Experts say the rise of artificial intelligence will make most people better off over the next decade, but many have concerns about how advances in AI will affect what it means to be human, to be productive and to exercise free will

A vehicle and person recognition system for use by law enforcement is demonstrated at last year's GPU Technology Conference in Washington, D.C., which highlights new uses for artificial intelligence and deep learning.

Digital life is augmenting human capacities and disrupting eons-old human activities. Code-driven systems have spread to more than half of the world's inhabitants in ambient information and connectivity, offering previously unimagined opportunities and unprecedented threats. As emerging algorithm-driven artificial intelligence (AI) continues to spread, will people be better off than they are today?

Some 979 technology pioneers, innovators, developers, business and policy leaders, researchers and activists answered this question in a canvassing of experts conducted in the summer of 2018.

The experts predicted networked artificial intelligence will amplify human effectiveness but also threaten human autonomy, agency and capabilities. They spoke of the wide-ranging possibilities; that computers might match or even exceed human intelligence and capabilities on tasks such as complex decision-making, reasoning and learning, sophisticated analytics and pattern recognition, visual acuity, speech recognition and language translation. They said "smart" systems in communities, in vehicles, in buildings and utilities, on farms and in business processes will save time, money and lives and offer opportunities for individuals to enjoy a more-customized future.

Many focused their optimistic remarks on health care and the many possible applications of AI in diagnosing and treating patients or helping senior citizens live fuller and healthier lives. They were also enthusiastic about AI's role in contributing to broad public-health programs built around massive amounts of data that may be captured in the coming years about everything from personal genomes to nutrition. Additionally, a number of these experts predicted that AI would abet long-anticipated changes in formal and informal education systems.

Yet, most experts, regardless of whether they are optimistic or not, expressed concerns about the long-term impact of these new tools on the essential elements of being human. All respondents in this non-scientific canvassing were asked to elaborate on why they felt AI would leave people better off or not. Many shared deep worries, and many also suggested pathways toward solutions. The main themes they sounded about threats and remedies are outlined in the accompanying table.

Specifically, participants were asked to consider the following:

"Please think forward to the year 2030. Analysts expect that people will become even more dependent on networked artificial intelligence (AI) in complex digital systems. Some say we will continue on the historic arc of augmenting our lives with mostly positive results as we widely implement these networked tools. Some say our increasing dependence on these AI and related systems is likely to lead to widespread difficulties.

Our question: By 2030, do you think it is most likely that advancing AI and related technology systems will enhance human capacities and empower them? That is, most of the time, will most people be better off than they are today? Or is it most likely that advancing AI and related technology systems will lessen human autonomy and agency to such an extent that most people will not be better off than the way things are today?"

Overall, and despite the downsides they fear, **63%** of respondents in this canvassing said they are hopeful that most individuals will be mostly better off in 2030, and **37%** said people will *not* be better off.

A number of the thought leaders who participated in this canvassing said humans' expanding reliance on technological systems will only go well if close attention is paid to how these tools, platforms and networks are engineered, distributed and updated. Some of the powerful, overarching answers included those from:

Sonia Katyal, co-director of the Berkeley Center for Law and Technology and a member of the inaugural U.S. Commerce Department Digital Economy Board of Advisors, predicted, "In 2030, the greatest set of questions will involve how perceptions of AI and their application will influence the trajectory of civil rights in the future. Questions about privacy, speech, the right of assembly and technological construction of personhood will all re-emerge in this new AI context, throwing into question our deepest-held beliefs about equality and opportunity for all. Who will benefit and who will be disadvantaged in this new world depends on how broadly we analyze these questions today, for the future."

We need to work aggressively to make sure technology matches our values.*Erik Brynjolfsson*

Bryan Johnson, founder and CEO of Kernel, a leading developer of advanced neural interfaces, and OS Fund, a venture capital firm, said, "I strongly believe the answer depends on whether we can shift our economic systems toward prioritizing radical human improvement and staunching the trend toward human irrelevance in the face of AI. I don't mean just jobs; I mean true, existential irrelevance, which is the end result of not prioritizing

Andrew McLaughlin, executive director of the Center for Innovative Thinking at Yale University, previously deputy chief technology officer of the United States for President Barack Obama and global public policy lead for Google, wrote, "2030 is not far in the future. My sense is that innovations like the internet and networked AI have massive short-term benefits, along with long-term negatives that can take decades to be recognizable. AI will drive a vast range of efficiency optimizations but also enable hidden discrimination and arbitrary penalization of individuals in areas like insurance, job seeking and performance assessment."

Michael M. Roberts, first president and CEO of the Internet Corporation for Assigned Names and Numbers (ICANN) and Internet Hall of Fame member, wrote, "The range of opportunities for intelligent agents to augment human intelligence is still virtually unlimited. The major issue is that the more convenient an agent is, the more it needs to know about you – preferences, timing, capacities, etc. – which creates a tradeoff of more help requires more intrusion. This is not a black-and-white issue – the shades of gray and associated remedies will be argued endlessly. The record to date is that convenience overwhelms privacy. I suspect that will continue."

danah boyd, a principal researcher for Microsoft and founder and president of the Data & Society Research Institute, said, "AI is a tool that will be used by humans for all sorts of purposes, including in the pursuit of power. There will be abuses of power that involve AI, just as there will be advances in science and humanitarian efforts that also involve AI. Unfortunately, there are certain trend lines that are likely to create massive instability. Take, for example, climate change and climate migration. This will further destabilize Europe and the U.S., and I expect that, in panic, we will see AI be used in harmful ways in light of other geopolitical crises."

Amy Webb, founder of the Future Today Institute and professor of strategic foresight at New York University, commented, "The social safety net structures currently in place in the U.S. and in many other countries around the world weren't designed for our transition to AI. The transition through AI will last the next 50 years or more. As we move farther into this third era of computing, and as every single industry becomes more deeply entrenched with AI systems, we will need new hybrid-skilled knowledge workers who can operate in jobs that have never needed to exist before. We'll need farmers who know how to work with big data sets. Oncologists trained as robotocists. Biologists trained as electrical engineers. We won't need to prepare our workforce just once, with a few changes to the curriculum. As AI matures, we will need a responsive workforce, capable of adapting to new processes, systems and tools every few years. The need for these fields will arise faster than our labor departments, schools and universities are acknowledging. It's easy to look back on history through the lens of present – and to overlook the social unrest caused by widespread technological unemployment. We need to address a difficult truth that few are willing to utter aloud: AI will eventually cause a large number of people to be permanently out of work. Just as generations before witnessed sweeping changes during and in the aftermath of the Industrial Revolution, the rapid pace of technology will likely mean that Baby Boomers and the oldest members of Gen X – especially those whose jobs can be replicated by robots – won't be able to retrain for other kinds of work without a significant investment of time and effort."

Barry Chudakov, founder and principal of Sertain Research, commented, "By 2030 the human-machine/AI collaboration will be a necessary tool to manage and counter the effects of multiple simultaneous accelerations: broad technology advancement, globalization, climate change and attendant global migrations. In the past, human societies managed change through gut and intuition, but as Eric Teller, CEO of Google X, has said, 'Our societal structures are failing to keep pace with the rate of change.' To keep pace with that change and to manage a growing list of 'wicked problems' by 2030, AI – or using Joi Ito's phrase, extended intelligence – will value and revalue virtually every area of human behavior and interaction. AI and advancing technologies will change our response framework and time frames (which in turn, changes our sense of time). Where once social interaction happened in places – work, school, church, family environments – social interactions will increasingly happen in continuous, simultaneous time. If we are fortunate, we will follow the 23 Asilomar AI Principles outlined by the Future of Life Institute and will work toward 'not undirected intelligence but beneficial intelligence.' Akin to nuclear deterrence stemming from mutually assured destruction, AI and related technology systems constitute a force for a moral renaissance. We must embrace that moral renaissance, or we will face moral conundrums that could bring about human demise. … My greatest hope for human-machine/AI collaboration constitutes a moral and ethical renaissance – we adopt a moonshot mentality and lock arms to prepare for the accelerations coming at us. My greatest fear is that we adopt the logic of our emerging technologies – instant response, isolation behind screens, endless comparison of self-worth, fake self-presentation – without thinking or responding smartly."

John C. Havens, executive director of the IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems and the Council on Extended Intelligence, wrote, "Now, in 2018, a majority of people around the world can't access their data, so any 'human-AI augmentation' discussions ignore the critical context of who actually controls people's information and identity. Soon it will be extremely difficult to identify any autonomous or intelligent systems whose algorithms don't interact with human data in one form or another."

At stake is nothing less than what sort of society we want to live in and how we experience our humanity.*Batya Friedman*

Batya Friedman, a human-computer interaction professor at the University of Washington's Information School, wrote, "Our scientific and technological capacities have and will continue to far surpass our moral ones – that is our ability to use wisely and humanely the knowledge and tools that we develop. … Automated warfare – when autonomous weapons kill human beings without human engagement – can lead to a lack of responsibility for taking the enemy's life or even knowledge that an enemy's life has been taken. At stake is nothing less than what sort of society we want to live in and how we experience our humanity."

Greg Shannon, chief scientist for the CERT Division at Carnegie Mellon University, said, "Better/worse will appear 4:1 with the long-term ratio 2:1. AI will do well for repetitive work where 'close' will be good enough and humans dislike the work. … Life will definitely be better as AI extends lifetimes, from health apps that intelligently 'nudge' us to health, to warnings about impending heart/stroke events, to automated health care for the underserved (remote) and those who need extended care (elder care). As to liberty, there are clear risks. AI affects agency by creating entities with meaningful intellectual capabilities for monitoring, enforcing and even punishing individuals. Those who know how to use it will have immense potential power over those who don't/can't. Future happiness is really unclear. Some will cede their agency to AI in games, work and community, much like the opioid crisis steals agency today. On the other hand, many will be freed from mundane, unengaging tasks/jobs. If elements of community happiness are part of AI objective functions, then AI could catalyze an explosion of happiness."

Kostas Alexandridis, author of "Exploring Complex Dynamics in Multi-agent-based Intelligent Systems," predicted, "Many of our day-to-day decisions will be automated with minimal intervention by the end-user. Autonomy and/or independence will be sacrificed and replaced by convenience. Newer generations of citizens will become more and more dependent on networked AI structures and processes. There are challenges that need to be addressed in terms of critical thinking and heterogeneity. Networked interdependence will, more likely than not, increase our vulnerability to cyberattacks. There is also a real likelihood that there will exist sharper divisions between digital 'haves' and 'have-nots,' as well as among technologically dependent digital infrastructures. Finally, there is the question of the new 'commanding heights' of the digital network infrastructure's ownership and control."

Oscar Gandy, emeritus professor of communication at the University of Pennsylvania, responded, "We already face an ungranted assumption when we are asked to imagine human-machine 'collaboration.' Interaction is a bit different, but still tainted by the grant of a form of identity – maybe even personhood – to machines that we will use to make our way through all sorts of opportunities and challenges. The problems we will face in the future are quite similar to the problems we currently face when we rely upon 'others' (including technological systems, devices and networks) to acquire things we value and avoid those other things (that we might, or might not be aware of)."

James Scofield O'Rourke, a professor of management at the University of Notre Dame, said, "Technology has, throughout recorded history, been a largely neutral concept. The question of its value has always been dependent on its application. For what purpose will AI and other technological advances be used? Everything from gunpowder to internal combustion engines to nuclear fission has been applied in both helpful and destructive ways. Assuming we can contain or control AI (and not the other way around), the answer to whether we'll be better off depends entirely on us (or our progeny). 'The fault, dear Brutus, is not in our stars, but in ourselves, that we are underlings.'"

Simon Biggs, a professor of interdisciplinary arts at the University of Edinburgh, said, "AI will function to augment human capabilities. The problem is not with AI but with humans. As a species we are aggressive, competitive and lazy. We are also empathic, community minded and (sometimes) self-sacrificing. We have many other attributes. These will all be amplified. Given historical precedent, one would have to assume it will be our worst qualities that are augmented. My expectation is that in 2030 AI will be in routine use to fight wars and kill people, far more effectively than we can currently kill. As societies we will be less affected by this as we currently are, as we will not be doing the fighting and killing ourselves. Our capacity to modify our behaviour, subject to empathy and an associated ethical framework, will be reduced by the disassociation between our agency and the act of killing. We cannot expect our AI systems to be ethical on our behalf – they won't be, as they will be designed to kill efficiently, not thoughtfully. My other primary concern is to do with surveillance and control. The advent of China's Social Credit System (SCS) is an indicator of what it likely to come. We will exist within an SCS as AI constructs hybrid instances of ourselves that may or may not resemble who we are. But our rights and affordances as individuals will be determined by the SCS. This is the Orwellian nightmare realised."

Mark Surman, executive director of the Mozilla Foundation, responded, "AI will continue to concentrate power and wealth in the hands of a few big monopolies based on the U.S. and China. Most people – and parts of the world – will be worse off."

William Uricchio, media scholar and professor of comparative media studies at MIT, commented, "AI and its related applications face three problems: development at the speed of Moore's Law, development in the hands of a technological and economic elite, and development without benefit of an informed or engaged public. The public is reduced to a collective of consumers awaiting the next technology. Whose notion of 'progress' will prevail? We have ample evidence of AI being used to drive profits, regardless of implications for long-held values; to enhance governmental control and even score citizens' 'social credit' without input from citizens themselves. Like technologies before it, AI is agnostic. Its deployment rests in the hands of society. But absent an AI-literate public, the decision of how best to deploy AI will fall to special interests. Will this mean equitable deployment, the amelioration of social injustice and AI in the public service? Because the answer to this question is social rather than technological, I'm pessimistic. The fix? We need to develop an AI-literate public, which means focused attention in the educational sector and in public-facing media. We need to assure diversity in the development of AI technologies. And until the public, its elected representatives and their legal and regulatory regimes can get up to speed with these fast-moving developments we need to exercise caution and oversight in AI's development."