

We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

[> Cookie Information](#)

Bill Gates: How we'll invent the future

The thinking behind this year's list of 10 Breakthrough Technologies began with the plow.

by **Bill Gates**

Feb 27, 2019

We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

[> Cookie Information](#)

I was honored when MIT Technology Review invited me to be the first guest curator of its 10 Breakthrough Technologies. Narrowing down the list was difficult. I wanted to choose things that not only will create headlines in 2019 but captured this moment in technological history—which got me thinking about how innovation has evolved over time.

My mind went to—of all things—the plow. Plows are an excellent embodiment of the history of innovation. Humans have been using them since 4000 BCE, when Mesopotamian farmers aerated

We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

[> Cookie Information](#)

exaggeration to say that a plow gives people more years of life. The plow—like many technologies, both ancient and modern—is about creating more of something and doing it more efficiently, so that more people can benefit.

Contrast that with lab-grown meat, one of the innovations I picked for this year's 10 Breakthrough Technologies list. Growing animal protein in a lab isn't about feeding more people. There's enough livestock to feed the world already, even as demand for meat goes up. Next-generation protein isn't about creating more—it's about making meat better. It lets us provide for a growing and wealthier world without contributing to deforestation or emitting methane. It also allows us to enjoy hamburgers without killing any animals.

Put another way, the plow improves our *quantity* of life, and lab-grown meat improves our *quality* of life. For most of human history, we've put most of our innovative capacity into the former. And our efforts have paid off: worldwide life expectancy rose from 34 years in 1913 to 60 in 1973 and has reached 71 today.

Because we're living longer, our focus is starting to shift toward well-being. This transformation is happening slowly. If you divide scientific breakthroughs into these two categories—things that improve quantity of life and things that improve quality of life—the 2009 list looks not so different from this year's. Like most forms of progress, the change is so gradual that it's hard to perceive. It's a matter of decades, not years—and I believe we're only at the midpoint of the transition.

To be clear, I don't think humanity will stop trying to extend life spans anytime soon. We're still far from a world where everyone everywhere lives to old age in perfect health, and it's going to take a lot of innovation to get us there. Plus, "quantity of life" and "quality of life" are not mutually exclusive. A malaria vaccine would both save lives and make life better for children who might otherwise have been left with developmental delays from the disease.

We've reached a point where we're tackling both ideas at once, and that's what makes this moment in history so interesting. If I had to predict what this list will look like a few years from now, I'd bet technologies that alleviate chronic disease will be a big theme. This won't just include new drugs (although I would love to see new treatments for diseases like Alzheimer's on the list). The innovations might look like a mechanical glove that helps a person with arthritis maintain flexibility, or an app that connects people experiencing major depressive episodes with the help they need.

We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

[Cookie Information](#)

I would love to see these questions shape the 2039 list, because it would mean that we've successfully fought back disease (and dealt with climate change). I can't imagine a greater sign of progress than that. For now, though, the innovations driving change are a mix of things that extend life and things that make it better. My picks reflect both. Each one gives me a different reason to be optimistic for the future, and I hope they inspire you, too.

My selections include amazing new tools that will one day save lives, from simple blood tests that predict premature birth to toilets that destroy deadly pathogens. I'm equally excited by how other technologies on the list will improve our lives. Wearable health monitors like the wrist-based ECG will warn heart patients of impending problems, while others let diabetics not only track glucose levels but manage their disease. Advanced nuclear reactors could provide carbon-free, safe, secure energy to the world.

One of my choices even offers us a peek at a future where society's primary goal is personal fulfillment. Among many other applications, AI-driven personal agents might one day make your e-mail in-box more manageable—something that sounds trivial until you consider what possibilities open up when you have more free time.

The 30 minutes you used to spend reading e-mail could be spent doing other things. I know some people would use that time to get more work done—but I hope most would use it for pursuits like connecting with a friend over coffee, helping your child with homework, or even volunteering in your community.

That, I think, is a future worth working toward. **T**

Share



Tagged [Climate change](#), [Silicon valley](#), [Tech and health](#), [Future of work](#), [Clean energy](#), [Ethical tech](#), [Artificial Intelligence](#)

Author [Bill Gates](#)

Popular

01.

China has started a grand experiment in AI education. It could reshape how the world learns.

We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

[> Cookie Information](#)

Sorry, scooters aren't so climate-friendly after all

AI education

China has started a grand experiment in AI education. It could reshape how the world learns.

In recent years, the country has rushed to pursue "intelligent education." Now its billion-dollar ed-tech companies are planning to export their vision overseas.



We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

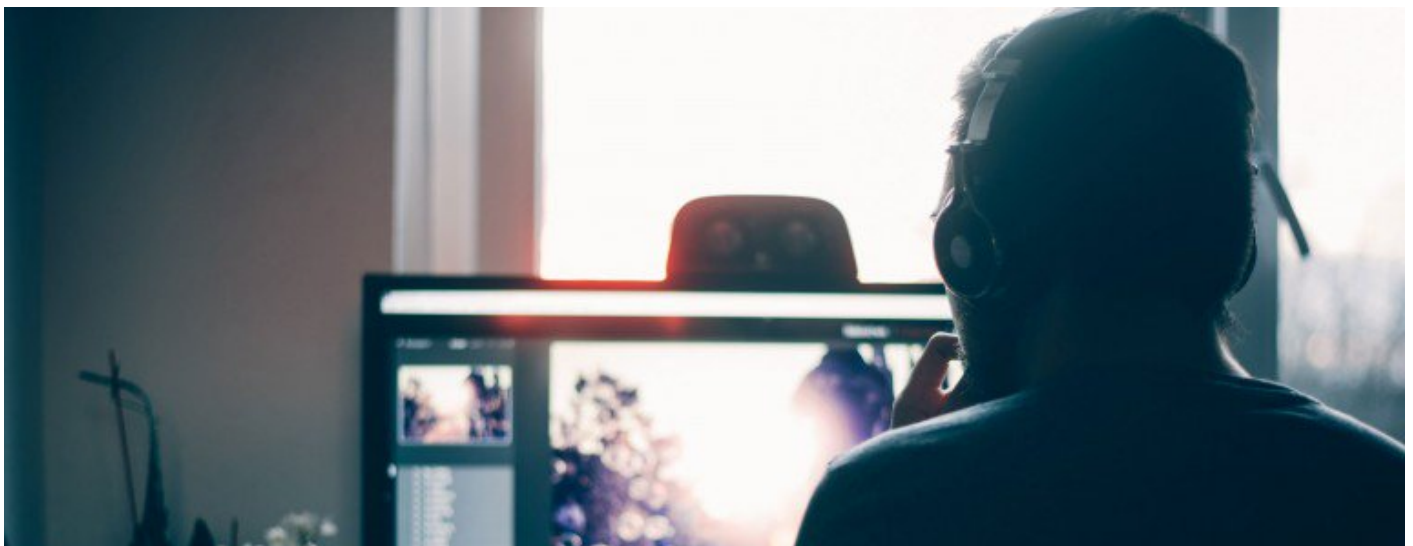
[> Cookie Information](#)

Read more



Tech Policy Aug 2

Apple and Google have stopped letting humans listen to voice recordings



We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

[> Cookie Information](#)

The suspension is only temporary, though, and in Google's case it has only ended the practice in European Union countries....

Expand

Humans and Technology Aug 2

AI could be your wingman—er, wingbot—on your next first date

AIMM wants to disrupt online dating. What could go wrong?

TR 35 2019

Innovators Under 35 | 2019

It's part of our ethos that technology can and should be a force for good. In these profiles you'll find people employing innovative methods to treat disease, to fight online harassment, and to create the next big battery breakthrough.

We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

[> Cookie Information](#)

Rediet Abebe

She uses algorithms and AI to fight socioeconomic inequality

Tim Ellis

He developed a massive 3D metal printer—for building an entire rocket

Ritu Raman

She's developed inchworm-size robots made partly of biological tissue and muscle



SPONSORED

Asia's AI agenda: The ethics of AI

Public and private actors in Asia are working to define regulatory frameworks, build a trusted AI ecosystem, and maintain harmony between humans and machines.

We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

[> Cookie Information](#)

Artificial Intelligence Aug 2

AI researchers need to stop hiding the climate toll of their work

The Allen Institute for Artificial Intelligence (AI2) is proposing a new way to incentivize energy-efficient machine learning....

Expand

Humans and Technology Aug 1

You're not imagining it: always checking dating apps makes you feel worse

We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

[> Cookie Information](#)

A [study](#) just out in the Journal of Social and Personal Relationships found that people who compulsively checked dating apps ended up feeling more lonely than before....

Expand

Tech Policy Aug 1

How YouTubers plan to take on YouTube for better working conditions

The nascent YouTubers Union has joined forces with Europe's largest trade union. They argue that YouTube is violating data privacy laws.

We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

[> Cookie Information](#)



Sign up for **The Download** — your daily dose of what's up in emerging technology

Also stay updated on MIT Technology Review initiatives and events? Yes No

Blockchain Aug 1

“Crypto rogue” nations want to use blockchains to undermine the US dollar

[Read more](#)

Biotechnology

Scientists are making human-monkey hybrids in China

Scientists may have taken a big—and controversial—leap by mixing human cells into monkey embryos.

We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

[> Cookie Information](#)

01.
Human-animal chimeras are gestating on US research farms
January 2016

02.
Pig-human organ farming doesn't look promising yet
January 2017

03.
Human-sheep chimeras won't grow us replacement organs just yet
February 2018



SPONSORED

Excelling in the new data economy

Effectively managing the massive influx of data is a matter of rethinking data management tactics and technologies.

Read more

We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

[> Cookie Information](#)

He Jiankui met with US investors and entrepreneurs to explore CRISPR-baby tourism.

[Read more](#)

Computing Aug 1

The importance of hackers: Analyst Keren Elazari

How thinking of helpful hackers as the immune systems of the internet can make your security stronger and better prepare and secure your digital presence.

[Read more](#)

SPONSORED

Trusted data and the future of information sharing

How policy innovation is promoting data sharing and AI.

[Read more](#)

We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

[> Cookie Information](#)

Brain-computer interfaces

Facebook is funding brain experiments to create a device that reads your mind

Big tech firms are trying to read people's thoughts, and no one's ready for the consequences.

We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

[> Cookie Information](#)

01.
Man with brain implant on Musk's Neuralink: "I would play video games"
July 2019

02.
What's new and what isn't about Elon Musk's brain-computer interface
July 2019

03.
Scientists have found a way to decode brain signals into speech
April 2019



Computing Aug 1

A new bill aims to protect US voters from the next Cambridge Analytica

We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

[> Cookie Information](#)

As the 2020 campaign season accelerates, a US lawmaker introduced a bill on Thursday that would regulate how political parties use voters' data in federal elections....

Expand

Biotechnology Aug 1

The Impossible Burger is coming to a shop (and a Burger King) near you

US regulators have approved a key ingredient in Impossible Foods' plant-based burger patties, clearing the way for them to go on sale directly to consumers....

Expand

Artificial Intelligence Aug 1

DeepMind's algorithm can predict serious kidney injury 48 hours before it happens

We use cookies to offer you a better browsing experience, analyze site traffic, personalize content, and serve targeted advertisements. Read about how we use cookies by clicking "Cookie Information." If you continue to use this site, you consent to our use of cookies.

[> Cookie Information](#)

Expand