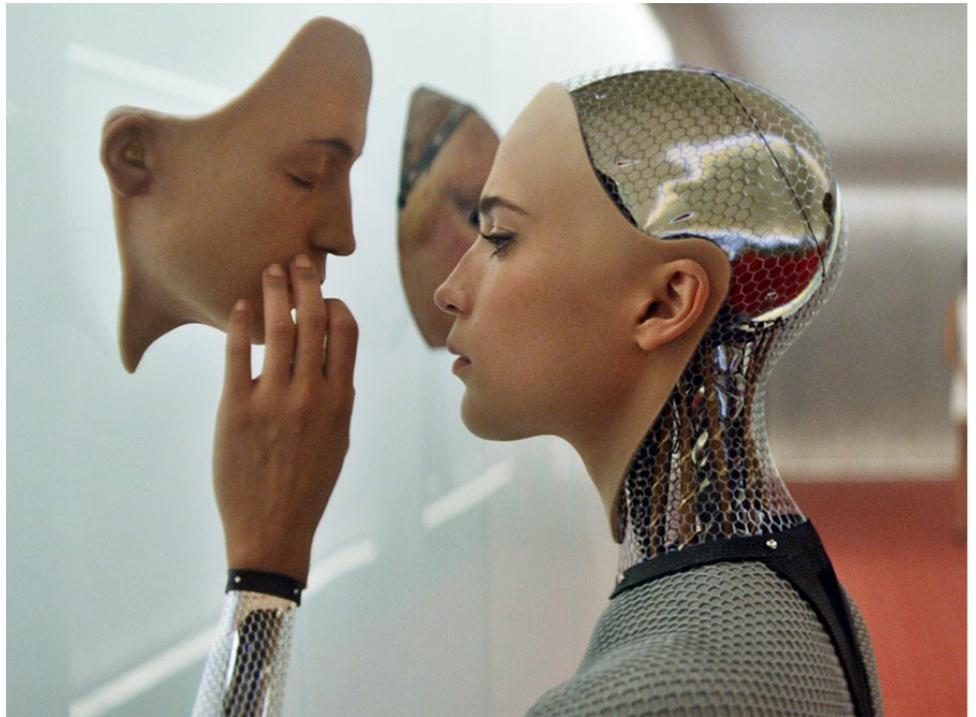


Brains, bionics and the future of bodies

Around the world, researchers are looking at how machines can be used to improve our bodies and minds. They have big plans for man-machine hybrids. Should we be excited or scared?



Machines "R" Us: Human-robot hybrids are a popular subject in science fiction.

After he lost his legs to frostbite in 1982, Hugh Herr told himself that his body was not broken. That bodies *cannot* break. If people have disabilities, it is because technology is broken.

Today, Herr can walk again, thanks to sophisticated **bionic** legs. Not only that, he heads the Biomechatronics Group at MIT, a lab that helps design cutting-edge robotic enhancements for the human body. The aim, says Herr, is to eliminate disability.

The group is working on improving prosthetics so that they integrate more naturally into the user's body. Researchers are closely observing how real legs move and trying to replicate that motion mechanically. They are also looking at how best to connect the prosthetic limb to the user's nervous system, so that it can be controlled via thought.

Herr's work is not unique. Technology known as a brain-computer interface (BCI), which **reads brain signals** and turns them into instructions for a machine, holds a lot of

potential for paralysed people. Though still in its infancy, it has been used by quadriplegics to operate a computer and **pick up a fork**.

But it does not end there. If machines can restore disabled bodies to health, there is no reason why they cannot also enhance healthy bodies. Herr's group is interested in this too: one of its projects is an **exoskeleton** that aids an able-bodied user's movement, reducing their exertion by 25%. Companies have begun to **equip employees** with such add-ons.

Looking to the future, some ask whether BCIs could evolve to the point where brains take on the powers of computers. By implanting devices, they suggest, we could acquire extra memory or telepathic communication.

Famed inventor **Elon Musk** has warned that this must happen if we want to compete with increasingly intelligent machines. But others say we will never design technology that improves the brain in this way — the organ is just too complex.

In any case, as Herr says, "We're at a key transition in human history." Increasingly, humans and machines are merging. Is this a good thing?

Planet inorganic

Of course, say some. We have always used technology to enhance our functions. The wheel helped us to move; glasses, to see; pacemakers, to live. The inventions mentioned in this article are simply the next step. We should welcome anything that improves our lives and brings out our full potential.

It's not that simple, reply others. This new technology brings new issues. If we can cure any health problem, will we live more recklessly? Will only the rich be able to enhance their bodies? Most fundamentally, at what point will we stop being humans and become robots? Messing with nature is risky — we need to think more carefully before doing it.

Q & A

Q: What do we know?

A: Scientists have a relatively good understanding of how the body's musculoskeletal system (the muscles and skeleton) works, including how it interacts with

the nervous system. This has allowed them to create pretty effective bionic limbs. In the TED talk in *Become An Expert*, you will even see a dancer who lost her legs, then learned to dance again on prosthetics!

Q: What do we not know?

A: By comparison, the workings of the brain are

still very mysterious to us. Experts estimate that it contains around 100 billion neurons, forming an incredibly complex network of electrical signals and chemical reactions. The question of whether brains could merge with computer networks, thus expanding our cognitive abilities, cannot be answered until we know more.

YOU DECIDE

1. How do you feel about the technology described in this article?
2. At what point does a human become a machine?

WORD WATCH

Bionic – A bionic body part is an artificial one, generally consisting of electrically operated mechanical parts.

MIT – Massachusetts Institute of Technology, perhaps the world's most famous centre for scientific and technological research.

Reads brain signals – This is done either

ACTIVITIES

1. Imagine you have been asked to brainstorm an invention for Hugh Herr's lab. In groups, write a project proposal, explaining why you think there is a need for your idea.
2. Class debate: "This house believes that bodies cannot break."

through an implant in the brain or a device that picks up signals through the scalp. The former can read signals more accurately, but the latter does not require risky surgery.

Pick up a fork – In March, a man who had been paralysed from the neck down was fitted with implants that allowed him to pick up a fork, not with a bionic limb but with his own hand!

Exoskeleton – A rigid structure that encases

SOME PEOPLE SAY...

"In the future, the Paralympics will be more important than the Olympics."

WHAT DO YOU THINK?

the body, offering protection and support. Some invertebrate animals, such as crabs and cockroaches, naturally have one.

Equip employees – For instance, hardware chain Lowe's is providing employees with exoskeletons featuring artificial tendons. These help the user to pick up heavy objects.

Elon Musk – The entrepreneur is known above all for his rocket company SpaceX and self-driving car manufacturer Tesla.

BECOME AN EXPERT

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 Notes