Maverick* Research: Being Human 2040 — The Life of the Architected Human in a More-Than-Human World

Refreshed 23 May 2022, Published 23 March 2020 - ID G00464191 - 21 min read

FOUNDATIONAL This research is reviewed periodically for accuracy.

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Initiatives: Technology Innovation

> Enterprise architecture and technology innovation leaders, along with CTOs, must prepare and lead their organizations to thrive in a world that will be directly impacted by nonhuman intelligence and architected humans. (Maverick research exposes unconventional thinking and advice.)

More on This Topic

This is part of an in-depth collection of research. See the collection:

- Maverick* Research Examines Our Evolving Relationship With Technology

Overview

Specific Maverick Caution

- This research breaks new ground by focusing on a future that is centered on not only humans, but nonhuman intelligent things as well. The focus is on society 20 years in the future, which will be impacted by the actions we take today.

Maverick Findings

- The definition of “human” will become more complex as humans and machines interact with each other and even combine with one another.
- Humans will be a part of a digital society that will be composed of nonhuman intelligent entities as a normal part of their everyday existence. Business and societal leaders must rethink the challenges that will come from this future.

Maverick Recommendations

- Determine a clear definition of “human,” as that definition will not only have organizational impacts, but societal and geopolitical as well. This will lead to new types of disruptions and the need for new business and operating models.
- Examine the technology trajectory for human augmentation in terms of capabilities, cost and performance, and begin planning for these technologies to be part of the future-state architecture and roadmaps.

Strategic Planning Assumption

By 2040, 30% of the world’s population will be enhanced with biosynthetic devices on or inside their bodies.

*Maverick Research

This is "Maverick" research, designed to spark new, unconventional insights. Maverick research is unconstrained by our typical broad consensus-formation process to deliver breakthrough, innovative and disruptive ideas from our research incubator. We are publishing a collection of several Maverick research lines this year, all designed for maximum value and impact. We'll explore each of these lines of research to help you be ahead of the mainstream and take advantage of trends and insights that could impact your IT strategy and your organization (see Note 1).

Analysis

Imagine for a moment coming to work in 2040. Maybe you are commuting to your office or working remotely at home with your immersive workspace. In either case, your co-workers will be as important as ever and many will also likely not be human. Robots and artificial intelligence (AI) will not only change our society, but also our everyday experience of it. Organizations will rely on the skills and intelligence of these nonhuman intelligent entity co-workers and so will we as their human colleagues. They will be not only our assistants, helping us to schedule our days and do mundane tasks, but also be able to handle more creative and innovative tasks as well. Nonhumans will also be customers that we need to serve, causing the need for a new approach to understanding customer journeys. Enterprise architecture and technology innovation leaders will need to account for humans and nonhuman intelligent things alike, many of which already exist (e.g., chatbots powered by augmented intelligence), in terms of:

- Defining business capabilities

- Achieving business and customer outcomes
- Recommending future-state architectures and business models

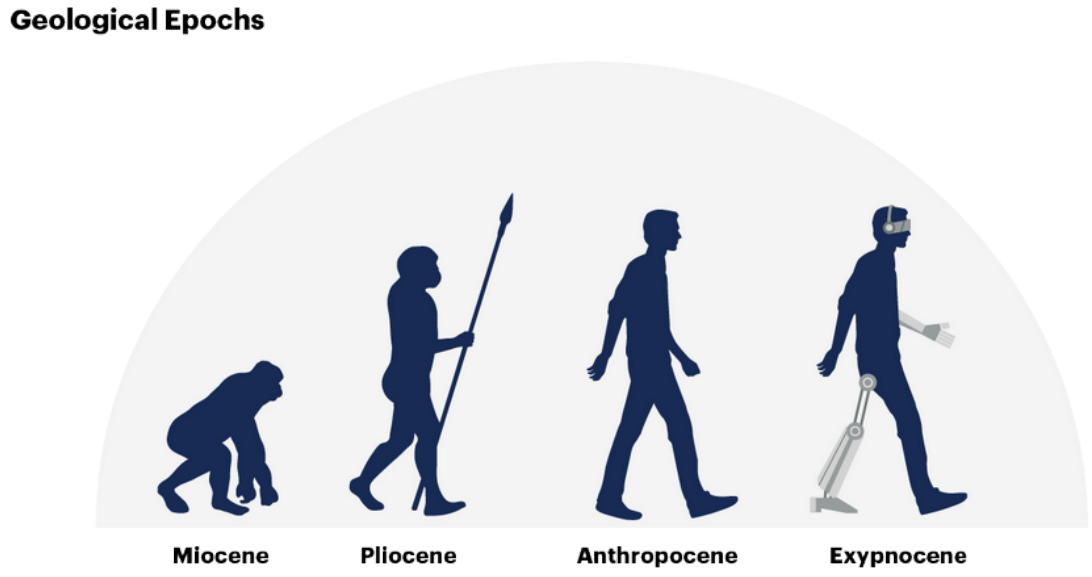
This type of society is already being developed. In Saudi Arabia, the NEOM project aims to develop 16 key economic sectors for the future. [1] This will be achieved through a focus on:

- **The Future of Energy:** Includes being fully powered by renewable energy, forward-looking energy storage and transport solutions, as well as R&D and manufacturing.
- **The Future of Mobility:** Includes seaports, airports, autonomous transport solutions such as autonomous vehicles/drones, and others.
- **The Future of Biotech:** Includes biotechnology, human biotechnology and pharmaceuticals manufacturing.
- **The Future of Technology and Digital:** Includes artificial intelligence, virtual reality and augmented reality technologies, data centers, the Internet of Things (IoT) and e-commerce.
- **The Future of Health and Well-Being:** Includes being at the forefront of adopting the latest technological advancements in healthcare, biotechnology and preventive healthcare.
- **The Future of Education:** Includes offering the latest innovations in learning pedagogy and technology that will deliver personalized learning journeys for students, from kindergarten to university and beyond.

NEOM is an example of a planned society that is built by humans, inhabited by human and nonhuman intelligent things — “Cars will drive themselves; drones will deliver the mail.” NEOM points to a new epoch of world history in 2040.

The *Anthropocene*, describing a significant human impact on Earth's geology and ecosystems, is a proposed name for the geological epoch in which we are currently living. Although it has not been officially approved by the International Union of Geological Sciences (IUGS), it has become a common term that is used especially when referring to the human's impact on climate change. However, by 2040 the geological epoch would be more accurately described as the *Exypnocene* (éxypnos comes from the Greek language and means intelligent), as NEOM demonstrates. It is characterized by the imminent emergence of an "intelligent world" encouraging a culture of intentional intelligent design. It moves from a worldview that the Earth was created for humans to one that is impacted by nonhuman intelligence and architected humans at its core. The goal of NEOM is to "provide a ubiquitous cognitive environment where humans and machines will live in harmony, as peers, to continually reinvent themselves through the application of advanced and future technologies." [2] Next to human beings, we will have to recognize other beings as well (a posthuman view) and architected human beings that require changed societal practices (a transhuman view; see Figure 1).

Figure 1. Geological Epochs



Source: Gartner
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Living in the Exypnocene

Humans living in the Exypnocene will be part of a world of architected humans — the term used for those humans that have been augmented physically and/or cognitively — and most likely will be architected themselves (see "Maverick* Research: Architecting Humans for Digital Transformation"). In fact, architecting humans will be the only way for humanity to thrive in a future that will be equal parts utopia and dystopia, inhabited by many forms of intelligence vying for rights, access to resources and social well-being.

Figure 2 is a projected view of how certain events may occur, extrapolated from a timeline of how events in this space have progressed so far illustrated in Figure 3.

Figure 2. The Future of Architected Humans

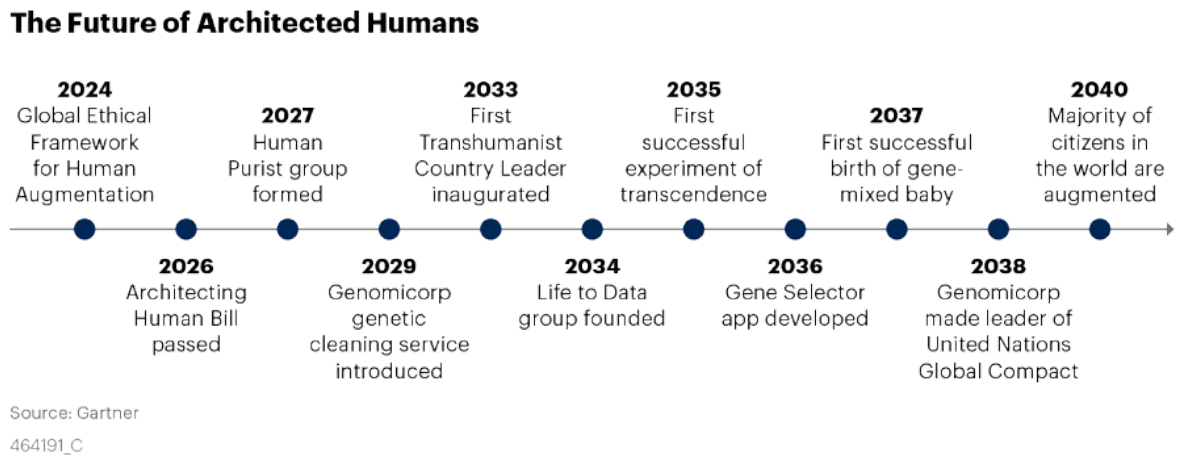
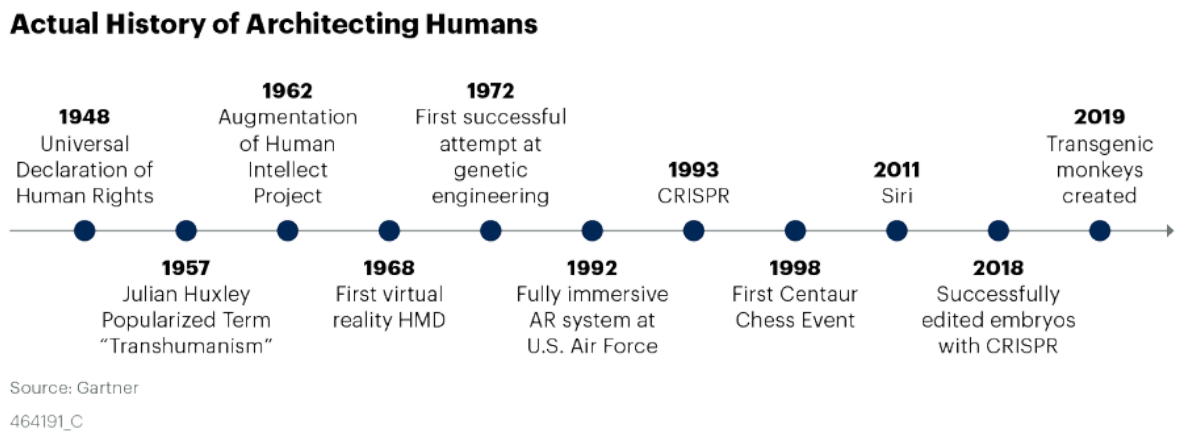


Figure 3. Actual History of Architecting Humans



After setting the stage with the timeline, the narrative below is designed to illustrate the impact of architected humans:

Pearson Taylor, along with his wife Whitney, reviewed the information on the tablet at Genomicorp while designing their new baby. It had been 11 years since their last child, Astrid, and back then it was so primitive: mostly the ability to clean up the genetic code to include or remove a particular gene to prevent disease. There were those who were doing a little dabbling with choosing the sex, but at that time, they hadn't considered the possibility. It was nothing like when they had their first born, Erica, 19 years ago. It was as much a mystery if they would get pregnant, as it was what "genetic lottery" natural selection would provide. But now, in 2040, the Gene Selector app they were using was more like an avatar creator for a video game, than a tool for creating a real-life person.

Pearson and Whitney had always wanted a boy, so after two girls, choosing the gender was the easy part. Now they were moving sliders to decide the shades of eye color and hair color, and even attributes such as artistic skills, athletic prowess, intelligence, and body type. Pearson contemplated the power he was being given to control their child's prospects in life — his child's potential career, hobbies, interests and capabilities. Not much was being left to chance anymore. In what seemed like much too short a time, there, floating before them, a full color, 3D holographic display of their future son, Kaam (short for Kaamil), a name meaning perfect. They even provided images of Kaam at various ages: 15, 25 and 40.

Just as a tear of joy was forming in Pearson's eye, a slight blinking green light was appearing in his upper right eye. His phone was ringing, and it was a number Pearson did not recognize. Answering the phone, he could hear the voice directly in his ear. "Mr. Taylor, this is Officer John Ortega from the Seattle Police. Is your daughter Erica Joy Taylor?" Speaking into what appeared to be midair, Pearson responded with a sigh, "what has she done now?" "Mr. Taylor," the officer responded, "your daughter was arrested for participating in a protest that turned violent. Many members of her 'Human Purist' group were boycotting a new transcendence center and barring people from entering. The 'Life to Data' group was also there to counter the protest and things got ugly." Pearson could only respond with, "I'm on my way."

Although Whitney could not hear the words from the Officer, based on Pearson's expression, Whitney knew exactly what was going on. "Go. I'll finish up here," she said. Pearson lightly kissed his wife's cheek and then his two fingers, placing them on the hologram of his future son.

Pearson tapped into the brain-computer interface implanted into his head and wordlessly ordered a ride from the shared autonomous flying car service, AirTaxi. By the time he had exited Genomicorp, the car was waiting for him. During the ride, Pearson had time to reflect on the irony of sitting in a genomixing center, essentially architecting his son, while his eldest daughter, only 19 years ago, was born into a completely different world. Erica always took pride in her "natural humanity," and, at 19, was idealistic and heavily influenced by the charismatic leader of the "Human Purist" group, Just Hughman. Pearson had no doubt that wasn't his real name, but it was effective.

Soon after Erica was born, the "shift" occurred. It seemed as if overnight humans went from fearing augmentation and bioengineering to endorsing and desiring it. The Architecting Humans Bill was passed in 2026. It encouraged innovation and research, and allowed for human testing for bioengineering. Embracing the Proactionary Principle from the Transhumanist Party that said, "innovation must continue unless it proves harmful to humanity," caused a global ethical framework to be adopted. Shortly after that, the United Nations' Universal Declaration of Human Rights was updated to include augmented humans as part of its definition of humanity. At this point, human dignity and human rights were now defined across the globe. With legal, social and ethical restraints seemingly handled, the technology of bioengineering and other human augmentations moved forward at an exponential pace.

Now only a small subset of the population, like the "Human Purists" stood in the way of a world that could be completely bioengineered in only a couple of generations.

The Taylor family, with the addition of Kaam, will be a modern day blended family, with members spanning the human augmentation spectrum. What could go wrong?

Enterprise architecture and technology innovation leaders will need to prepare and respond to technologies designed for human augmentation, but also to disruptions to the social impact that nonhumans will have as well. In many cases, regulation compliance and legal implications will be facilitated by a clear definition of human. Gartner defines "digital disruption" as an effect that changes the fundamental expectations and behaviors in a culture, market, industry or process that is caused by, or expressed through, digital capabilities, channels or assets (see "Digital Disruption and the New Disruptors: Recognize, Prioritize and Respond — A Gartner Trend Insight Report"). Enterprise architecture and technology innovation leaders must lead their organizations to take the appropriate actions based on how the future definition of human will cause digital disruptions that need to be responded to (reactively) or better yet prepared for (proactively).

The Definition of "Human"

Society at large will confront disruptive change from many different areas. We tend to focus only on trying to prepare for a transhuman future of genomics, synthetic biology, nanotechnology, and the singularity — what futurist Ray Kurzweil describes as the merging of human and machine intelligence. [3] In most cases, these futures are presented through a dystopian lens. Although these emerging technological trends will dramatically impact the future, they should not be extrapolated independently.

The combination of these trends is where business leaders and policymakers will be able to understand, prepare and create future horizons and scenarios (see "Inventing the Future With Continuous Foresight"). We anticipate a future that will impact business operating models, how jobs are defined, how we use technology to interact with the world (and with each other), and how we architect living, and nonliving things. These disruptions will challenge the status quo and bring about societal changes paving the way for a digital society and Digitopia (see "Digitopia 2035: 3 Scenarios for the #DigitalSociety, and What They Mean for Us Today"). Emerging trends and technologies offer boundless opportunities and risks. Leaders must seize these opportunities, mitigate risks, and start preparing now. Preparation begins with a clear and agreed up definition of what being human really means.

> **"In this age of unprecedented technological progress, we can no longer ask 'what is man?' without examining what we think man will become." [4]**
>
> *— Marion Roussel, from "Towards a Post-Human Era? — Digital Architects and the Future of Mankind."*

The definition of "human" is a tricky one and will be a question with an immeasurable number of answers from many different perspectives. However, there is one two-part answer to this question that makes a lot of sense from Jorge Martínez-Lucena, a faculty member at Universitat Abat Oliba CEU: [5]

1. The human has an infinite desire, which he cannot satisfy by himself (beauty, truth, moral ideal, etc.)

2. The human has awareness of himself

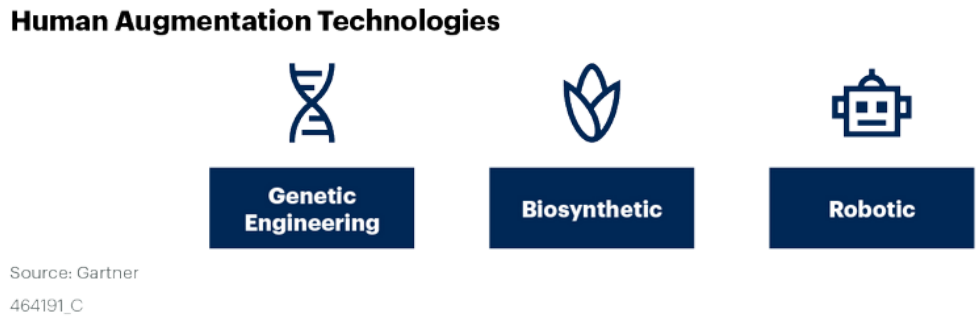
Furthermore, according to Benjamin Franklin, "man is a tool-making animal." Throughout history, humans have had an insatiable desire to better themselves; not only to better themselves, but also to better the objects in the world around them (e.g., tools). From the oldest tools that were made of stone to the aspiration of creating artificial general intelligence (AGI), humans are focused on using technology to help improve and extend their lives. Combining these ideas about what it means to be human will logically extend to transhumanism. It is a way of thinking about the future that is based on the premise that the human species in its current form does not represent the end, but rather a comparatively early phase, of our development. [6] In 2040, the transhumanist belief will be the dominant belief.

Technology Trajectory for Human Augmentation

While ethical arguments are already being waged to accelerate or dramatically limit research and development efforts around human augmentation (see "Maverick* Research: Architecting Humans for Digital Transformation"), the science and technologies are advancing rapidly, with some promising results. It's important to understand the technology's 20-year (and beyond) trajectory in terms of capabilities, price and performance.

The underlying technologies for human augmentation have deep roots in medical research for healthcare and disease prevention (see Figure 4).

Figure 4. Human Augmentation Technologies



Genetic Engineering

Almost 20 years ago, in his book "The Age of Spiritual Machines," Ray Kurzweil proposed that human enhancement would initially be driven by the need to cure or at least diminish infirmity among unfortunate humans born with genetic disorders, crippled in accidents, and acquiring a debilitating disease (genetic predisposition or bad luck).

Genetic engineering has now been used for more than a decade to selectively breed specific animals and plants (e.g., fungus and pest-resistant species). CRISPR-Cas9 is one of the techniques (as well as SATI [7]) exploited for this purpose, and there have been controversies around its use (especially in Europe) for GMO crops. But it continues to be utilized. In humans and animals, there are variations of genetic engineering therapies (e.g., CAR T) being used to fight cancers and other diseases by "reprogramming" antibodies (e.g., T cells), viruses and bacteria to attack specific mutations, or to better arm the body's immune system to recognize aberrant cells. One plausible use for a better-armed immune system would be to fight new viruses such as the COVID-19 coronavirus and the ever-mutating flu, or even to create new viruses, leading to new threats and military tactics. Almost two years ago, the U.K.'s National Health Service (NHS) approved a procedure in which the mitochondrial genome of a mother was replaced with that of a third party to ensure the offspring would not be born with mitochondrial disorder. (These disorders can lead to a devastating disease that is an early death sentence after much suffering.)

There are a few approvals and many clinical trials in this arena. But controversy is escalating. Last year a Chinese scientist allegedly used CRISPR to “reprogram” the germ cells of two baby girls that had a high likelihood of developing HIV due to the mutant genes they would inherit. Because these changes are permanent, this procedure has raised even more significant ethical issues because it potentially changes, permanently, the evolutionary trajectory of these humans. People are already beginning to speculate about how similar procedures could someday eliminate inherited diseases like Type 1 diabetes, cystic fibrosis, Tay-Sachs disease, sickle cell anemia, some cancers, and so on. But beyond displacing harmful mutations, these same genetic engineering techniques could potentially be used to confer genetic advantages or desirable characteristics in offspring, including physical and mental characteristics, like a predisposition for intelligence or physical prowess in specific sports.

When studying the trajectory and benefits of human augmentation technologies and methodologies, enterprise architecture and technology innovation leaders must examine four major areas:

- **Security.** Human augmentation technologies must achieve and maintain a known and acceptable state of security-related risk. This risk is across an attack surface that’s no longer tied to a specific device or physical location, but may travel with the human subject.
- **Privacy.** Human augmentation provides the ability to access intimate knowledge and data about the human it’s enhancing. That data must be protected.
- **Compliance.** Government and regulatory agencies are issuing regulations and providing compliance requirements on a frequent basis. This makes compliance extremely complex for global enterprises, especially because agencies are still trying to grasp the implications of human augmentation technologies.
- **Ethics.** Implementing human augmentation technologies and processes poses serious ethical issues. These include ethical considerations and assessments for determining specific vulnerabilities, risks and moral issues.

The trajectory of genetic engineering technology improvements is quite steep, and will be significantly accelerated as prices for full genomic profiles drop precipitously during the next 10 years, and become part of our personal health records (PHRs). The cost of doing genetic engineering will also fall. Although many humans will realize that they can prevent many inherited infirmities in their offspring, the current sentiment for genetically engineering humans for "enhancement" is overwhelmingly negative, and it's likely to be discouraged or even illegal for the short term. That will hardly stop wealthy parents from seeking this advantage for their children (and paying huge sums for it), much as they currently seek the best schools, tutors, ADHD drugs, etc. to improve the "chances" of their offspring "succeeding." This is an example of the ethical dilemma that will manifest in the near future. Prohibition and tough regulatory regimens will mean that primarily the wealthy will gain from this technology versus a more democratized approach. These limitations will reverse by 2040, affirming the benefits of architecting humans and the desire to make genetic engineering accessible to all people.

More "Intelligent" Synthetic and Biosynthetic Prosthetics Devices

The second area of human augmentation is around more "intelligent" biosynthetic and synthetic devices that will, like genetic engineering, have their initial uses in helping disabled or handicapped people to overcome their physical limitations. Some prosthetic arms and legs are laden with sensors and connections to compute power. Prosthetic joints will also have sensors and processors and, eventually (with some new reactive materials), be "programmable" to adjust for comfort or competition. Some may even have miniature motors or other actuators that aid movement. This technology is already enabling people who have lost or damaged limbs to regain some to even excellent mobility. Exoskeletons are improving rapidly, and with new materials and power, will soon become less bulky and cumbersome. Exoskeletons are already being used in the workplace and being tested by the military. New materials will also be lighter and some will be inserted into the body (seven to 15 years away), while making them seamlessly controllable by the human nerves and brain, thus providing new capabilities.

Visual and audio prosthetics (e.g., "hearables") are already enabling blind and deaf people to gain some sensory perceptions. Other senses will likely be enhanced as brain-computer interfaces evolve to a more "native" communications capability. Many of these devices will be 3D printed, which will enable better personalization and customization. Challenges include:

- Brain-to-computer interfaces (e.g., a "speaking" neurotransmitter is likely 10 to 15 years away)

- Powering prosthetics with (endogenous) “batteries” that can be energized by the body’s bloodstream and movement (five to 10 years away)
- Wireless communications between sensors (image, sound, etc.) and the processors and memory

An example of progress in this area is Stephen Hawking. He was able to (slowly) “communicate” thoughts (via movement of blood and nerve signals in the brain) into words on a computer screen. And some people with missing limbs have been able to “program” them to perform specific tasks (e.g., running, dancing, lifting utensils, etc.).

Of course, combining genetic engineering and biosynthetic devices will truly enable human augmentation.

Highly Augmented “Intelligence” Embodied in a Variety of “Robots”

The final area of human augmentation is about humans interacting with nonhuman intelligent things: highly augmented “intelligence” embodied in a variety of “robots” like Siri or Alexa; drones; autonomous vehicles; assembly line and warehouse robots; surgical robots; helper robots; and so on. Initially, and likely for many years, these devices will be secondary or extensions of humans, even when they are driven by powerful AI/machine learning (ML). These robots will help humans in multiple tasks and will improve their living standards. Along with other automatons and machines, they will produce virtually all of the first- and second-level human requirements (as per Maslow’s hierarchy of needs — food, clothing, shelter, safety, healthcare and education). Moreover, “sex and companion robots,” are already beginning to appear, and their capabilities and realistic appearances will improve dramatically during the next five to 10 years. Key developments in the 10-year trajectory of these “robotic devices” and software will be:

- Inexpensive, more capable electric motors and other actuators to improve mobility/agility
- More capable sensors, especially for image processing — to improve situational awareness
- Better power management
- Much better software, including AI
- Superior user interface/experience

- Prodigious processing power, some onboard (at the edge) and other parts in the cloud

By 2040, it's likely that these robotic humanoids will become increasingly autonomous and function as "quasi citizens." This, of course, will raise all sorts of policy, practical and ethical decisions.

Acronym Key and Glossary Terms

Transhumanism	Transhumanism is a philosophical movement that advocates for the transformation of the human condition by developing and making widely available sophisticated technologies to greatly enhance human intellect and physiology.
Transcendence	From the Latin prefix trans-, meaning "beyond," and the word scandare, meaning "to climb." When you achieve transcendence, you have gone beyond ordinary limitations. The word is often used to describe a spiritual or religious state, or a condition of moving beyond physical needs and realities.
United Nations Global Compact	"We are a voluntary initiative based on CEO commitments to implement universal sustainability principles and to take steps to support UN goals."

Evidence

1 "Fact Sheet," NEOM Project.

2 "The Future of Technology and Digital," NEOM Project

3 "The Singularity, a Talk With Ray Kurzweil," Edge.org.

4 "Towards a Post-Human Era? — Digital Architects and the Future of Mankind," International Society for the Philosophy of Architecture.

5 "What Is a Human Being?," Academia.

6 "Transhumanist FAQ," Humanity+.

7 "SATI Gene Editing Could Replace CRISPR," News Medical.

Note 1
Roots of the Word "Maverick"

Derived from the name of Texas rancher Samuel Maverick and his steadfast refusal to brand his cattle, "maverick" connotes someone who willfully takes an independent — and frequently disruptive or unorthodox — stand against prevailing modes of thought and action.

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