

Last month, a woman succeeded in moving a robotic arm using only her mind. Soon we could be using technology to enhance or even replace our muscles, our senses – and perhaps our brains.



**SCIENCE
DESIGN & TECHNOLOGY**

The science so far

The age of cyborgs has arrived. Emerging technology allows the human brain to interact directly with computers and machines – and the science is progressing fast.

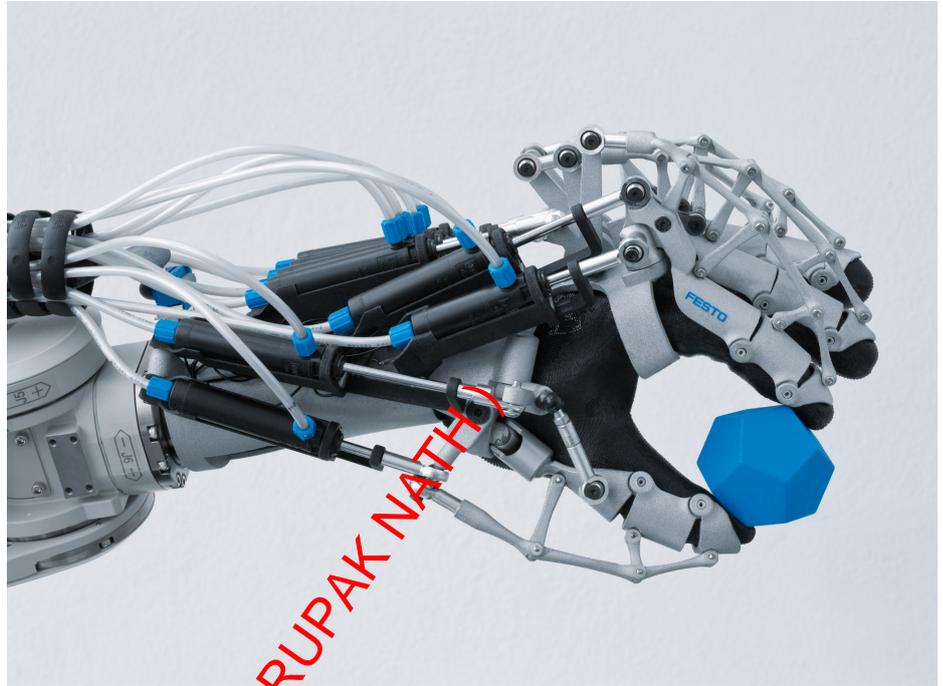
Cathy Hutchinson, for instance, has had almost no control of her muscles for fifteen years. But last month she picked up a coffee and directed it to her mouth using a robotic arm. Astoundingly, she was able to control this sophisticated machinery using only her thoughts.

For those with physical disabilities, this could be the most important development in decades. Work is already underway on robotic legs that allow patients to walk up stairs; blind patients can now use ‘electronic eyes’ to restore some of their vision.

Body-enhancing technology can also be used to aid healthy humans. ‘Exoskeleton’ suits are being developed in Japan that could give users five times their ordinary strength. It is possible too to inject microchip implants under the skin that allow carriers to light up rooms or open doors with just a wave of the hand.

How it works

All of our body’s processes – from digestion to imagination – are controlled by a network called the ‘nervous system,’ with the brain and spinal cord at its centre. The nervous system is made up of cells called neurons, which transmit signals to each



An ‘exo-hand,’ used to strengthen the grip of elderly and disabled patients.

other in the form of an electrical charge.

Most of our conscious activities occur mainly in the outer parts of the brain. This means that the electrical impulses for these activities can be located fairly near to the surface.

By attaching sensors to our brains, scientists can capture these impulses and transmit them into computers. It sounds simple, but that is deceptive: each brain has billions of neurons and no two brains are the same. Building a computer that can make sense of this mass of electrical activity is an enormous challenge.

Gradually, though, scientists are cracking the code. At first users could only control very simple actions, like the movements of a cursor on a screen. But last month’s breakthrough demonstrates that even complicated three-dimensional mechanisms can be controlled using the power of thought.

Where this might lead

Even some of the short-term implications of this technology come straight from the pages of science fiction. Cyborg soldiers with super-strength armoured suits? The US military is researching them. A house in which everything can be controlled by thoughts? Already a theoretical possibility.

These are all examples of the brain controlling a computer. But the really jaw-dropping possibility is that the interaction might become two way. Infor-

mation could be downloaded directly into your brain through the internet. We could transfer memories directly from one brain to another – and why stop there?

It may even one day be possible to upload our entire mind onto the internet. From there, it could be transferred into any physical object in the world.

Fantasy or nightmare?

Some people believe that this technology would enhance us so dramatically that it would represent a new type of evolution. These infinitely knowledgeable, super-powerful beings that suffered no ill health or ageing, they argue, could no longer be described as ‘human.’ The glorious march of scientific progress will have created a new and better species. Those who believe in the possibility and desirability of this future are known as ‘transhumanists.’

But less optimistic people find this vision repellent. Our biology makes us who we are, they say. the more of it we replace with machines, the greater the danger of losing our identities. One day a computer will be a part of our brain; the next, our brain will be part of a computer.

SOME PEOPLE SAY...

‘Humans are just fine as they are, thank you.’

WHAT DO YOU THINK?

► FUTURE SCIENCE: Birth of the super human

WORD WATCH

Cyborgs – A cybernetic organism (or ‘cyborg’ for short) is a being that contains both biological and mechanical elements. Cyborgs depicted in science fiction tend to be evil: the Borg from *Star Trek* Dr. Who’s enemies the Cybermen or, perhaps most famously, the Terminator. So far, however, cybernetic additions to the human body have only been used to help individuals with disabilities.

Microchip implants – Current microchip implants are usually inserted under the skin, and often use the same technology used in no-contact credit cards. But some chips currently being tested can be inserted directly into the brain.

Conscious activities – One question over brain-computer interfaces is whether we should use them to respond to unconscious as well as conscious

thoughts. This raises further issues because our unconscious is usually seen to be beyond our control.

No ill-health or ageing – Another strand of transhumanism (perhaps the most famous) is the belief in genetic enhancement: some predict that we will soon be altering our genes to become fitter, more intelligent and more creative. In the same way it may even be possible to cure old age.

YOU DECIDE

1. If you were offered an implant that allows you to download information to your brain from a computer, would you accept?
2. Could a being without flesh and blood ever be truly alive?

ACTIVITIES

1. Come up with three events for a ‘cyborg olympics’ in which future humans compete using their robot-enhanced bodies and computer-enhanced minds.

2. Research the nervous system and draw a diagram showing how electrical impulses pass between neurons.

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 NOTES

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