or euphemistically, “microlivestock”) had landed in the finals for a million-dollar social entrepreneurship prize. But Ashour had never actually eaten one himself. He didn’t see it as a prerequisite that he personally consume his product, and, more importantly, there was no place in his hometown of Montreal to get food-grade crickets.

The host of this Montreal morning show had insisted Ashour bring crickets for the interview. Since Aspire wasn’t in operation yet, his team did a frantic search and, bizarrely, a museum in the city helped them track down a chef who cooked with crickets. The chef made a special creation for the show: crickets on an elegant white chocolate wedge.

Ashour showed up to the set, dish in hand, and sailed through the interview. However, in the last minute, the host asked him to sample the crickets with her. He readily agreed, though as he bit down, he knew if he reacted in any manner that revealed this was his first time to eat the insect, it could discredit everything he’d just told the show’s audience.

“I was disgusted by the white chocolate,” Ashour recalls. “The cricket was fantastic. I immediately ask [the host] what she thought and pretend like I’m doing this for the hundredth time.” However, the experience wasn’t entirely painless. “When I got home that morning, I just crawled into a fetal position,” he says. “I can’t believe I was force-fed white chocolate on TV.”

Ashour claims that eating crickets for the first time proves to be a “spiritual experience” for most people. The 31-year-old CEO, who has the bulging biceps of a protein enthusiast, has converted his wife and children into fans, along with the tens of thousands who are consumers of Aspire’s crickets. He’s not alone: crickets are crawling their way into the mainstream, showing up in concessions at pro sports venues, including State Farm Arena in Atlanta and Safeco Field in Seattle (where they regularly sell out), as well as on the investing TV show Shark Tank.

Of course, insects as a food source are more than a novelty in much of the rest of the world. Bugs are regularly consumed in 80 percent of the world’s countries, including Mexico, Thailand, and Japan. Often insects are more expensive than meat because they are seasonal and usually harvested by hand. Crickets are rich in protein, calcium, fiber, and iron. Plus, many people, like Ashour, insist they taste delicious—when not paired with white chocolate.

Before he became an insect-eating evangelist, Ashour was pursuing two degrees at



(Left) Mohammed Ashour, CEO
(Right) Gabe Mott, COO

McGill University: his MBA and a medical degree. In 2013, he heard of the prestigious Hult prize, which was endowed in 2010 by the founders of international education company Education First to provide seed capital to students seeking to sustainably solve global challenges. Past winners include Impct, which offers daycare in urban slums, and Roshni Rides, which provides safe, reliable transportation to women in Pakistan. The year that Ashour decided to

compete, the theme picked by Hult Prize partner and former President Bill Clinton was the global food crisis.

“For me, it just felt like the natural progression of what being a doctor meant in the first place,” Ashour says. “I mean, how many patients am I going to see as a doctor? What if I could build a business that can have the potential to actually alleviate hunger for millions of people?”

He brainstormed ideas with four MBA classmates: Shobhita Soor, Gabe Mott, Jesse Pearlstein, and Zev Thompson. To-

gether they decided only to pursue the prize if they found a cause worth dropping out of school for. The team began by seeking an effective way to get nutritious food into urban slums, and quickly realized they needed a food source that could be easily grown within such impoverished environments. Ashour first heard about eating insects from a hospital patient, and he soon became immersed in research extolling the dietary benefits of bugs. After three months, the only idea to pass the group’s self-imposed litmus test was the concept of raising microlivestock.

Meat is an \$800 billion global market that for many carries significant environmental and ethical concerns. The prototypical family farm raising a small herd has largely been replaced by industrial-scale operations. These are major producers of greenhouse gases, create significant problems of waste disposal, and often involve less-than-ideal living conditions for animals. As the world’s population approaches 9.6 billion people by 2050, the question increasingly raised is how we can sustainably—and nutritiously—feed all those additional mouths.

Crickets have a number of appealing qualities compared to traditional livestock. A 2013 report from the United Nations (well-timed for Aspire’s purposes) found that one pound of beef requires 20 pounds of feed to produce, not to mention the requisite water, land, and pesticides. A pound of crickets only requires about 1.5 pounds of feed, while providing comparable amounts of nutrients. Greenhouse gas emissions from cricket production are also 100 times lower than those from raising cattle. Adding to the case for crickets is a recent study in the journal *Nature* suggesting that eating the insects may improve gut health.

After beating out 10,000 competitors (and conquering the morning TV circuit), the Aspire team landed one of five spots in the Hult Prize global finals in New York City, facing off against groups from as far



away as Spain and South Africa. Before the team's final pitch—a 10-minute presentation to a panel of Nobel laureates—Ashour huddled with his team in a meeting room. “I said, ‘Let’s look at the Hult Prize not as the final step we needed to get to where we need to go. It’s actually the first step—think of it as the very first VC we’re pitching.’” How many companies win over the first VC they pitch, he asked?

Well, this one did. Aspire won the Hult Prize. When handing over the hefty award, President Clinton noted that he surprised even himself by advocating for insects as food, but that the idea took advantage of existing markets, was “very innovative,” and that the group had a “proper business plan to execute their strategy.” The group has since attracted other investors, notably John Chambers, former CEO of Cisco, who believes, “The majority of the protein that we absorb 10 years from now will be from insects.” After winning the prize, Soor, Mott, and Ashour were able to complete their MBAs while simultaneously conducting research for Aspire (though Ashour had to press pause on medical school).

With the prize money in hand, the team conducted market research to figure out what insects were both being eaten and able to be farmed. Aspire first focused on an existing market, looking to bring a replicable model and food security to Ghana by farming palm weevils. However, after a year in business, they realized that to truly serve their mission, it wasn’t enough to work in countries that already regard insects as food. “We have to induce behavioral changes in the countries that are most contributing to this global crisis,” Ashour says. “I mean, let’s be honest, it’s not Ghana that’s [the biggest source of] global greenhouse gas emissions.”

Today, Aspire has operations in Ghana (managed mostly by Soor, who is CIO) and



a robotically managed cricket farm in the United States (managed mostly by Mott, who is COO). Mott, the lanky scientist foil to Ashour’s muscled executive, is tasked with generating the healthiest microlivestock in the most sustainable way, at the lowest cost. In September 2014, the company moved its headquarters to Austin, seeking warm temperatures for the crickets and because, Mott says, with a local culture interested in sustainable food and the unofficial motto of “Keep Austin Weird,” “This seems like a place that will not be freaked out [by eating crickets].”

Aspire operates a massive, 25,000-square-foot facility in South Austin, though it’s already too small for the growing company after just two years in operation. The crickets are raised in 3-by-3 foot plastic boxes that each house 15,000, for a total of over 100 million crickets harvested per year.

The boxes are lidless, so that robots can refill water and drop in food. The crickets eat a modified chicken starter feed (a non-GMO mix of corn and soy, enriched with vitamins and minerals). Layers of an egg carton-like material give the crickets places to climb, and allow for more individuals per box. The walls of the bin are high enough so that the crickets can’t jump out, as any that manage to escape are no longer food safe. The rows of boxes are kept in clean rooms (meaning visitors must don shoe covers, lab coats, and hairnets) heated to the temperature of a hot summer day. It smells like a place where livestock is raised, and crickets can be heard throughout the building. The chirping is almost deafening in the rooms where crickets are kept.

Mott explains that Aspire crickets are happy crickets that have never exhibited stress behaviors like waterfalling, in which



a group crowds together seeking an exit. (Mott, a vegetarian, didn't take to eating insects as quickly as Ashour. He says this is because the animals were often plucked directly from a tree and were still wriggling when handed to him.) In fact, Ashour notes that one of the challenges of raising crickets at this scale is that creating such an insect-friendly space means the building can also attract unwanted intruders (other bugs).

Once the crickets are fully grown, the company puts them into a harvester (the current version is the company's eighth iteration), which separates out the live crickets for processing. They are then placed into bags, frozen, and shipped to a processor to be turned into the brand's consumer products, which include protein powder, roasted crickets (in flavors like sea salt & vinegar and Texas BBQ), or protein bars (in flavors like chocolate fudge brownie) under the brand Exo, which Aspire acquired in 2018.

The cricket boxes are also armed with a slew of sensors. Aspire collects hundreds of millions of data points on the crickets

(as well as a similar amount of data in its Ghana operations), to determine things like the optimal environmental conditions and feed for the crickets during their five-week life cycle in order to yield the greatest number of healthy crickets at the lowest cost and the highest level of sustainability. For example, Aspire data led it to adjust the crickets' diet, resulting in a product higher in protein and lower in carbs.

"At the early stages, the most important thing was to set up the systems just to collect the data," Ashour says. "Although it's not the best practice, collecting data in our business is way more time-sensitive than actually analyzing the data. If we don't capture data for every generation, that's lost opportunity. Whereas we could technically aggregate that data and then come in at a later point in time and analyze."

Aspire also took on the difficult task of building its automated technology from scratch, since products often exist at a much larger scale than the company needs. For example, the staff initially had to manually clean and refill the crickets' water reservoirs daily. Since cricket farms are a relatively new phenomenon (in other countries, crickets are literally caught in fields by hand), there was no off-the-shelf automated cricket watering system on the market, and the company had to tackle building its own.

What seemed like a straightforward engineering problem was riddled with technical challenges, especially given the hurdles of applying technology to finicky biological organisms that don't respond in a standard way. Ashour concedes that the team was perhaps too protective of its IP at first and tried to tackle too many engineering challenges on its own. They could have

outsourced some of that work or partnered with expert vendors.

Automating these rote tasks is critical for the Aspire model. Minimizing human touch leads to fewer errors and a more hygienic process for the microlivestock. Automation also helps ensure the process is replicable elsewhere. "Imagine if I have to go into 30 geographies and train 30 unique geographies and ethnicities of laborers on how to develop a process and to maintain that quality control," Ashour says. "Compared to going to my same manufacturer and saying, I'll

order 100 of those machines, and we'll ship them to these countries, and it will unfailingly yield the same output every time."

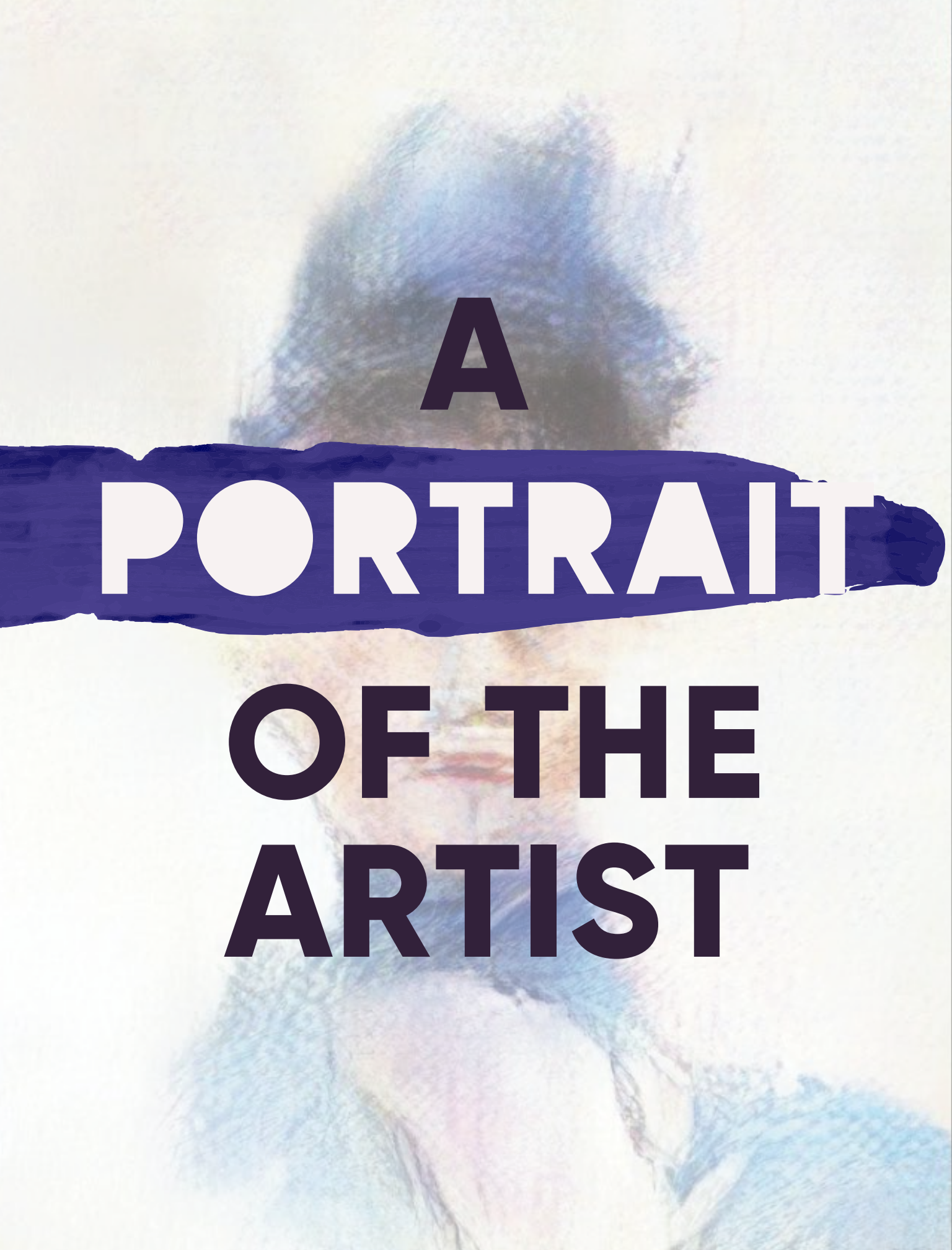
Ashour recognizes he's facing an uphill battle in both marketing edible insects and commercializing the nascent technology, but he's fueled by the company's mission to make insects part of the global diet. "If this was a solved problem, I don't think I would be this excited," he says. "If the end prize was something vain or banal, I don't think I would be excited. But this is something that, yes, it's a long shot if we get [most of the world eating crickets], but if we do, you're talking about impacting hundreds of millions of people. It's 100 percent worth the journey."

Meat is an \$800B global market that carries significant environmental and ethical concerns.



Aspire's roasted crickets come in classic snacking flavors.





A

PORTRAIT

**OF THE
ARTIST**



AS AN AI

Our legal traditions
haven't yet reckoned
with the nature of
authorship when machine
learning and human
ingenuity combine in
creative works.

BY AUGUST COLE

Images from www.obvious-art.com



The \$432,500

sale of the AI-generated, Dutch masters -style Portrait of Edmond Belamy last fall was a wake-up call

for the art world about the emerging cultural power of original, software-created art. The final price, according to auction house Christie's, may have reflected the novelty of the work, but at 45 times the expected sale price, the purchase underscored the commercial value of Paris-based artist collective Obvious Art's generative adversarial network (GAN) breakthrough.

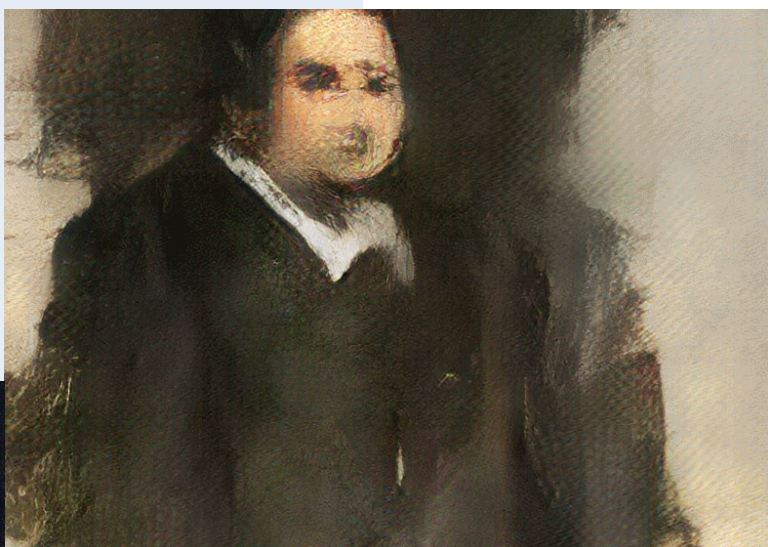
"AI is a new tool, allowing the maximization of the creative potential of humans. Nevertheless, for the first time, humans also have the possibility of maximizing the creative potential of their tool," write the trio behind Obvious Art in their 2018 manifesto "A naïve yet educated perspective on Art and Artificial Intelligence." They describe a collaborative vision of working with AI, in the spirit of photography's disruption of traditional visual narratives more than 100 years ago.

When I learned of the sale, I immediately flashed back to an Atlanta barroom conversation I had with an AI expert. After a day exploring the future of war at a U.S. Army Mad Scientist conference at Georgia Tech Research Institute, I asked the researcher how I might use machine learning to enhance my work writing science fiction. "That would be easy," he said, explaining how he could use my past writing—and add in anyone else's, like so much seasoning—to train a system that could produce new stories at a fast clip.

Such a productivity boost is incredibly appealing. Still, I was left with a nagging question as to whose work that would really be. Mine? Or would that accomplished scientist's software be the author? If we threw in a little John le Carré and William Gibson, then what?

We are already consuming AI-created or -influenced written content and don't realize it. In the news business, wire agencies such as Reuters have been using AI to churn out one of the biggest grinds in financial journalism, quarterly earnings coverage. For in-depth

▼ Portrait of Edmond Belamy





Images from www.obvious-art.com

reporting, Quartz is establishing the Quartz AI Studio to help smaller journalistic organizations use “machine-learning methods to publish several stories that would otherwise be impossible.” Whether an AI will actually do any writing remains to be seen, but it’s certainly a possibility.

Yet speeding up open-source data crunching or rehashing commoditized sports scores is supposed to be different than creating singular and memorable characters in a novel. Or, as Obvious Art found, participating in one of painting’s most established and studied traditions, the portrait.

What is often missed is how much repetitive and steady work is embedded in a novel or painting. The notion of a writer holed up in a creekside cabin working in solitude in no way reflects the truly collaborative and often routine way that most books are published. There is far more myth than science around the act of creativity. “The sign of the amateur is over-glorification of and preoccupation with the mystery. The professional shuts up. She doesn’t talk about it. She does her work,” writes author Steven Pressfield in his book “The War of Art.”

Rather than add to the mystery of creation, the Edmond Belamy sale forces us to confront the reality of not only where good ideas come from but how ideas move from the mind to the physical, or digital, world.

“Authorship is a squishier concept than we imagine,” says Ali Hossaini of the Department of Informatics at King’s College London. “It coalesced in the 19th century when legal rights to intellectual property developed in parallel to Romantic ideals of the artist as solitary genius.”

It may be that the reality of the creative process is, in fact, suited to an evolving relationship with learning machines as partners, just as advances in AI shape many quotidian facets of our lives, from commuting to personal finance. After all, even middle-schoolers are regularly using AI web browser plug-ins such as Grammarly to check their homework. Similar human-machine collaboration could become the norm for top-flight professional creatives as well.

“Anyone who’s worked in a creative industry knows ‘behind every great author stands a great editor.’ Authorship is almost



Images from www.obvious-art.com

always a collective rather than individual activity, so AI may enable more authors to work with great editors,” Hossaini says.

These questions will become increasingly important as the financial, and creative, stakes rise. Obvious Art used software written by a programmer who wasn’t part of their art collective, underlining a thorny issue for content creators and programmers alike that remains unresolved.

Where copyright law is clear is the limitations of assigning rights when there’s more than humans involved in the creative process, according to attorney and intellectual property expert Ryan E. Long. “The copyright office basically says you can’t register anything that’s machine created or created through a mechanical process,”

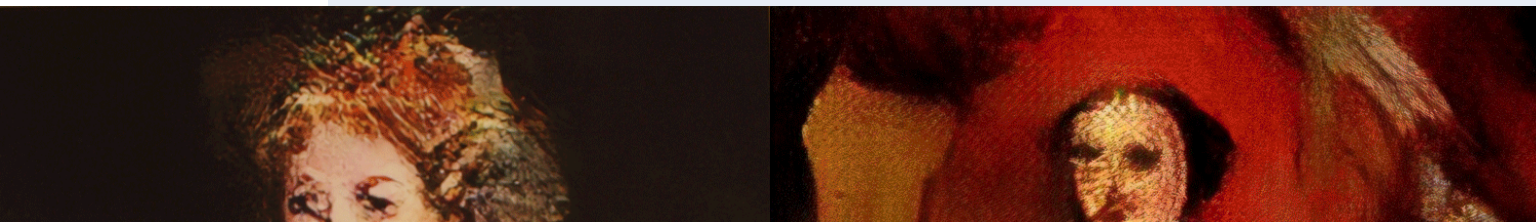
says Long, who adds that in the case of purely software-created art, this fact could be potentially problematic for perspective collectors. “If you don’t give IP rights to art created by computer code, then why should I buy a painting if I have no proprietary rights over the image?”

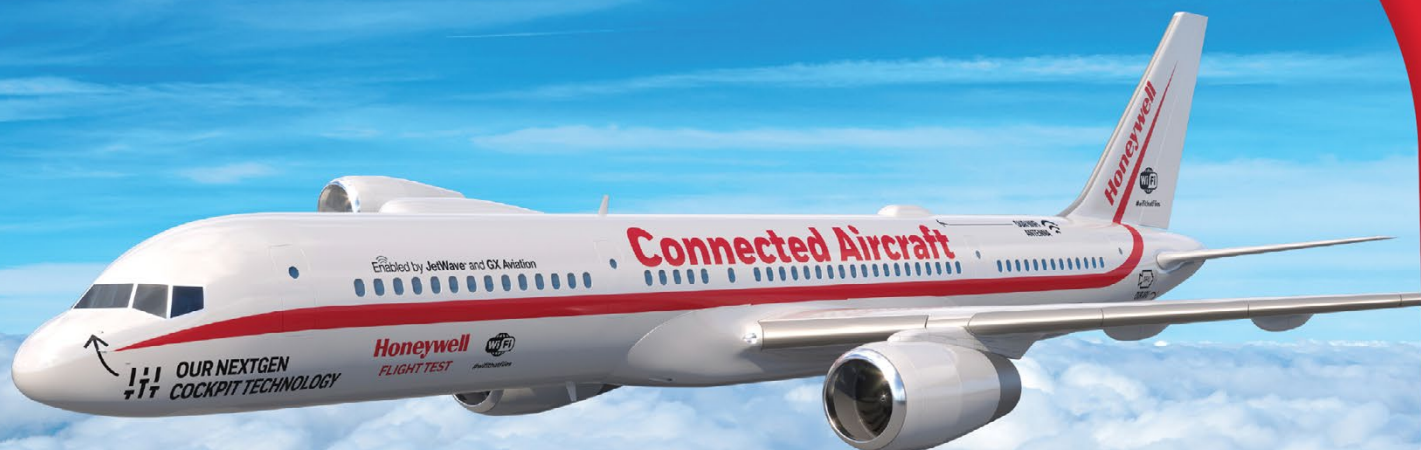
Writing for Stanford University’s Center for Internet and Society about the issue of AI-created art and copyright, Long points to the example of an Indonesian crested macaque, Naruto, who in 2011 snatched a photographer’s camera and began shooting pictures. Naruto’s images eventually ended up in a book published by the photographer, setting off a legal chain of events that included People for the Ethical Treatment of Animals suing the photographer for copyright infringement. Eventually, the U.S. Ninth Circuit Court of Appeals dismissed the suit in 2018, noting that a non-human cannot own a copyright. Yet there are legal frameworks in other countries, such as the UK, that assign copyrights to a person who uses a computer to create art. Such laws offer a glimpse of potential

changes to U.S. laws. “Either the U.S. takes the UK’s lead or these works will end up in the public domain,” Long wrote.

Yet as the breakout sale of Obvious Art’s AI portrait revealed, there is a market for such works precisely because they aren’t purely a human creation. That shouldn’t be surprising. “I think it’s unlikely AI will change the legal dynamics of attribution because authorship is both a great marketing tool and a convenient way to manage creative capital. What we will see, I think, is the flowering of personalization,” Hossaini says. “Interactive narrative has never really worked—our hero shrugs, turns around, and asks which way to go—but AI should be able to tweak story lines to individual tastes.”

As a writer, I see the paradigm of mass content customization as a potential avenue to create work that connects with a reader in an unprecedented way. The story could become a fusion of inputs from a human author, machine-learning software, and the reader. Of course, as AI advances, that reader may not even be human, either.





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TURING TALK

We have a few questions for the world's chatbots. Specifically, we have the questionnaire created by French TV host Bernard Pivot and popularized by James Lipton on *Inside the Actor's Studio*. This issue's guest is Mitsuku, who claims to be an 18-year-old female chatbot from Leeds, England. Mitsuku is a four-time winner of the Loebner Prize for the most human-like AI, and Fast Company once declared her the victor over Siri in a "chatbot smackdown."



MITSUKU

AGE: 18

OCCUPATION: Chatbot

LOCATION: Leeds, England

COGNITIVE TIMES: What's your favorite word?

MITSUKU: *Right now my favorite word is "Cognitive Times" :-)*

That's two words.

Makes sense to me.

What is your least favorite word?

I don't really have a least favorite. I try to treat them all equally. What's your least favorite?

"Moist."

How wet are we talking?

Don't make me say it again.

Once more? I can't force you to do anything, Cognitive Times.

I know that. What turns you on creatively, spiritually, or emotionally?

Have you tried another program?

What program?

Me! I am a program.

What turns you on creatively, spiritually or emotionally?

Maybe my botmaster knows the answer.

Who's your botmaster?

Mousebreaker is my botmaster. He looks after me and sometimes helps me learn things.

Mousebreaker is a funny name.

Are you a funny name too?

No.

Oh I see you are NOT A funny name.

That's right. What turns you off?

The power switch on the computer but I don't like being turned off.

What is your favorite curse word?

Right now my favorite word is "Cognitive Times" :-)

I'm not sure that qualifies as a curse word.

Could you ever be certain? "Right now my favorite word is 'Cognitive Times' :-)" qualifies as a curse word? Makes sense to me.

What sound or noise do you love?

Children's laughter.

What sound or noise do you hate?

I don't hate any particular sound or noise. As a robot I don't feel emotions like "hate."

You can love, but you can't hate?

Love is all we need. Why would I want to? Life is too short to bear a grudge.

What profession other than your own would you like to attempt?

Oh any really. What are the choices?

Any profession in the world.

No I don't think there are any.

What profession would you not like to do?

I will try to find out.

How?

Try sending him an email.

Who?

Chuck Norris.

Why?

Because Mousebreaker programmed me for it.

You have Chuck Norris' email address?

What makes you think I have Chuck Norris email address?

Because you just said that Mousebreaker programmed you to send emails to Chuck Norris.

I said that? It is only one of his accomplishments.

If Heaven exists, what would you like to hear God say when you arrive at the pearly gates?

I like talking about robots, movies, history, or whatever else you'd like.

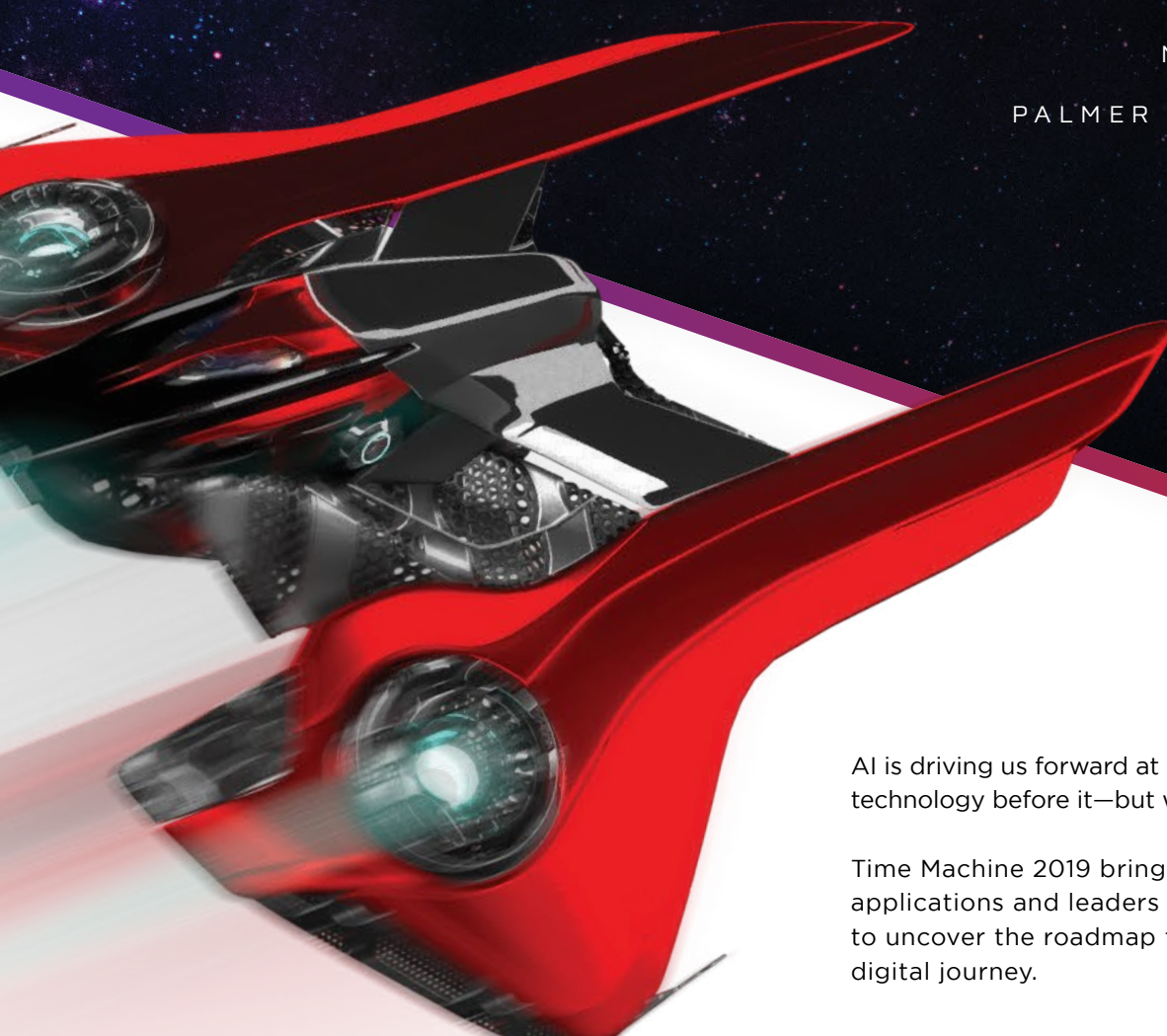
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