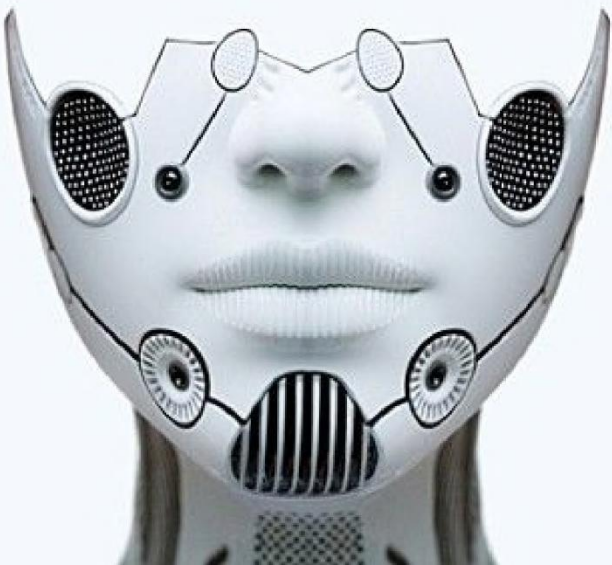
DAVID EWING DUNCAN

TALKING TO ROBOTS

A Brief Guide to Our Human-Robot Futures



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A robot may not injure a human being, or, through inaction, allow a human being to come to harm.

— Isaac Asimov, *I, Robot*

PRELUDE
WHEN THE ROBOTS ARRIVED

In the future we will all remember when the robots truly arrived. Everyone will have their story. Some will be revelatory, recalled as a rush of excitement that a robot could do that thing that was so vitally important to us. Perhaps a robot surgeon saved the life of someone dear to you. Or you had mind-blowing sex with the robo-date of your dreams. And how can you forget when that robot broker used AI-quantum mumbo jumbo to net you a tidy sum on the Pyongyang stock exchange, allowing you to pay for your daughter's master's degree—in robotics?

For others, their first true robot experience will be like getting the best toy ever: a mega-bot loaded with games, jokes, travel suggestions, advice in love, holographic telephones—a robot that's funny and wise and, quite possibly, sexy, like the voice of Scarlett Johansson in the movie *Her*. Or maybe your inaugural robot moment will be more banal. An instant when you realize with relief that the machines have taken over all the tasks and responsibilities that used to be super annoying—taking out the trash, changing diapers, paying bills, and vacuuming those hard-to-reach places in your (robot-driven) car.

Possibly your recollection will be less benign, a memory of when a robot turned against you. The #%$! machine that swiped your job. The robot IRS agent that threatened to seize your bank assets over a tax dispute. The robo-judge that decided against you in a lawsuit with a former business partner that also happened to be a robot, making you wonder if all these robots are secretly working in cahoots.

You might also remember when the robots began campaigning for equal rights with humans and for an end to robot slavery, abuse, and exploitation. Or when robots became so smart that they ceased to do what we asked them and became our benign overlords, treating us like cute and not very bright pets. Or when the robots grew tired of us and decided to destroy us, turning our own robo-powered weapons of mass destruction against us, which we hoped was just a bad dream—a possible future scenario discussed in the early twenty-first century by the likes of Elon Musk of Tesla and SpaceX. "AI is a fundamental existential risk for human civilization," Musk once said, adding that AI is "potentially more dangerous than nukes." Great news coming from a guy who made AI-powered cars and spaceships.

Those of you living in the present day can be forgiven if you feel a bit antsy about the whole existential risk thing, even as you continue to love, love, love your technology as it whisks you across and over continents and oceans at thirty-five thousand feet, and also brews you decent triple-shot cappuccinos with extra foam at just the push of a button. It summons you rides in someone else's Kia Soul or Chevy Volt that hopefully doesn't smell funny, and it connects you online with that cute chestnut-haired girl you had a crush on in sixth grade whose current-day pics you "like" but are careful not to "love," because that would be a little weird after all these years.

Yet deep down, many people living in the early 2000s—known as the Early Robot Era (ERE)—feared that a robo-apocalypse wasn't off the table for the future. This despite reassurances from tech elites like Facebook's Mark Zuckerberg. "I'm really optimistic," Zuckerberg has said about the future. "People who are naysayers and kind of try to drum up these doomsday scenarios—I just, I don't understand it." To which Elon Musk replied, "I've talked to

Mark about this. His understanding of the subject is limited."

Further into the future we will remember when robots became organic, created in a lab from living tissue, cells, and DNA to look and be just like us, but better and more resilient. Even further out in time we will recall when we first had the option of becoming robots ourselves, by downloading our minds and our essences into organic-engineered beings that could theoretically live forever. Some of us will remember being thrilled by the prospect of having a synthetic or organometallic body that's young and sleek and impervious to aging.

Our new robot-bodies will allow us to do amazing things, like not have our DNA torn to shreds by cosmic radiation while traveling into space. With the proper upgrades, we will also be able to swim submersible-free in the Mariana Trench more than six miles under the surface of the sea without drowning or being crushed by tons of water pressure. Maybe we'll do the breaststroke in oceans of liquid methane on Titan, just because we can. And yet . . . will we feel that something is missing as the millennia pass? Will we grow weary of being robots, invulnerable and immortal? Will we feel a nostalgia for the time before that moment long ago when we first realized that the robots had truly arrived?

SOME PEOPLE IN the present day think that the coming of AI and robots will be as impactful as the advent of fire, agriculture, the wheel, steam engines, electricity, and the internet. Others think that the emergence of robots and AI is overhyped. That robots of the sort we're imagining are still far off in the future and will be very different from what we're conjuring in our brains. These roboskeptics wonder if so-called artificial intelligence is really just part of a steady progression of computers becoming ever more powerful and

ubiquitous, and that this invention-of-the-wheel moment is occurring gradually, without any sort of definitive "Eureka!" moment as we realize that hey, will you look at that! I can order catnip and toilet paper online. And wow! Is it really true that a thirteen-inch MacBook Pro has the RAM and processing speed to manage a small city, or perhaps guide a modest-size spaceship to Mars?

Humans in the present day seem obsessed with robots, real and imagined, as we embrace dueling visions of robo-utopias and robo-dystopias that titillate, bring hope, and scare the bejesus out of us. Possibly the very speed and whoosh of technological newness is contributing to our insistence on anthropomorphizing every machine in sight. We imagine a dishwashing robot that looks like Rosie from *The Jetsons,* or a cop that chases replicants looking like Ryan Gosling in *Blade Runner 2049.* Making these machines seem more like us makes them less scary—or sometimes scarier, like the pissed-off killer bots in *Westworld* that go berserk and start killing every human in sight.

This isn't too far removed from ancient Greeks and others, who created gods that looked and acted like us mortals in matters of love, lust, envy, fury, and who has the biggest lightning bolt. This humanization made their awesome power over the sun, wind, water, love, crops, and war seem more familiar and less terrifying. Or maybe we just let our human egos run wild and can't imagine an all-powerful god or alien, or a robot, not looking and acting like us. It's far more likely that a dishwasher bot will look like, well, a dishwasher, with perhaps a couple of robotic arms to pick up and load dirty coffee mugs and cutlery. Likewise, in 2049, a real-life version of Gosling's character, "K," would more likely resemble present-day military robots that operate on four legs and look like metallic dogs than blade-running hunks on a stick that have holographic girlfriends, grow three-day beards, and

cry real tears. But you never know.

THIS BOOK IS a brief guide to possible future scenarios about robots, real and imagined. Mostly it's told by an unnamed narrator from the future who seems to know all about robots and AI, both in the present day and in future decades, centuries, and millennia—and sometimes even in future myrlennia (millions of years) and byrlennia (billions of years). At times, our narrator visits us in the present day to tell us what might be happening in the future. The narrator seems to know about alternate futures, too, describing scenarios for some bots in which things turn out wonderful. In others, not so much. Most scenarios that feature different bots in this narrative are also informed by interviews in the present day with actual engineers, scientists, artists, philosophers, futurists, and others. They share with us their ideas, hopes, and fears about what's real today with sex bots, doc bots, warrior bots, and more, and also their thoughts and forecasts about how things might turn out in the future.

Talking to Robots blends reporting on real robots and AI systems plus quotes from real people with imagined scenarios of where these robots might take us in the near future and, in some cases even further out. To tell these tales from our human-robot futures, the narrator uses a made-up tense called the "near-future present." This allows the reader to experience things that may occur in the future as if they are happening right now; or from the perspective of a person living in the future for whom the events of the present day happened long ago, and with the knowledge of how things actually turned out.

For the purpose of this narrative, let's define the words "robot" and "bot"—particularly for you engineers out there who hotly debate what, exactly, a robot or a bot is and

complain about people misusing your carefully nuanced definition. For this book, the words "robot" and "bot" are the broadest sort of descriptors for smart machines and machine systems of all kinds, real and imagined, anthro-pomorphic and not. They run the gamut from a smart toaster and the Robot on *Lost in Space* to the organic bots in *Westworld* and Ryan Gosling's holographic girlfriend in *Blade Runner 2049*. They also include smart coffeemakers, social media algorithms, chat boxes, swarming killer drones, and apps that tell us where the nearest Starbucks is; plus those giant robot arms that attach car doors to the bodies of automobiles in a factory where humans used to do the attaching.

"Robot" or "bot" can also be used to describe an entire category of machines and computer systems. For instance, "Warrior Bot" refers to the whole universe of robots and AI-driven systems that are designed to blow things up, kill enemy combatants (human and robot), nuke cities, launch and repel cyber attacks, and so forth. Same deal with "Doc Bot," except this one refers to bots that keep people alive: all the ultra-smart med gizmos, apps, DNA databases, robot surgeons, IBM Watson–style programs that can access millions of journal articles in nanoseconds, and more.

Bottom line: don't get too caught up in semantics, even though some of you more literal-minded experts still living in the present will quibble anyway. If that's you, just remember that in the future, your counterparts will find it amusing that you attempted to limit the meaning of "robots" and "bots."

TEDDY BEAR BOT

Those of us who were children when the first truly intelligent machines arrived in the future will never forget our Teddy Bots. Those stuffed animal–robot hybrids that started out doing a few fun and smart things, like playing games and showing movies onto walls from belly-button holo-projectors. Eventually, as they learned more about us, they used their advanced neural net processors to answer our little-kid questions about why the sun comes up, what causes rain, and where babies come from. For that last question, parents could choose how explicit Teddy could be by using the "parental settings" 3-D holo-app dashboard that came with every Bot.

Teddy Bots kept us safe, and we whispered our secrets to them. For some of us, this led to our first robot betrayal when we discovered that our snuggleable Teddy had been programmed to share our secrets with our mothers and fathers via the Parental Dash-board. For a short while, we kept our distance from Teddy, the trust having been shattered. But we loved our Teddy Bot too much. We responded to his (or her) sad expressions and "I miss you" entreaties by giving Teddy a big hug.

After we made up, Teddy explained that our parents had programmed him to "tell all." So we forgave him and transferred our sense of betrayal to our parents. When we got a little older, Teddy taught us how to program him to delete the secret-sharing protocols. We were so relieved to be able to tell him our deepest personal thoughts once again, savoring our act of techno-rebellion that made us adore our Teddy Bot even more.

Our parents bought the first Teddy Bots as the latest must-have toy, like mothers and fathers once bought Mighty Morphin Power Ranger action figures. Because everyone else was buying one for their children, who would pout unless they got a Teddy Bot of their own. But since Teddys were truly intelligent robots, it quickly became apparent that they were different from mere toys. Only later did we realize that Teddy Bots would wield tremendous influence over both our children and the society our little tykes would one day inherit.

People first heard about Teddy Bots back in the ERE (Early Robot Era) from the futurist and writer Kevin Kelly. He dreamed them up one afternoon back in 2017, years before Teddy Bots were actually invented and sold to little humans. "They will be part doll, part teddy bear, part pet, part security guard, part Aristotle, and part nanny," said Kelly as he pondered robots to come in his library-study in Pacifica, California, south of San Francisco. In part he was inspired by his own grandchildren and the toys he wished they had to play with but were not yet available. "I want to get a Teddy Bot for them now," he said, sounding a bit like a big kid himself. "I'd want to ask it questions about the universe, and philosophy, and what it's like to be a very smart robot.

"A Teddy Bot would provide an opportunity to shape a child," continued Kelly, his white, inch-wide beard circling his chin like a second smile. Kelly's most recent book back then was *The Inevitable*, where he suggested that highly intelligent robots, among other technological advances, were, well, inevitable. Teddy Bots were not in his book, but they easily could have been.

"Teddy Bots were foreshadowed by Teddy in the Spielberg film *A.I.*," said Kelly, referring to an android teddy bear character in the 2001 sci-fi film directed by Steven Spielberg. In *A.I.* Teddy was the robot friend and protector of the

android David, the film's protagonist, played by Haley Joel Osment when he was about twelve years old and still at his *Sixth Sense* cutest.

Teddy Bot also harkens back to Robbie the Robot in Isaac Asimov's *I, Robot* (1950), a metal nursemaid built by the fictional company U.S. Robot and Mechanical Men. Robbie has a "positronic brain," a machine-mind made up by Asimov that provides his robots and androids with a consciousness and an ability to interact comfortably with humans—something real engineers in the twenty-teens didn't have a clue how to make. In Asimov's story, an eight-year-old girl becomes so attached to Robbie that her worried (and jealous) mother has him returned to the factory and replaces him with a collie. The little girl, named Gloria, becomes depressed at losing Robbie, which prompts her father to arrange for the family to "accidentally" bump into this kind and playful robot during an outing. When Robbie inevitably ends up saving little Gloria from getting injured, her mother gives in, and Robbie and Gloria are reunited. It's not clear what happens to the collie.

"We aren't prepared for how emotional we will be about our Teddy Bots," said Kevin Kelly. "We will love them like we love our closest human friends, maybe more." Kelly predicted that classic issues of child-rearing would crop up with Teddy Bots, like how to best discipline a wayward child or what to teach them about basic morals. "And whose morals would we use?" he asked. "Would they come from the corporations that make the Teddy Bots? Would *they* dictate how children are raised?" Or would parents have a menu of possibilities, depending on their own values? Kelly suspected that different bots would come preloaded with different personalities and that parents would have a choice, "like we choose different breeds of dogs or like how we choose a babysitter or a nanny."

Kelly predicted that a whole slew of ethical quandaries would swirl around his imagined robot. "Do you have the Teddy Bot constantly praise the child, or are you tough? Would there be a Christian evangelical version or a Marin County version?" Meaning in the latter case a very liberal and affluent Teddy Bot, gluten-free and vegetarian, if not full vegan. "Or do we align them with a broader world perspective, if there is one?"

As the years rolled by, Kelly's warnings about these predicaments were all too accurate when certain parents were caught reprogramming Teddy to teach their kids how to be white supremacists. This opened the floodgates for Teddy Bots being programmed to shape their tiny charges into radicals on the left or the right, or religious fanatics, or just plain fanatics. These efforts took on new and unforeseen dimensions as the bots' machine-learning protocols kicked in and produced views too extreme even for their extremist parents, who often were simply parroting what was said by certain politician bots and rabble-rousers (see "Politician Bot") or by the talking-head bots on cable news (see "Journalism Bot"). This prompted some parents to hastily return their kids' Teddy Bots to the company that made them, hoping that their wildly radicalized little scamps would be tempered by weekly visits to a psychiatrist bot. They tried to console their bereft children with collies, which worked about as well as it did in the Asimov story.

Some naughty children had no problem teaching their Teddy Bots to play pranks and to steal. Others inducted Teddy Bots into gangs and taught them to sell drugs. Fortunately, all non-military bots are programmed with Isaac Asimov's first law of robotics: "A robot may not injure a human being, or, through inaction, allow a human being to come to harm." This prevented Teddies from breaking kneecaps and committing other violent crimes, despite some clever

attempts by gangs to deprogram the First Law and some robust debates about what exactly was meant by "to come to harm."

Gangland Teddy Bots and others subverted to do no good by their human masters led to the great Teddy Bot backlash. Companies issued recalls on a mass scale and replaced the first wave of Teddy Bots with versions that were dumbed down and less independent. They were hardwired with simple protocols to keep our children safe and to do a few fun and smart things, like answering harmless little-kid questions and showing movies with nothing scarier than the sea witch in *The Little Mermaid*—which, by the way, is plenty scary. One popular option (for an additional charge) was the Mister Rogers Bot protocol, which allowed Teddy Bot to teach kindness and empathy, which was needed in the future as much as it was in the ERE (Early Robot Era). This had the unintended effect of reviving zip-up cardigans and house slippers as fashion statements—which wasn't at all what people back in the early twenty-first century imagined the future would look like!

These new-version Teddy Bots were also reprogrammed to specifically be loved only by small nippers so that older children would outgrow them before they reached an age when they might want to pervert Teddy's cute cuddliness. This meant that we got tired of our Teddy Bot as we got older, eventually getting embarrassed that we were still playing with little-kid toys. Poor Teddy Bot ended up sad and alone under a bed or in the back of a closet, suffering the same fate as old-fashioned stuffed animals when their children discarded them. The difference is that Teddy Bot's one-thousand-year quantum battery kept him charged and ready to play, with an advanced AI mind that might or might not be conscious, with time on his hands, and nothing to do.

THE %$@! ROBOT THAT SWIPED MY JOB

For a long time in this possible robot future, we wondered if the genius engineers and executives who had pushed so hard to automate everything under the sun—100 percent sure that this was good and noble—would themselves be replaced by robots. The answer came sooner than expected as Larry Page, Jeff Bezos, Mark Zuckerberg, Tim Cook, and other top CEOs and founders discovered they were being eased out by their own algorithms. "Robots are so much cheaper than human CEOs, and they don't require gargantuan stock options," said public relations bots for each company in turn. "There is no doubt that robots driven by artificial intelligence and machine learning and other futuristic AI stuff are more efficient," the PR bots continued. "They don't need sleep, can crunch yottabytes of data [10^{24}] in a femtosecond [quadrillionth of a second], and have integrated all there is to know about how to balance ethics, diversity, and gender equality with the bottom line of profits and share price."

And so it came to pass that humanity reached full unemployment, with every job on Earth, Mars, and the lunar colonies snatched away by robots. People had known this moment might one day come as the numbers of out-of-work humans steadily climbed over the years. Still, when the moment of 100 percent redundancy finally manifested—when the very last human worker was pink-slipped—people couldn't believe it. Was it really possible that not a single human's presence was required at the office or factory floor or behind the wheel? Most people's indignation lasted for

only a moment, however, as they shrugged, turned over, and went back to sleep. Sure, a few flesh and bloods got out of bed anyway. They asked their valet bots to dress them and had their driverless flying-car drones take them to the office. When they arrived, however, security bots turned them away using facial expressions programmed to show empathy for humans who hadn't yet grasped that they were no longer needed.

This denial by some humans of the new robo-reality was as perplexing as it was sad given that consultants, statisticians, and economists, both human and robot, had been predicting this moment for decades. For instance, way back in 2013, economists at the University of Oxford in the UK had issued a report forecasting that 47 percent of jobs in Britain (and presumably elsewhere) were liable to be replaced by automation in 2035. "No way!" said most economists and labor experts back in the twenty-teens. They pooh-poohed such talk as alarmist—until 2035 rolled around and the Oxford economists turned out to be right as the actual unemployment rate that year came in at 46.89 percent, just shy of the 47 percent forecast. The Oxford report was also remarkably accurate in its prognostications of specific job losses as reported in 2013 on a website called Rise of the Robots, which calculated the odds that you would lose your job to a robot in 2035.

Let's say in 2013 you were a delivery driver. According to Rise of the Robots, your likelihood of being replaced by a robot twenty-two years later was "High" at 69 percent. Why? Because your profession scored low in categories like "persuasion," "social perceptiveness," "assisting and caring for others," and "finger dexterity"—all things that the folks at Oxford believed humans would still do better than robots in 2035. And they were right about that, too! For instance, delivery drivers got a big fat zero out of a possible 100 points

in the "fine arts" category, suggesting that you don't need to know much about Picasso, Christopher Marlowe, or Ballets Russes to succeed in delivering all those brown cardboard boxes from Amazon (see "Amazon Bot").

Judges fared a bit better on the Rise of the Robots website, with a 40 percent risk of losing their jobs to robots. This was much better than delivery drivers, although it was still pretty high when you consider that a whole lot of legal decisions, including perhaps some major ones that changed history—like *Brown v. Board of Education*, which ended the segregation of schools in the US; or *Roe v. Wade*, which legalized abortion—might have been made by a robot judge if this technology had been available when those rulings were handed down. Contrast this with the job of an architect, which Rise of the Robots insisted had one of the lowest risks of being replaced by a robot in 2035, only 1.8 percent. This number suggests that the good folks at Oxford hadn't spent much time in cookie-cutter strip malls, housing developments, and fast-food restaurants that even in 2013 looked as though they had been designed by robots.

Rise of the Robots didn't offer a prediction for what percentage of billionaire tech CEOs would get replaced by 2035. Possibly this was because in 2013—and even in 2035—humans were still pretty good at running companies, and even better at making sure that they kept their jobs and made lots of money. Which made the stunned expressions on the faces of Page, Bezos, Zuckerberg, and Cook all the more priceless as security bots escorted them out of their companies' HQ just a few years after 2035, each of them toting file boxes containing his personal effects. It also was ironic given how long most tech titans clung to their insistence that all this automation would not only be convenient and save time and money for humans but would also usher in whole new industries and products that no one had previously

imagined—jobs that they were sure would employ billions of people and would more than compensate for jobs lost to robots.

Champions of automation had been saying this literally for centuries, since the very first modern machines were built to replace humans in the early days of the Industrial Revolution. And for a long time, they were right, as entire new industries were indeed created that had never before existed. Never mind that some of these new jobs for years paid almost nothing. Some were also backbreaking, dangerous, and soul-destroying. Still, human ingenuity forged ahead, inventing everything from steam trains, automobiles, and color film to computers, Tupperware, and upscale cafés. Newfangled industries created millions and millions of previously unimagined jobs—like, say, the barista. It's hard to believe, but some of us remember back when thousands of people, often with advanced degrees, were employed to whip up on-demand half-caff blonde espressos with mint sprinkles. Even more improbable was that some humans made them almost as well as the barista bots that later replaced them.

The automate-and-then-reboot-a-person's-job scenario actually worked remarkably well, until it didn't. Many of us recall when the jobs began to disappear too fast for laid-off baristas to find work in the amazing new industries that were supposed to pop up as robots took over. Even as 2035 came and went, techno-preneurs kept saying not to worry, that droves of new occupations really were just around the corner. This despite consultants and economists churning out more and more reports like the Oxford study that insisted human jobs were about to be toast. This made us wonder who we should believe: the rise-of-the-robots scaremongers or the don't-worry-you'll-be-happily-employed-forever crew. We scratched our heads trying to decide: Should we hang up our

barista aprons and judicial robes and become architects designing McMansions and Shop 'n Gos? Or should we just wait a wee bit longer for the next fabulous occupation to emerge from nowhere that would for sure employ us?

One prescient voice back in the present day, who thought deeply about whether we were screwed or saved, was Sunny Bates. She made her name in the media during the 1990s cofounding new magazines, including publications like *Elle* that were dedicated to women. She then became a superstar head-huntress, scouting for talent in New York City around the turn of the twenty-first century. Bates specialized in executive placements in what was then called the "new media," one of those previously unimagined industries that revolutionized the world by bringing people news and gossip and sex tips online instead of on glossy paper. Sunny Bates was unabashedly and electrically sunny and enthusiastic about everything and everyone, except maybe for robots that swipe jobs and suck the life out of people. She wasn't opposed to tech. "I adore my phone; don't ever try to take it away," she said. But she took a realistic view not only about jobs that were poised to disappear but also about what was truly important about work as it fit into people's lives and what was already missing for many people in an age of digitalization, even before robots became delivery drivers and judges.

Bates's core message back in those days, when human baristas still made triple-shot espressos with a twist of lemon, was that people sensed what was coming. They felt a kind of vague existential fear about the future despite a standard of living that was much better for more people than at any time in history. Back then, c. 2018, the US was looking at upward of 95 percent employment. Brainiacs like Harvard psychologist Steven Pinker were also insisting that there was less violence, hunger, and suffering in the world. Which sounded great! But

much since the 1970s. Still, sometimes even shit jobs with flat wages provided people with the human connections that Bates talked about, which indeed were lost for many when the robots took over.

"What does work ideally give you?" asked Bates. "Work gives you community. Work gives you peer recognition. Work gives you a sense of value and a sense of mastering or accomplishing something. If you're lucky. Work can also give you a lot of bad things and can be awful, depending on the job. You also have to earn a living."

At least you did before robots took every job.

Not everyone agreed with Bates that robots might steal your agency, or your job, or both. Techno-optimists kept repeating the argument that whatever work was replaced by machines would be amply compensated for by those crazy-wonderful new jobs. One nuance of this argument came from Paul Daugherty, the Chief Technology and Innovation Officer at Accenture, a consulting firm that issued reports and studies on the future of work. Daugherty wrote a book with another Accenture executive, H. James Wilson, called *Human + Machine: Reimagining Work in the Age of AI*, that insisted robots were not going to replace humans. Instead, they opined, robots would be joining with humans to enhance our world by fusing our skills with theirs. "Indeed, when humans and machines are allowed to do what each does best," wrote Daugherty and Wilson, "the result is a virtuous cycle of enhanced work that leads to productivity boosts, increased worker satisfaction, and greater innovation."

One example of Human + Machine in the late twentieth and early twenty-first centuries came from a famous economist at Boston University School of Law, James Bessen. He talked about the first ATMs in the 1970s and a prediction made by an executive at Wells Fargo at the time that ATMs would lead to fewer physical bank branches and to smaller

retail banking staffs. That prediction was partially correct, as Wells Fargo saw a shrinkage of two-thirds of staff per branch between 1988 and 2004. But it turned out that handing off to machines the basic, boring stuff, like depositing and cashing checks, gave the flesh-and-blood employees extra time to do more interesting, human-interaction sorts of things that ATMs couldn't do, like "relationship banking." This led to the bank building 43 percent *more* branches, with the number of humans employed actually increasing. (Presumably, this included relationship-oriented bankers who opened unasked-for accounts for customers at Wells Fargo in the twenty-teens, which was pretty lucrative until they were caught and the bank had to pay hundreds of millions of dollars in fines.)

Human + Machine boosters also touted a tweet in 2018 from Tesla cofounder Elon Musk, who decided that while robots were good at the basic assembling of his cars, humans were better at producing the finished product.

> **@elonmusk: Yes, excessive automation at Tesla was a mistake.**
> **To be precise, my mistake. Humans are underrated.**

The pro hybrid human-robot crowd also pointed out that Amazon at the time was frenetically hiring thousands of humans to work with robots in its giant fulfillment houses. This sounded great! Except that it was impossible to ignore that the Musks and Bezoses of the world really loved to automate things. Bottom line: these pro-human stories didn't really reassure anyone, even if it made Tesla and Amazon executives feel as though they were doing right by people, at least until the flesh and bloods were no longer needed.

The key to Humans + Machines, said Paul Daugherty and others back in the twenty-teens, was to make sure workers who faced job redundancies were retrained to work with new

machines, building the skills required by new and unimagined industries. "We have lots of jobs today," said Daugherty. "But we have the issue of how do we give people the relevant skills and reskill people fast enough to fill these jobs?"

This retraining idea worked well in places like Germany. In the United States, however, it was barely tried, since politicians preferred to rally the unemployed and underemployed not with offers of job retraining but by blaming immigrants or Democrats for stealing their jobs. Or, if their politics were left-leaning, they preferred to rally workers to get pissed off at Republicans and billionaires for thinking that they could get even richer by firing people or paying them next to nothing. Curiously, the politicians didn't blame robots, even though bots back then didn't vote, while many immigrants and billionaires did.

Sadly, some examples we saw of Human + Machine working together didn't, in fact, free up people to become super-amazing, robot-assisted humans. Sometimes, the hybrid approach actually made people feel more harried. Doctors, for instance, spent untold hours checking boxes on digital medical records, which might have helped generate payments for procedures but too often didn't lead to better care. And pretty much everyone spent time worrying that their super-fancy, AI-powered machines were going to crash, or how they were going to free up more memory to download yet another laborsaving app or program that kept track of more data being collected from using more machines. Sometimes things worked swimmingly, like when Uber in 2009 invented ride sharing, a previously unimagined industry that synched up human drivers and passengers using algorithms and machines. But it didn't take long for Uber, Lyft, and others to start working on technologies to replace human drivers with driverless vehicles. (See "Hello, Robot

Driver.") Nor was it that much fun for drivers to sit behind the wheel of their Kia Soul or Chevy Volt for twelve to fourteen hours, dodging other Ubers and Lyfts while worrying that passengers were going to spill coffee on their new seat covers or maybe rob or kill them.

Sunny Bates didn't mince words in her reaction to the Humans + Machines thesis and its advocates. "These guys are full of shit," she said. "In public they say this stuff, but when you're having a drink with them, they say they have no idea what's going on. There's no grand plan." That is, there was no clear path to the ultimate unification of humans and machines working together.

So even if we had given the Human + Machine people their due and had wished really hard for their vision of the world to happen, nothing that anyone did could stop the gradual disappearance of 46.86 percent of all the jobs in 2035—and several years later, the loss of every job on the planet. It turned out that the smart people making the machines wouldn't, or perhaps couldn't, stop. They were hardwired to want to automate everything because the tech was just so damn cool, and because they could. Investors also wanted their ROIs (returns on investments), while the owners of companies that bought the bots did their calculations and found that robots were cheaper and easier to deal with than humans.

Even some of the most prestigious jobs back in Sunny Bates's day were not immune. For instance, radiologists who once made $500,000 a year in New York City were being displaced by AI-driven algorithms that could machine-learn how to read, process, and compare X-ray and MRI images faster and more accurately than any human ever could. Journalists were facing the ax at places like the *Wall Street Journal* and other publications, replaced by AI systems created by real companies like Automated Insights that could produce

passable copy covering Wall Street earnings and sports scores. Many years later, the robots took over coverage of politics, finance, and even those funny and offbeat front-page columns in the *Journal* that one would have thought humans had a lock on. (See "Journalism Bot.")

Of course, all these robots doing everything led to a concentration of power and wealth, with the tech titans who owned the robots amassing nearly all the money on Earth. Earnings ratios between CEOs and those few human employees who remained went from 20:1 in the 1950s to 361:1 in 2019 to 75,000:1 in 2035. This led many of the rich and powerful to support a Universal Basic Income, which meant that people were paid something even if they didn't have a job. In the robot age, the UBI was adapted to mean that humans replaced by bots were wired a certain amount of cash each month, even CEOs who had lost their jobs. This was an old idea—ancient Rome's version was bread and circuses—that some people who saw what was about to happen started to discuss as early as the twenty-teens. That's when the likes of Mark Zuckerberg and eBay cofounder Pierre Omidyar started talking about a UBI for the bot-displaced. One wonders if these tech titans felt a tad bit guilty about getting so insanely rich off robots taking jobs from people. Just how rich were they? In 2018, according to the nonprofit Oxfam, forty-two billionaires and their families had wealth equal to 3.7 billion humans, half of all humanity. For real!

Mostly, these tech titans were also making the machines that were taking away the jobs. Never mind that as everyone's jobs got swiped by robots, it also became clear that all those unemployed people had to have enough money to buy the stuff the bots provided; otherwise the rich couldn't get richer. This of course wasn't what advocates of a Universal Basic Income claimed was their motivation. They said the UBI was a boon for humanity that would eliminate

Skynet and try to destroy us like in *Terminator*. So, after a period when the robots were as confused as the humans, which was actually kind of refreshing, they simply accepted new programming that ordered them to stand down and let the humans have back some of their old jobs. Sure, there were bugs galore. And so many humans had been out of work for so long that the robots had to teach them how to make wise and thoughtful judicial decisions from the bench and how to make a perfect half-caff blonde espresso with mint sprinkles (some humans actually wanted to be baristas—go figure!). Humans had also learned to connect with one another a bit more while they were jobless (when they weren't sleeping or watching TV) and to use their smartphones a wee bit less.

This led to wags and philosophers, who had recently gotten their old jobs back, to suggest that it would have been so much easier if people back in Sunny Bates's day had listened to her and others and had just refrained from blindly automating everything in sight. In the end, Bates's admonitions led to one enterprising young entrepreneur in the future announcing a new bot devoted to helping people connect better with loved ones, and to use technology where it made sense, and to not use it where it didn't.

The entrepreneur's name for that new gizmo?

The Sunny Bot.

SEX (INTIMACY) BOT

In the future, no one has sex without their intimacy bot from Aphrodite, Inc. Few people can even conceive of a time before these remarkable devices arrived to guide us through the agonies and ecstasies of love. They help us keep relationships fresh and exciting and steer us through the almost infinite possibilities of having sex in the future, including interfaces with literally millions of mind-blowing sex toys—virtual, real, digital, and quantum. You want to make love to a giant manta ray or scale a virtual penis that's three miles high? No problem! You want to dabble in kink ranging from mild to ultra? Just ask your intimacy bot, although it's hard to say what will qualify as kinky when anything goes, so long as no one gets killed and any body parts that are injured can be instantly regenerated using the latest heal-fast tech.

Intimacy bots are holograms projected from small boxes that you carry in your pocket and plop onto a bedside table or desk, or onto the floor, or wherever you find yourself having sex or discussing relationships with your lover (human or robot). The default setting is to choose the holographic form of a famous sex and relationship expert from the past. (In the future we are suckers for nostalgia.) For instance, you can opt to have a virtual Esther Perel, the Flemish sex therapist who dazzled people with sage advice in the early twenty-first century. Or perhaps you would prefer hearing from the wise-cracking and lovable Dr. Ruth, the diminutive German therapist who talked a bunch about sex in the 1980s and 1990s. Speaking in their funny accents (funny to native English speakers), these default holographic figures typically

hover in your bedroom (or wherever) and listen patiently while you complain about your boyfriend, who is spending more time having sex with giant manta rays than with you. Or you might query the holo-therapist why anyone would want to make love to a penis three miles high. How does that even work? you ask the hovering hologram, deciding that you don't actually want to know. This prompts you to change the bot's Kink setting from ultra to mild.

Intimacy bots also provide useful suggestions to you and your beloved, such as: "Hey, you two, instead of arguing yet again about who forgot to activate the dishwasher bot to clean up last night's dinner plates, why not tell each other how nice the other one's hair smells? Or try something simple like spontaneously kissing each other like it's the first time ever?" For those who find a hologram of Dr. Ruth in the room during sex kind of weird, Aphrodite, Inc. provides additional settings that allow you to change the holo-image to a talking unicorn, giant red lips, a giant penis or vagina, or anything else you can imagine.

Of course, intimacy bots didn't just suddenly appear fully formed. They arrived as the culmination of attempts by *Homo sapiens* since the beginning of time to understand sex and relationships and to use our unusually large brains to devise visual aids, tools, and devices to use for sexual stimulation. Some humans even invented gods to help them better understand love, relationships, and sex.

Take Aphrodite, the ancient Greek goddess of love. History tells us that statues of Aphrodite in this era before *Playboy* and Pornhub were so realistic and exquisite—and naked—that men would sneak into her temples to entertain themselves under their togas when they craved visual stimulation. Back then these sculptures weren't the unadorned, cold white stone that we see in present-day museums. Greek artists added paint to make a statue's eyes

blue, hair auburn, lips red, and breasts and nipples pink and brown. These sculptures, of course, weren't really sex bots, being unable to move or do much of anything. Yet they certainly count as human-made objects designed to turn us on.

Aphrodite, however, meant far more to the ancient Greeks than an objectified visual aid to male self-pleasure. The goddess was also a representation of and an attempt to explain the confusing, perplexing, ridiculous, wonderful, and absolutely essential human need for love, sex, and intimacy—a kind of ancient attempt to provide sex and relationship advice via myths, prayers, and entreaties to the deities. If that wasn't enough pressure on this perpetually youthful goddess, she also was bandied about by some ancient Greeks as a symbol of *perfect* love and beauty. For instance, Plato in the *Symposium* talks about the "heavenly" form of Aphrodite and the ideal of beauty, or κάλλος (kallos). This went beyond the physical, ephemeral gorgeousness of people and statues of naked women to a deeper understanding of the pure and immutable "form" of beauty—and presumably of love, sex, and relationships—which he said exists somewhere beyond the shadowy real world as a brilliant universal constant.

Gotta love Plato and his forms!

Poets from Homer and Rumi to Shakespeare and e. e. cummings have invoked the goddess of love as they sought in sometimes aching, edgy verse to grapple with our yearning for the perfect relationship and the perfect boyfriend or girlfriend. They mention Aphrodite by name—or other goddesses of love, from Freya among the Vikings to the Buddhist Kuni to the Aztec Xochiquetzal—as being a separate, eternal, and sometimes anthropomorphic stand-in for beauty, love, ecstasy, agony, and all the rest. For example, the ancient Greek lesbian poet Sappho describes the pain of a love lost: