

# Superprostheses and reality

March 20 2018, by Prof. Robert Riener

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Visions of the future: the video game Deus Ex: Human Revolution highlights the emergence of physiological augmentation. Credit: Square Enix

Assistive devices may soon allow people to perform virtually superhuman feats. According to Robert Riener, however, there are more pressing goals than developing superhumans.

What had until recently been described as a futuristic vision has become a reality: the first self-declared "cyborgs" have had chips implanted in their bodies so that they can open doors and make cashless payments. The latest robotic hand prostheses succeed in performing all kinds of

grips and tasks requiring dexterity. Parathletes fitted with running and spring prostheses compete – and win – against the best, non-impaired athletes. Then there are robotic pets and talking humanoid robots adding a bit of excitement to nursing homes.

Some media are even predicting that these high-tech creations will bring about forms of physiological augmentation overshadowing humans' physical capabilities in ways never seen before. For instance, hearing aids are eventually expected to offer the ultimate in hearing; retinal implants will enable vision with a sharpness rivalling that of any eagle; motorised exoskeletons will transform soldiers into tireless fighting machines.

## **Hero mythology and Hollywood**

All of these prophecies notwithstanding, our robotic transformation into superheroes will not be happening in the immediate future and can still be filed under Hollywood hero myths. Compared to the technology available today, our bodies are a true marvel whose complexity and performance allows us to perform an extremely wide spectrum of tasks. Hundreds of efficient muscles, thousands of independently operating motor units along with millions of sensory receptors and billions of nerve cells allow us to perform delicate and detailed tasks with tweezers or lift heavy loads. Added to this, our musculoskeletal system is highly adaptable, can partly repair itself and requires only minimal amounts of energy in the form of relatively small amounts of food consumed.

Machines will not be able to match this any time soon. Today's assistive devices are still laboratory experiments or niche products designed for very specific tasks. Markus Rehm, an athlete with a disability, does not use his innovative spring prosthesis to go for walks or drive a car. Nor can today's conventional arm prostheses help a person tie their shoes or button up their shirt. Lifting devices used for nursing care are not

suitable for helping with personal hygiene tasks or in psychotherapy. And robotic pets quickly lose their charm the moment their batteries die.

## **Solving real problems**

There is no denying that advances continue to be made. Since the scientific and industrial revolutions, we have become dependent on relentless progress and growth, and we can no longer separate today's world from this development. There are, however, more pressing issues to be solved than creating superhumans.

On the one hand, engineers need to dedicate their efforts to solving the real problems of patients, the elderly and people with disabilities. Better technical solutions are needed to help them lead normal lives and assist them in their work. We need motorised prostheses that also work in the rain and wheelchairs that can manoeuvre even with snow on the ground. Talking robotic nurses also need to be understood by hard-of-hearing pensioners as well as offer simple and dependable interactivity. Their batteries need to last at least one full day to be recharged overnight.

In addition, financial resources need to be available so that all people have access to the latest technologies, such as a high-quality household prosthesis for the family man, an extra prosthesis for the avid athlete or a prosthesis for the pensioner.

## **Breaking down barriers**

What is just as important as the ongoing development of prostheses and assistive devices is the ability to minimise or eliminate physical barriers. Where there are no stairs, there is no need for elaborate special solutions like stair lifts or stairclimbing wheelchairs – or, presumably, fully motorised exoskeletons.

Efforts also need to be made to transform the way society thinks about people with disabilities. More acknowledgement of the day-to-day challenges facing patients with disabilities is needed, which requires that people be confronted with the topic of disability when they are still children. Such projects must be promoted at home and in schools so that living with impairments can also attain a state of normality and all people can partake in society. It is therefore also necessary to break down mental barriers.

The road to a virtually superhuman existence is still far and long. Anyone reading this text will not live to see it. In the meantime, the task at hand is to tackle the mundane challenges in order to simplify people's daily lives in ways that do not require technology, that allow people to be active participants and improve their quality of life – instead of wasting our time getting caught up in cyborg euphoria and digital mania.

Provided by ETH Zurich

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