CATALOGUE

SUPERPOWER DESIGN

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INTRODUCTION

INTRODUCTION

The pursuit of performance, the drive to be faster, stronger, more beautiful and more intelligent, established itself as a model for social behaviour in the 1980s.[1] Sporting prowess, mass consumption and professional ambition have become the dogmas for a society committed to constant growth. As a species, humans have always adapted to their environment, but the demands we face when it comes to performance continue to grow, and are evolving fast. Associated both with success and with excess, this culture of striving for "more, more, more" drives us towards a new way of adapting so that we aren't left behind: enhancement. These days, we don't just try to repair a body, we attempt to perfect it. A kind of body design, the "art of non-medical transformation"[2], to improve individual performance by scientifically or technologically tweaking the body.

From Icarus to Frankenstein, the desire to go beyond our biological limits is as old as the history of humanity. Since the dawn of time, men and women have been striving to enhance their natural capabilities. From rudimentary tools to today's highly advanced technology, we are constantly attempting to go beyond the limits imposed by our anatomy. With the arrival of computers and computer networks, we have found new ways to merge with technology, both physically and mentally. During an interview, engineer and author Ray Kurzweil explained: "Our technology, our machines, is part of our humanity. We created them to extend ourselves and that is what is unique about human beings. We are the only species on the planet that extends our reach that transcends. We didn't stay on the ground, we didn't stay on the planet, we didn't stay within the limits of our biology."[3]

The Promethean dream of intrinsically transforming human beings is now within our grasp, thanks to the convergence of nanotechnology, biotechnology, information technology and cognitive science (*NBIC*). In the not-so-distant future, these technologies will without a doubt have an impact on human biology and increase life expectancy. Popularised in the early 1990s, transhumanism is an intellectual and cultural movement that champions and promotes the use of science and technology to boost our physical, mental and cognitive capabilities with a view to pushing our biological limitations. According to Grégory Aimar, who wrote the futuristic novel *I.AM*, transhumanists want to make humans immortal, omniscient and omnipotent.[4] It is true that the potential for modifying our bodies seems to be limitless, thanks to tissue engineering, neurotechnology and the development of prosthetics and integrated electronic systems. Whether you are a critic or a champion of transhumanism, you have to recognise that modifying the human body is feasible, duplicating the mind is plausible and extending our lifespan is probable.[5]

Can design turn us into superheroes?

Since its very early days, design has had a unique relationship with the technical development of our day-to-day lives. Not only does it represent the perfect platform for experimentation, but it also crystalises an ideology that has an ongoing relationship with the different industrial revolutions of the 19th and 20th centuries.[6] In today's technological and digital landscape, it is a tool that helps us think about and come up with ways to improve our capabilities. The application of design in fields such as sporting performance, prosthetics and healthcare are concrete manifestations of a desire to break biological boundaries using technology. Exoskeletons, prosthetic eyes or third thumbs: this vision of a superior human is reminiscent of certain works of science fiction. However, above and beyond the fantasy of a human cyborg, contemporary design is tackling experiments involving a whole series of objects, materials, implants and extensions to the human body, allowing us to transcend our physical, intellectual and emotional performance. Some speculative projects are forcing us to think about the moral value of these future transformations, in terms of liberty, autonomy, equality and human dignity. Doping humans with technology raises new questions about whether or not we should be using certain emerging processes to enhance human beings. As has happened at different moments in its history, design is once again at the very heart of the public debate about the moral and social implications of technology in our day-to-day lives.

Albert Camus once said: "Man is the only creature who refuses to be what he is".[7] This observation takes on its full meaning in the current quest for a perfect being blessed with "super powers". However, this notion of an enhanced human makes us more aware of our own fragility.[8] Technology seems to be the solution to this quest for standardised perfection. But couldn't this technology be used to serve less individualistic ideals than human performance?

Thanks to design, could the superhuman of the future be more empathetic, more sociable, more environmentally responsible, in other words: more human?

1 EHRENBERG Alain, *Le culte de la performance*, Paris, Ed. Calmann-Levy, 1991.

2 GOFFETTE Jérôme, «Anthropotechnie [ou anthropotechnique] et Human Enhancement», in HOTTOIS Gilbert, MISSA Jean-Noël, PERBAL Laurence : *L'Humain et ses préfixes – Encyclopédie du trans/posthumanisme*, Paris, Vrin, 2015, pp. 17-25.

3 ADAMS Anthony David, «Evolution Is a Spiritual Process: An Interview With Ray Kurzweil», Huffpost, 08/08/2011, https://www.huffpost.com/entry/ray-kurzweil-interview_b_921015

4 AIMAR Grégory, «Le transhumanisme, une nouvelle religion?», in *Intelligence Artificielle et Transhumanisme*, 10/04/2018, https://iatranshumanisme.com/ 2018/04/10/transhumanisme-une-nouvelle-religion/

5 VITA-MORE Natasha, «H+: Bringing Arts/Sciences and Design Into the Discussion of Transhumanism», in *Essay, Transhumanism and Its Critics*, 01/09/2011, https://metanexus.net/h-bringing-artssciences-and-design-discussion-transhumanism/

6 MIDAL Alexandra, Design – *introduction à l'histoire d'une discipline*, Paris, Pocket, 2009

7 CAMUS Albert, *L'homme révolté*, Paris, Gallimard, 1951.

8 RODUIT Johann, *The Case for Perfection: Ethics in the Age of Human Enhancement*, Lausanne, Peter Lang, 2016.

01. REPAIRED HUMANS

Our body is the result of some amazing evolutionary engineering. However, this phenomenal machine is still fragile, and will probably have to undergo some repairs and tweaks during the course of its existence. Bionic prostheses, exoskeletons, bioprinting, nanotechnology and biotechnology: our modern world has managed to develop a whole arsenal of solutions that make it possible to repair a traumatised or diseased body. We can replace mutilated limbs, correct malfunctions and discover capabilities that have been lost.

The application of design to repairing the human body has come on in leaps and bounds during the 20th and 21st centuries. Indeed, industrial design has helped to transform the medical and healthcare landscape over the last 40 years. Technological progress, scientific discoveries and social changes have given rise to a growing need for innovation when it comes to designing medical devices, hospital equipment and healthcare environments. In 1942, the American army asked Charles and Ray Eames to design a leg splint for wounded soldiers that was both lightweight and sturdy, and that could be mass-produced. The pair developed a model made of curved plywood that would replace metal versions, which risked wounding soldiers, as well as demanding raw materials that were now needed to make weapons. The Eames put a lot of work into the ergonomics of the splint, offering the perfect level of support thanks to its natural shape. The symmetrical slits relieved the tension of the curved plywood, but also offered nurses a way to change bandages. It is estimated that 150,000 splints were produced and used at the end of the Second World War.[9] The use of curved plywood was not only practical, it also demonstrates the Eames' interest in exploring the potential of different materials. This research project marked a key chapter in the two designers' careers, illustrating their ability to apply their expertise to resolve real problems. The knowledge and experience acquired thanks to this project would go on to influence their future work, including their famous furniture pieces, like the *Plywood Group DCW* in 1946 and the *Lounge Chair produced* in 1956.

After the Second World War, the world experienced a time of intense industrial and technological development. This had a huge impact on medicine, stimulating the demand for more sophisticated, better designed devices.

ERGONOMICS, CUSTOMISATION AND ACCESSIBILITY

Ergonomics and patient comfort are major concerns when it comes to medical design. When designers and healthcare professionals work closely together, the end product can be honed to enhance the user experience and meet their needs. The field of prosthetics and orthotics is a particularly good demonstration of the successful partnership between technology, medicine and design. Shaped by technological advances, interdisciplinary approaches and a better understanding of users' needs, the history of prosthetics has seen some revolutionary transformations. This progress has had an impact on the day-to-day lives of patients, opening the door to new levels of functionality, customisation and comfort. In 2014, in collaboration with medical professionals, the designers Filippo Nassetti and Alessandro Zomparelli from the MHOX studio, came up with a mass customisation system for generative orthotics. The system is based on three phases: the patient *bodyscan*, generation of a 3D model of the orthosis and 3D printing. The process will help to replace the traditional system using sizes (XS, S, M, L, XL, XXL) with a completely bespoke product.

The hand orthosis is designed to make rehab easier after an operation by limiting movement. The porosity of the surface can vary in terms of size and distribution, which ensures that the hand is ventilated and washable. By combining a design inspired by biology and high quality materials, this 3D printed object offers new and improved aesthetics for this kind of device.

FiLIPPO NASSETTI (°1984)
& Alessandro Zomparelli (°1984),
Generative orthoses, hand I, II (2014)
© Photos: MHOX studio

FiLIPPO NASSETTI (°1984)
& Alessandro Zomparelli (°1984),
Generative orthoses, leg (2014)
© Photos : MHOX studio

The leg orthosis is a device designed for patients with peroneal muscle weakness and the walking difficulties that this causes. A 3D scan means that it can encompass both the leg and the sole of the feet. Thanks to the flexibility of the material, the orthosis offers active support and walking control.

Bionic devices have emerged as one of the most striking developments in the field of prosthetics. By incorporating sophisticated electronic components, these devices reproduce natural movements to a remarkable degree. Sensors receive electrical signals from remaining muscles or use brain-computer interfaces, giving the user incredibly precise control over their movements. This advanced capacity to control has significantly improved the autonomy and functionality of prosthetics. The use of lightweight, resistant materials like carbon and titanium will help make these devices last longer and weigh less. For its part, 3D printing has revolutionised how they are manufactured by making it possible to customise them to suit the user's morphology. This approach has also cut production costs as well as the time needed to make customised medical devices. For the last decade or so, open source prosthetics have represented a major step forward in the field of health and technology. They are designed to be accessible, affordable and customisable. Thanks to initiatives such as e-Nable, designers from around the world can share their plans and models for prosthetics online. A citizen-based initiative whereby anybody with a 3D printer who understands the basic principles can produce prosthetics for people with specific needs. The e-Nable France association coordinates the design, production and donation of devices for people who are missing fingers or wrists. By combining 3D printing and the sharing of prosthetic designs with open source licences, the organisation is able to produce functional, fun devices in a short space of time. Launched in the USA, the e-Nable movement has grown thanks to the dedication and cooperative work of Ivan & Jen Owen, and Jon Schull, Professor at the Rochester Institute of Technology between 2011 and 2013. They worked with the families of beneficiaries to create the first prosthesis prototypes, and decided to make the designs available on sharing platforms like *Thingiverse* and *Instructables*. They have also developed the concept of "matching", where Recipient / Maker pairs are identified so that customised devices can be produced near to where they are needed.

CIRCLEG ONE (2023)
Circleg
Photo : © Circleg - Henry Robinson

The accessibility and ecological credentials of projects are major concerns when it comes to creating the next generation of medical devices. For amputees in East Africa, Circleg produces long-lasting prosthetic legs. The project was the brainchild of two young students from ZHdK, the Zurich University of the Arts, Simon Oschwald & Fabian Engel, as part of their degree project in 2018. The prosthetics are made using reinforced, certified recycled plastic, which results in lightweight, high quality, comfortable prosthetics. The idea is to offer prosthetic systems for legs that are affordable and functional, whilst also responding to specific local needs and circumstances. The prosthetics are produced on the basis of a circular economy encompassing all of the phases in the product's lifecycle: collecting the materials, production, distribution, fitting and recycling. This results in a local production cycle. It has a direct social impact as it creates jobs and simplifies the logistics of the production process.
The prosthetic system is implemented in collaboration with engineering and design companies, together with orthopaedic technicians, so that the end product meets the specific needs of the amputees and complies with ISO standards and recommendations by the International Society for Prosthetics and Orthotics (ISPO) and the World Health Organization (WHO). The approach taken by the two designers is focused on the user experience. The key is to come up with a prosthesis that responds to the needs of the amputees and allows them to carry out their day-to-day activities as comfortably and easily as possible. The project offers fantastic flexibility, adapting to the size of the body and the range of activities required.

DESIGN THINKING

Design Thinking helps to make healthcare more accessible, more effective and more patient-centred. Improving the ergonomics of these devices will reduce fatigue among healthcare professionals and make it easier to offer more targeted intervention. Incorporating a design that focuses on the user from the beginning of the design process remains a crucial challenge. For Gaël Guilloux, Director of the Care Design Lab at L'École de design de Nantes Atlantique between 2014 and 2018, design offers an opportunity to raise awareness among the stakeholders in a field where expertise is organised into different specialities. This does not always encourage an holistic approach to the issues faced by the user and their loved ones. So design opens up new possibilities. It's not just a matter of putting forward solutions, but also being proactive about approaching health against the much broader backdrop of wellbeing and society as a whole.[10] This approach is shared by Belgian designer, Damien Bihr, whose NAOS .iD+ studio has worked on the designs for a number of medical devices: "Many healthcare professionals think like engineers. They focus on solutions, but often don't think enough about use. When creating a drug, the designers hypothesise that the target will undoubtedly end up breaking it in two. But they hardly ever check to see if that is the case."[11]

The goal of any industrial design studio tackling medical issues is to be able to put forward solutions adapted to the body of the patient, who must be able to use the object or service correctly and intuitively. The iol Strategic Design studio has been involved in the design of a number of medical devices, including the walking stick with wheels, *Wheeleo* and the *Cefaly* which relieves and prevents the pain of migraines. Worn on the forehead, the device uses a small electrical current (eTNS) to stimulate and desensitise the trigeminal nerve, which is the main source of migraine pain. The studio's contribution involved transforming the old device, a headband, which was problematic as it might fit one head but not another. The designer Michael Verleyen suggested a device that can simply be applied to the patient's forehead, and suits any kind of head.

Every year, many projects incorporating design in medical environments and devices are recognised in prestigious international competitions such as the Red Dot Design Award and the International Design Excellence Awards (IDEA). For a couple of decades, the inclusion of specific categories for medical design in these competitions reflects the growing recognition of design in the development of medical products. Design is not limited to aesthetics: it plays an important role in ergonomics, functionality and the user experience offered by medical products. This particular attention has a positive impact on the effectiveness of healthcare treatments and patient wellbeing. The A*dapt-Air* prosthesis won a Red Dot Design Award in 2020, as well as the German Design Award Gold and the Good Design Award in Australia in 2021. *Adapt Air* adjustable prosthetics are made of silicone and are really comfortable for women who have had a double mastectomy. An integrated air chamber means that they can be adjusted to fit each individual's chest wall and natural shape. This solution helps patients who are keen to carry on with their lives without any stigma. The design focuses on the user experience and how the prosthesis can be personalised.

IOL STRATEGIC DESIGN, Michael Verleyen (°1978)
BE Cefaly (2014)

AMOENA MEDIZIN (°1975) - DE
Adapt Air (2019)

CERHUM (°2015) - BE
MyBone
Photos : © Caroline Dethier

INNOVATION ALL THE WAY!

In recent years, developments in biotechnology, nanotechnology and 3D printing have revolutionised medical design. Made-to-measure implants, prosthetics and implantable devices have benefited from this progress. In Belgium, the MedTech sector employs approximately 17,000 people (Source: Medical Technologies Belgium). Our country is the sixth biggest employer in Europe, ahead of the United Kingdom, France and the Netherlands. There are many companies that stand out in this sector, such as Cerhum, Cefaly and Lunaris. Founded by Grégory Nolens, Doctor of biomedical sciences at the University of Liège, Cerhum is a start-up specialising in printing bone implants using hydroxyapatite (a mineral in the same family as calcium phosphates characterised by its impressive hardness). The implantable medical device *MyBone* is designed using 3D printing, and stands out thanks to its innovative features in the medical world. The composition of the bioceramic used is very similar to that of human bone, and offers the advantage of being both more biocompatible and durable than metal or plastic. It also significantly helps to reduce the risks of infection and rejection.

Design has come a long way in the medical world since the 1940s. Significant progress has been made that has improved the life of patients and made things easier for healthcare professionals. However, the dizzying speed of technological advances demands constant adjustments to designs in order to meet society's emerging needs. The future of medical design looks promising, with more and more opportunities to innovate and improve care around the world. Portable technology and connected applications have broadened the scope of industrial design by incorporating technology that can track and manage personal health. Some designers have recently started using living beings as their material for future projects. Biodesign explores how living organisms interact with their environment to resolve complex problems, and attempts to apply these principles to designing products, materials, architecture and even economic systems. The designer Rosie Broadhead has recently explored the use of biosynthetic materials and living organisms to create fabrics that can adapt and respond to the

ROSIE BROADHEAD (°1992),
Endocrine Enhancer (Hormone Hacker Kit) - (2023)
© photo Caroline Dethier

body's needs. The *Hormone Hacker* kit offers a way of improving hormonal changes using a series of wearable stimuli. This set of tools is designed to provide natural support for women's health using different treatments involving oestrogen and cortisol, such as low-frequency vibration, prebiotic underwear and transdermal fabric coatings infused with magnesium. These clothes are designed as a natural way to improve the biological pathways responsible for our physical and mental wellbeing.

In future, perspectives might change in the field of medicine and medical technology. Indeed, repairs could go even further than just correcting existing damage, improving an individual's natural capabilities, above and beyond their standard levels. The progress being made by new NBIC technologies (nanotechnology, biotechnology, information technology and cognitive science) is happening at a rapid pace, and the results are getting more surprising by the day. Despite the moral and ethical transgressions that these innovations might trigger, society seems to be finding it easier and easier to accept them. According to Laurent Alexandre, we are gradually turning into transhumans, modified by technology. For the urological surgeon, impressive biotechnological advances should revolutions society between now and 2050: "organs regenerated by stem cells, gene therapies, brain implants, anti-ageing techniques, made-to-measure babies, ova made from stem cells..."[12]

9 Eames Office. [s. d.], *Molded Plywood Leg Splint - Eames Office,* http://www.eamesoffice.com/the-work/molded-plywood-leg-splint/

10 GUILLOUX Gaël, LE BŒUF Jocelyne, *Design et territoires de pratiques en santé: enjeux pour la recherche et la formation,* in *Sciences du Design* 2017/2 [n° 6], pages 26 à 39, Éditions Presses Universitaires de France, Paris.

11 *Le design en santé selon Damien Bihr - WeLL*.[2018, 15 novembre].WeLL. https://well-linvinglab.be/design-sante-selon-damien-bihr/

12 ALEXANDRE Laurent, BESNIER Jean-Michel, *Les robots font-ils l'amour ? Le transhumanisme en 12 questions,* Dunod, Malakoff, 2016, p.42

02. IMPROVED HUMANS

From the economy to technology, via the world's population, we live in an environment where growth is everywhere we turn. The concept of improved humans, carrying out day-to-day tasks more efficiently, but also capable of pushing their own limits, is one of the consequences of this unstoppable growth. The body seems increasingly to be perceived as a tool that can be improved. By sport, by medicine or by cosmetic surgery, but also by the use of psychostimulants that boost cognitive performance.[13]

Indeed, the use of non-prescription drugs has become more common in certain professional environments, as well as at universities where there is an ever-present pressure to succeed. These psychostimulants are used to improve or boost creativity, concentration, memory or alertness. Plastic surgery is another concrete example of how we are improving our bodies, and one that has become increasingly commonplace over the last decade. This technology allows people to achieve aesthetic ideals that go above and beyond inherited genetic characteristics. By deliberately changing our physical attributes, it raises concerns about the boundaries of authenticity and the integrity of our bodies. Plastic surgery can be seen as the expression of a certain individual autonomy, but also as the manifestation of the current obsession with physical appearance. This endless quest for perfection raises philosophical questions about the changing definition of beauty, the commodification of the body and how we perceive ourselves.

WE ARE ALREADY IMPROVED HUMANS!

The technological environment in which we now live gives us a series of objects and applications that are already improving our capabilities. Wearable technology like smart watches and clothes, or intelligent earbuds, are all devices that help to analyse, calculate and adjust our bodies. Measuring sleep, health and physical activity, this technology adapts in real time, to our morphology as well as to our everyday tasks. Thanks to our mobile phone and other devices that are connected to the Internet, it's easy to find our bearings, access information quickly or check our heart rate. *The Internet of Things* (*IoT*) strives to transform ordinary tools into smart devices to improve efficiency, productivity and the user experience. These devices, fitted with sensors, processors and communication technology, can interact with each other and with computer systems. This makes it easier to gather information in real time, automate decision-making and create intelligent services. Products like *Google Glass* offer a visual interface that displays information directly on to the user's field of vision. In the same way, certain items of clothing, like T-shirts, socks and shoes can incorporate sensors to measure parameters such as heart rate, body temperature and other physiological data. These high-tech gadgets have become extensions of our physical and mental selves. They give us instant access to information, people and services around the world.

Our relationship with these devices goes way beyond any we have with one simple tool. These new objects have emerged, driving forward the transformation of our day-to-day lives, changing the way we communicate, work, have fun, and even take care of our health. This discreet, yet potent revolution has profound ramifications in many different aspects of our lives, redefining the way we interact with the world around us. They are so tiny, and their technology is so advanced that these new everyday assistants are becoming real human-machine interfaces. The *Wisear* project uses neural technology to allow users to control their everyday devices without using their voice or any physical contact. Tiny little electrodes are fitted in the device that record the bioelectrical activity in the user's brain, eyes and facial muscles. AI algorithms interpret this neural activity in real time so that the user can trigger actions on the device while keeping their hands free and without making any noise.

However, we absolutely must find the right balance between the careful use of technology and the preservation of our humanity. When we become too reliant on our digital devices, we run the risk of losing our capacity for critical thinking, focusing on a task or maintaining significant relationships outside the virtual world.

This insole can heat and cool depending on how it is used. It relies on a thermodynamic process that uses the pressure of the foot on the ground. The insoles are made of watertight honeycomb panels that compress on one side, and honeycomb panels that hardly compress at all on the other. They are connected to each other by a nozzle (a little conical-shaped hole) to help compression and, most importantly, release air.

PHOTO : *CLIMFEET* (2022)
© SoleCooler

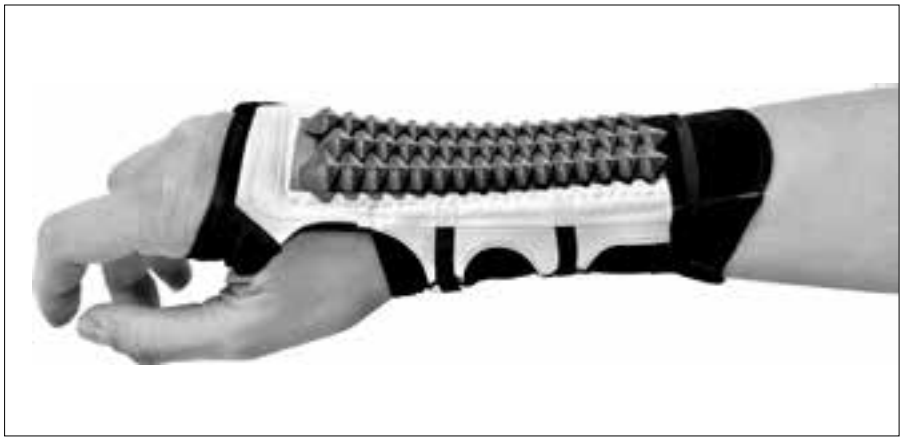

PHOTO SCALED,
NATALIE KERRES (°1995)
© Scaled Tech

In sport, these devices have broadened the realms of possibility: monitoring performance, customisation, managing recovery, preventing injury and honing training strategies. As technology continues to progress, it is likely that its impact on the world of sport will only get bigger, opening up new possibilities for athletes and sports fans. But there are some ethical questions regarding the influence of this technology on the integrity of sport. For example, Speedo's *LZR Racer* swimming costumes, or Nike's *Vaporfly* shoes, have been linked to a number of sporting records thanks to their technical features. Their use could eclipse sportsmen and women's individual abilities and reduce competition to a technological battle rather than a demonstration of talent and determination. Indeed, these running shoes are made up of a foam midsole and a carbon plate to maximise your stride efficiency by giving you more energy return. Athletes wearing *Vaporfly* shoes have achieved exceptional performance, particularly in marathons. In 2019, Eliud Kipchoge ran a marathon in under two hours during the INEOS 1:59 Challenge wearing *Vaporfly NEXT%* shoes. This type of equipment could tarnish the fundamental principles of fairness and equality when it comes to opportunities in sport. The *LZR Racer* is a swimming costume developed in 2008 by Speedo, in collaboration with textile company Petratex, NASA and the Australian Institute of Sport. A number of world records have been broken by competitors wearing the swimsuit. In 2010, it was deemed to be an example of "technology doping". The main source of controversy lies in the mechanical advantage offered by the polyurethane panels in the upper part of the costume. Swimmers wearing the *LZR Racer* can float closer to the surface of the water, thus reducing drag and boosting speed.

Designed to be lightweight, resistant and aerodynamic, these new sports textiles will help boost the physical capabilities of athletes. The materials used often incorporate advanced technology that manages humidity and regulates body temperature and muscle compression to improve blood circulation. Founded in 2020 by designer Natalie Kerres, SCALED is a company specialising in wearable technology, developing customised products for athletes to minimise the risks of injury. Inspired by nature, the fabric used to produce these flexible protective clothes is made up of a series of scales. It helps prevent injuries, encourage recovery and improve sporting performance thanks to regulated movement control. The use of parametric design allows the structure to respond to the user's specific needs and the restriction of movements can be regulated according to defined parameters.

LAURA DELSCH (°1993)
The Healing Imprint (2021)
Photo: © Iris Rijskamp & Laura Deschl –
Interaction Designer & Design Researcher

Impressive achievement or technology doping?
It can be hard to judge how legitimate these technologies are in sport. Let's take one example that's a commonplace and popular, but also puzzling, way of improving sporting performance. Music is a factor that improves muscle performance and plays an important role as a natural stimulant for physical effort. Listening to music helps our brains release opioids that offer natural pain relief. These opioids boost our levels of dopamine, the pleasure hormone, and reduce pain signals. Fast rhythms reduce the feeling of fatigue and improve coordination. Whereas slow, gentle music reduces physiological and psychological stimulation during exertion and improves endurance. Considered to be a performance enhancer by the French Athletics Federation (FFA), music can help to improve an athlete's performance by 15%. The FFA has prohibited "running to music" during official races and competitions since 2016.

This outfit is made up of a grid in which massage balls can be moved around to find specific acupressure points. It explores the therapeutic potential of acupressure, combined with movements, to heal emotional wounds. The garment is not just an interface that helps an individual tap into an understanding of their body and their own self, but it also demonstrates how design can bring together fields such as science, medicine, psychiatry and textiles.

MARC SAPETTI (°1984)
Noonee Chairless Chair (2019)
© Chairless Chair 2.0 - Noonee -
Designed by Sapetti
© Photo: Marc Sapetti

THE FANTASY OF A HUMAN CYBORG

The word cyborg was first used in an article about space travel that was published in 1960. It described the use of external devices and clothing to allow a human to exist in space. Above and beyond the image conveyed in science fiction, the modern-day cyborg is no *Terminator* or *Robocop*, but rather a representation of our day-to-day lives, modified by technology.[14] Indeed, for anthropologist Amber Case, a cyborg is quite simply an individual who interacts with technology. We outsource some of our knowledge and memory to an external device, which changes how we interact with the world around us.

Today, the progress that has been made in the fields of medicine and robotics has resulted in the development of devices that can be implanted in us and prosthetics that improve the day-to-day lives of people with disabilities. Cochlear implants allow deaf people to perceive sounds, and bionic prosthetics give people who have lost a limb the ability to move and feel once again. Then there are exoskeletons - mechanical structures worn outside the body that improve movement and physical strength. They offer support, as well as amplifying human capabilities, opening the door to significant advances in a range of different sectors. When it comes to defence, these devices enhance soldiers' endurance and boost their protection, transforming the field of battle and improving the chances of survival for troops. Their use in modern military operations represents a step forward in the security and performance of armed forces. In medicine, they have become essential tools for rehabilitating patients who are paralysed or debilitated. By allowing controlled movements, they help restore mobility and improve the quality of life of their users. In 2023, a man who had been a paraplegic for ten years was able to control his legs naturally once again. Thanks to a combination of a number of revolutionary techniques, he can now walk by controlling his limbs with his mind. With a brain implant, electrical signals can be detected from the part of the brain that controls movement. These signals are read by AI and passed on to the exoskeleton.

DYSON (°1991)
Dyson Zone (2023)
© photo Caroline Dethier

Exoskeletons have quickly diversified to respond to the needs of industry and the world of work. These structures are technological masterpieces, boosting productivity and reducing fatigue by aiding repetitive movements and offering physical support for demanding tasks. This technology thus improves efficiency in the workplace, as well as reducing the risks of injury associated with handling heavy objects. The *Noonee Chairless Chair* by Swiss designer Marc Sapetti is a flexible, portable ergonomic support. It is used in manufacturing businesses where employees have to stand for long periods or in situations where a traditional seated position is not possible. Workers can walk around, wearing the support, without obstructing the working environment and avoiding bad posture, including leaning, crouching and hunching.

The headset was designed to combat urban noise and air pollution. It captures pollution, especially gases, allergens and particulate matter, whilst also blocking out unwanted noise thanks to an advanced noise-cancelling system with pure, high-definition sound.

Against the backdrop of a rapidly evolving world of work, many businesses are tempted by the idea of using exoskeletons. However, the use of this new technology that offers physical assistance raises a number questions about the health and safety of future users. It is important to anticipate any problems that arise from how these devices work (electrical, mechanical, thermal and sound risks). Problems associated with posture, stress, information overload and falling could also occur when handling these devices. The concept of the *BIONIC CHAIR* offers a different way of using an exoskeleton in the working environment. For his graduation project at the Design Academy Eindhoven in 2014, Govert Flint came up with the idea of an exoskeleton chair that would allow us to exercise while working in a sitting position. It could help improve our body's mobility and functionality, while we work, looking at a screen. By observing dancers from *Scapino Ballet* Rotterdam, the Dutch designer discovered which movements could be applied every day. The chair lets you move your body in every direction, improving the user's physical fitness. It is the body that controls the computer. Sensors are fitted under the chair, detecting the body's centre of gravity, which directly controls the cursor on the screen. To click the mouse button, all you need to do is kick your foot.

GOVERT FLINT (°1989)
Bionic chair //
The segregation of joy (2014)
© Lisa Klappe

WHEN HUMANS AND TECHNOLOGY COMBINE

On the subject of exoskeletons, the philosopher Jean-Michel Besnier explains that the users of these devices for medical purposes are dependent on the design of the object to which they must adapt. “These tools extend the body and define an exteriority that has to be accommodated.” [15] But recent innovations are increasingly invasive, encouraging the user to merge with technology. Science fiction novels have been exploring this marriage between humans and machines for a long time, but now it is starting to materialise in different forms in our modern-day reality. This convergence between the organic and the digital is on the brink of redefining the very nature of what it means to be a *human being*. Does the merger of humans and technology represent the inevitable evolution of our species?

Dreamt up by Iga Węglińska, *Emotional Clothing* refers to technological clothing that acts as a sensory prosthetic, giving our bodies new capabilities. It uses a phenomenon called biofeedback, signalling psychophysiological changes that occur in the wearer’s body, such as body temperature, heart rate, electrodermal activity or proprioception. The clothes work as a direct response to external stimuli, acting as a gateway between our skin and the technology. The outfits could help an anxious person calm down, stimulate cognitive engagement and develop mindfulness, a sense of involvement, of welcoming what you feel at any given time. Iga Węglińska worked on this project as part of her PhD dissertation entitled *Human-object interaction Textiles - new technologies* for the industrial department at the Academy of Fine Arts in Krakow. The goal of her dissertation was to demonstrate how the use of smart materials in clothing implies the development of the participatory role of the user, and can be used to open up how clothing is experienced. The Polish designer was inspired by Andy Clark and David Chalmers’ theory of *The Extended Mind*, whereby material objects, such as intimate diaries and personal computers (external accessories that can record information) can take over some of our thought process and be treated as peripheral elements in the process of perception, and our mind does not only live in our brain or even in our body, but can extend out to the physical world through the medium of objects.[16]

IGA WĘGLIŃSKA (°1986)
Emotional Clothing (2021)

For Jean-Michel Besnier, merging with technology will always be to the detriment of the human being[17] Delegating the management of a physical failing to machines will result in us losing our human autonomy. Because turning humans into machines is designed to make sure that safety triumphs, which will completely obliterate the notion of chance, a distinguishing feature of human existence and how we function biologically. Indeed, this merger between humans and technology appears to present us with the challenge of preserving our humanity in a world that is increasingly dominated by technology. It is an invitation to think about how we use technology, and how it affects us both individually and as a society. The answer lies in our ability to handle this evolution carefully, ethically and compassionately, making sure that it benefits the wellbeing of all human beings.

Future developments could lead to more radical enhancements and raise some much more complex questions. Indeed, it is vital that we consider the ethical, social and cultural implications of these advances. The term “enhanced human” may trigger concerns about the creation of social disparities, unequal access to technology, data protection and non-consensual human genetic modification. Where is the boundary between a human and a machine when our bodies and minds are enhanced by technology? Are we still completely human when we depend on artificial devices to function? And what risks come with this merger, in terms of control, privacy and free will?

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03. ENHANCED HUMANS

MINWOOK PAENG (°1993)
The Third Eye (2021)
© Minwook Paeng

As we have seen, rapid technological advances are opening up new possibilities when it comes to how we interact with our environment and, even more importantly, with our own body. Human enhancement - or anthropotechnics - is defined as any modification designed to improve human performance, permitted by bodily interventions based on scientific and technological principles.[18] This performance may be physical, intellectual or emotional. In his reflections on the development of an anthropotechnic environment, Jérôme Goffette explores a whole array of extra-medical practices focusing on human enhancement including boosting strength, sharpening intelligence, managing procreation, modulating sexuality, adjusting aesthetics and altering emotions.[19]

For philosopher Jean-Michel Besnier[20], these desires to enhance human beings reveal our fatigue with being ourselves. This quest for perfection is first and foremost a means of not being overtaken by the machines that humans themselves have created. Indeed, you have to improve so as not to be outdone by technology. In his project *The third eye*, Korean designer Minwook Paeng critiques and analyses our behaviour when it comes to using technology in our day-to-day lives. Smartphones have permeated our lives to such an extent that we can't take our eyes off them while we walk. *Phono Sapiens* has evolved to have a third eye, allowing them to see what is around them while continuing to use their phone.

THE DESIGNER'S ETHICAL ROLE

Enhancing the human body raises a whole host of ethical questions. The creation of new capabilities triggers all sorts of fears and feeds into a number of fantasies. American anthropologist Amber Case specialises in exploring interactions between humans and technology. She explains how society is adapting quickly to these innovations and how social norms are evolving just as fast. The prospect of generating a visual memory of any single moment of the day thanks to glasses fitted with a camera might seem frightening today. It sounds like something from science fiction. But in the future, society will get used to it, and as a result, new rules will be established.[21]

Against this backdrop, design plays a key role in shaping these innovations responsibly, taking into account the social, psychological and philosophical implications of human enhancement. Indeed, how can we assess the relevance of the future development of these enhancement technologies? For French sociologist Pierre-Yves Cusset[22], there are three key questions to be answered. What impact will these enhancements have on the environment and health? How could these technologies transform how our contemporary societies function? And lastly, do these enhancements comply with our currently accepted moral and ethical norms?

The ethical role of the designer in future technologies that enhance the body is vital if we want to make sure that these advances respect human values. This means that we must think very hard about issues around consent, safety, fairness and accessibility, as well as how we can minimise the potential risks to users' mental and physical health. Could our brains cope with an extra eye, a third thumb, or a robotic tail that extends our spine? Designers have a responsibility when it comes to creating tools to improve the lives of individuals, whilst also respecting their fundamental rights. *The Third Thumb* was presented in 2017, and is the graduate project of designer Dani Cole, who studied at the Royal College of Art in London. This project explores the idea of adding an extra thumb to increase the hand's capabilities and versatility. This extension, controlled by the feet via Bluetooth, would help us understand the relationship between movement and controlling technology connected to the body.
The addition of an extra thumb raises questions about how it would be assimilated, taking into account the anatomy and biomechanics of the human hand and the capacity of the nervous system to control this extra extremity. The cognitive integration of an extra thumb would probably require a significant period of adjustment. Users would have to learn how to coordinate their movements with the new appendage in order to use it effectively.

If such a technology were to be developed on a large scale, it would be important to think about accessibility and the implications in terms of social and economic equality. Would everybody have access to this technology? Would it create disparities between individuals who could benefit from these enhancements and those who couldn't? The socio-economic implications of enhancement technologies merit particular attention. The creation of a class of enhanced humans could result in social fragmentation and cultural conflict, which could threaten social cohesion.[23] If we find it easy to accept that repairs to our bodies are in part covered by our social security system, what about these future enhancements?
The boundaries between legitimate medical improvements and aesthetic or performance enhancements are fluid and are redefining the remit of human health and wellbeing. In addition to this, the commercial exploitation of these technologies raises questions about the ethical priorities of businesses, and how we can guarantee fair, responsible commercial practices. This issue of access to advanced technology is one that is frequently discussed on transhumanist forums.

We are evolving in an environment in which the boundaries between technology and the human body are increasingly fluid. It is therefore vital that designers pay attention to human rights and social values. Informed consent is crucial when it comes to physical enhancements. The users of these future technologies must be given comprehensive, clear information about the potential risks, such as medical side effects or potential privacy breaches. We need to anticipate any possible consequences for the security, protection and exploitation of personal details. This consent becomes a particularly delicate subject when we start talking about more advanced technologies, such as genetic modification. In these circumstances, it is vital that individuals fully understand the potential risks to their health and the repercussions on future generations. *The Fellatio Modification Project*, by designer Kuang-Yi Ku, highlights the more extreme side of modifying our bodies. This speculative project applies biological techniques used in dentistry to tissue engineering in order to transform the oral cavity. The goal is to deliberately transform this part of the body to improve sensory pleasure during oral sex, particularly among homosexual men. The project explores extreme techniques used to enhance the body, as well as raising questions about the relationships between sex, technology, humans and society in the ultimate quest for physical pleasure. It is interesting to dwell on the intentional aspect of these modifications and anticipate how any changes to our bodies could be abused. Could this type of procedure become the norm in a hypothetical future? Some philosophers like Léon Kass and Michael Sandel are raising the alarm about the dangers of eugenics and selective enhancements, highlighting the fact that such practices could lead to discrimination, stigmatisation and the marginalisation of those regarded as “inferior” or “unenhanced”. The quest for genetic perfection could result in a society in which individuals are judged according to their genetic characteristics or where those that do not fit in with arbitrary norms are marginalised.[24]

All of these speculative projects force us to think about the appropriateness of these enhancements, and reflect on how far we are willing to go as individuals. If somebody voluntarily chooses to modify their physical or cognitive capabilities, that could be seen as them legitimately exercising their autonomy and free will. However, it is vital that this decision is made without any external pressure or coercion, taking into account the potential risks for their health and wellbeing. By thinking about these principles of responsibility, consent, inclusion, accessibility and preserving individual identity, we can help to build a society in which each individual can feel free to explore the technological options available to enhance their bodies. This idea of designing humans through physical and genetic modifications challenges our traditional conceptions of the nature of humanity and the fundamental values that define our existence. Identity becomes increasingly fluid and malleable, opening the door to new ways of existing and expressing ourselves. If we modify our body and our genome, are we still the same person? Are we still human?

SPECULATIVE DESIGN FOR THE BENEFIT OF FUTURE ENHANCEMENT TECHNOLOGIES.

Human enhancement raises questions about the society in which we live.[25] This frenzied quest for the perfect being reflects an environment obsessed with continuous growth, boosting individual performance and the domination of technology. Are we individuals who are dissatisfied with the capabilities of our own humanity? By trying to modify, adapt and enhance our body, we are striving to avoid being overtaken or even submerged by the technology that we ourselves have created.[26] For neurologist and neuroscientist Hervé Chneiweiss, this "performance society" is driving humans to enhance themselves no longer to be the best, but to be able to fit in with a group of individuals.[27] He also points out the fact that human enhancement could become a civic duty, a norm imposed by school, an employer or the government.[28] How will designers be able to come up with devices for a hypothetical enhanced humanity?

Speculative design will give our society a new approach, dedicated to exploring and challenging potential futures. Projects that use speculative design can be provocative, calling into question existing norms and forcing us to think critically. This stimulates discussion about the ethical, social and cultural values associated with human enhancement. It is an awareness-raising tool that encourages public engagement in a broader debate about the relationship between our body and technology. By concentrating on potential human experiences in enhanced futures, speculative design highlights a human-focused approach. This allows us to take into account the needs, concerns and aspirations of individuals in the design process.

In the documentary *Can Science Make Me Perfect*, broadcast on BBC Four in 2018, renowned anthropologist and naturalist Alice Roberts embarked on a daring scientific and speculative project. What would the perfect body by like if it were genetically modified, taking its inspiration from evolutionary adjustments seen in the rest of the animal kingdom? Alice Robers met leading medical and animal experts to identify the biggest problems with the human body and how some surprising adaptations of other living species could be a source of inspiration to create the perfect body. Thanks to

natural selection, animals have developed incredible capabilities, from highly honed senses to extremely powerful limbs. During her research, the professor used a cat's eyes to amplify sound and an octopus's retinas to eliminate our blind spots and allow us to see in the dark. New legs, inspired by those of an ostrich, would boost our running speed thanks to their muscles and cushion impact thanks to their tendons. Thanks to the pigments in the skin of a cephalopod, skin can adapt to how much sunshine there is. She took inspiration from marsupials for the pouch, to reduce the risks and difficulties associated with childbirth in women. But these modifications do have consequences. By creating new organs that are more powerful and more reliable, we have no doubt generated a number of diseases that would result from that. The anthropologist acknowledges that every time she changed something, she lost something else along the way. By taking inspiration from a chimpanzee's spine to improve ours, we might improve our stability, but we will become less mobile. This research and this experiment of genetically improving a human being are a lesson: evolution has given us a body that works, and it is hard to remove individual elements, transform them and then put them back.

ALICE ROBERTS (°1975),
SCOTT EATON (°1973),
SANGEET PRABHAKER (-) *Alice* (2018)
© photo: Caroline Dethier

CHENG CHANG (°1998)
The Augmented Limb /For Zero Gravity Movement Control (2022)
© Chandeler Chang

Speculative design is a creative approach that explores potential futures using prototypes and imaginary scenarios. This method can not only stimulate innovation, but also trigger empathy, by making us really think hard about future human experiences. In his robotic tail project, presented in 2022 at the Royal College of Art in London, Cheng Chang came up with a new appendage that would help us improve our motor skills. In a plausible future, a whole generation of humans could live in zero gravity on a space station. This type of change of environment would completely overhaul our understanding of space and how the body works. When our hands and feet are no longer capable of controlling our movements in zero gravity, we would need a new kind of extension for our body. This limb would be able to anchor itself in an environment automatically and stabilise our position before starting to float.

RAFAEL GIL CORDEIRO (°1993) - *Print my sleep* (2020)
© Photo : Caroline Dethier

In this other futurist scenario, Rafael Gil Cordeiro has dreamt up a new way of using sleep to create objects. A way of augmenting our body's nocturnal activity, while translating it using 3D printing. The Swiss designer suggests using technology to free up sleep from the medical paradigm that is all about optimisation and idealisation, to restore some of its original intimacy. Lauded as a tool for boosting efficiency, here sleep is used to create objects. Symbolising a different stage of sleep, 3D printed ceramic sculptures are created based on individual sleep data, such as pulse, oxygen saturation and movement.

By examining suggestions made by speculative design, we will find out how it can broaden our understanding of other people, connect us with potential realities, and encourage us to anticipate and tackle social challenges. Presenting alternative futures encourages us to question current models and offer different prospects for how we could make different choices. In a future in which technology could solve all the problems faced by humanity, including illness, ageing, death and even climate change, how should we deal with physical enhancements to be part of this society?

FROM HUMAN-FOCUSED DESIGN TO HUMAN DESIGN.

Homo sapiens is also *Homo faber*, made of a combination of theory, technique and even "bricolage" (DIY in English).[29] This "bricolage" offers design a key role. Indeed, since its very early days, design has focused on shaping the world around us. Over the last few years, this discipline has been involved in biomedical processes such as biotechnology, neuroscience and medical engineering. For designer Pleun Van Dijk, we repair what is damaged, replace the broken body parts and modify our appearance until it corresponds to whatever we want. And so we seem to hold the key to perfection, gradually turning ourselves into "designer" humans. Now that we have got better at deconstructing human beings, the question is whether we are also capable of reconstructing ourselves. This reconstruction raises a number of moral, philosophical and ethical questions about the type of humans we want to be in the future.

Human-focused design is about understanding the needs, desires and capabilities of users, and creating solutions to suit them. Whereas human design goes above and beyond that, attempting to actively improve capabilities and human experiences thanks to technological innovation. Using prototypes and regular tests, designers can explore different ways of incorporating new technology to improve human aptitudes, while also considering the demands and preferences of users. In addition, close collaboration with experts from the worlds of science, medicine and social science guarantees a holistic, informed approach to the future of human design. The goal is to raise awareness among potential users and the general public about the benefits and the risks of human enhancement. This can help encourage a broader understanding and a social acceptance of the emerging technology in this field.

PLEUN VAN DIJK (°1992)
Reborn (2016)
© Photo Caroline Dethier

Presented in 2016, *Reborn* is Pleun Van Dijk's graduation project for the Design Academy Eindhoven. The goal of this project is to raise our awareness about the ethical and moral implications of the vast potential of the biomedical improvements to which we have access these days. We can genetically manipulate the next generation, but we cannot predict the consequences that this will have on human evolution. Could we become the designers of our own selves? Are we sufficiently aware of the consequences? How long will we be humans? Could humans merge completely with technology?

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04. SUPER HUMANS

This vision of our future that only considers an essentially technoscientific approach to human progress completely disregards the idea of social progress. However, if we consider the ideal of human perfectibility inherited from the humanism of the Enlightenment, the emancipation of human beings relies more than anything else on improving the conditions of their social and political lives.[30] These techniques for improving our intellectual and physical capabilities are driving humans to feel imperfect and dysfunctional. This race towards performance and perfection puts us in a situation in which the fragility of our bodies, associated with their status as living organisms, becomes an "illness" that needs to be treated.[31]

Instead of imagining an efficient, flawless superhuman, couldn't we come up with alternatives that could enhance other capabilities, such as empathy, inclusion or creativity? Instead of being stronger, faster, more attractive people, couldn't we be better at communicating, more sociable and more environmentally responsible?

It is not just necessary that we take another look at design practices in the Anthropocene Epoch: it is our responsibility to do so.[32] This will involve completely rethinking design, production and consumption in our societies. While the Anthropocene Epoch raises questions about environmental responsibility and the sustainability of our technologically advanced ways of life, enhancing the body explores the possibilities and implications of using technology to improve and transform humanity. Enhancement technologies are often regarded as a response to the challenges presented by the Anthropocene Epoch. They offer potential solutions to compensate for physical defects, treat illnesses connected to the environment and improve human resilience in the face of environmental changes. However, some critics see an extension of Anthropocene tendencies in human enhancement, arguing that the quest for technological perfection in humans could exacerbate environmental problems, by increasing our ecological footprint and disrupting natural ecosystems to an even greater extent.

ENHANCEMENT, ENVIRONMENT AND ECO-RESPONSIBILITY

Could we enhance our physical and intellectual capabilities in order to make us more environmentally friendly? This idea could be interpreted as a metaphor in order to adopt more sustainable approaches rather than considering physical modifications that would help us adapt more successfully to changing environments. However, some wearable tech could help us monitor and optimise individual energy consumption, or control our impact on the environment. These tools could encourage more environmentally friendly habits, by reminding or incentivising us to be more sustainable. Indeed, instead of wearing a watch that counts our daily steps, couldn't we come up with a watch that calculates our daily carbon footprint? Would it be possible to recuperate the kinetic and thermal energy generated by human movement? These systems could be used to power embedded electronic devices, thus reducing our dependence on external energy sources and contributing to a smaller carbon footprint.

In a hypothetical future, these enhancements to the human body could be designed in a way that protects the environment, incorporating advanced technologies to minimise our impact on the environment. By creating objects or scenarios that expose the potential consequences of our current choices, speculative design encourages us to think, triggering a more thorough understanding of the ecological implications of our actions. Environmental problems are often complex and interconnected. Speculative design can help demystify these issues by presenting them in a way that is tangible and accessible. Using stories, tools and visual installations, it makes complex problems easier to understand, thus raising awareness and encouraging public engagement. *Metamorfosi Vegetali* is a project that began in 2014, the brainchild of designers Francesca Lanzavecchia and Hunn Wai. This speculative, poetic project looks at digital implants that would help us find a symbiotic relationship between humans and nature. These technological prostheses inspired by plants would allow us, in a hypothetical future, to produce the oxygen that we breathe, feed ourselves from the ground, and even identify the most sub-

FRANCESCA LANZAVECCHIA (°1983)
& HUNN WAI (°1980)
Metamorfosi Vegetali (2014)
© PHOTO CAROLINE DETHIER

tle meteorological changes. The concept put forward by the two designers can be interpreted as an allegory of our relationship with the environment. The leaves receive energy from the son, and the roots are the intelligent antennae that sound out the depths of the earth.

Technology that could enhance humans in the future could help us adapt to changing environments, whether we're talking about climate change or other ecological developments. We are talking here about an enhancement that could help us tackle the climate disruption that human activities have caused. Adapting the human body to extreme environmental conditions is a theme that is often covered in science fiction novels, like The *Drowned Cities* by Paolo Bacigalupi and Jeff VanderMeer's Borne. These futuristic scenarios feature characters who use prosthetics or genetic modifications to adapt to the consequences of pollution or climate change. In his *Damage* project, Sruli Recht has dreamt up a series of foot extensions to deal with extreme environments and to help an ageing population. The collection put together by the Icelandic designer includes three different "prosthetic shoes", each one designed to draw attention to an environmental or social issue. This speculative project uses passive, biological, non-electrical technology, where the human body is used as a starting point and frame of reference to extend existing functions. In a not-so-distant future, populated coastal areas will become increasingly more likely to flood. The city of Venice could be particularly badly affected by this rise in water levels.

SRULI RECHT (°1979)
VENICE HEEL | LO_TIDE & HI_TIDE (2021)
PHASE_CHANGE
UN_BALANCED
PHOTO: © MARINÓ THORLACIUS

The *VENICE_HEEL - HI/LO TIDE* project looks at the flooding that overwhelms the City of Canals, coming up with the idea of a solution for walking in deep water. The prosthesis adapts to the wearer's current shoes, and allows the user to navigate through the low or high tide in the city's streets. In *PHASE_CHANGE*, Sruli Recht proposes a vascular passive cooling device that reduces body temperature without using energy. Inspired by an elephant's ability to regulate its temperature, the shoe is fitted with an integrated cooling system that cools the user down when it's hot.

With the *UN_BALANCED* prosthesis the designer has come up with a claw-like device that keeps the user stable. A kind of sensory prosthesis, it would help elderly people with their balance.

PAUL GONG (°1988)
Human Hyenas (2014)
PHOTO © ANDREW KAN

In order to use our food resources more efficiently, some body enhancements could be designed to improve human metabolism. This could help reduce the world's need for food, thus reducing pressure on the natural resources needed for agriculture. Genetically modifying humans so that they could use photosynthesis to produce their own food from sunlight has already been explored by science fiction. Individuals could survive in environments where food is rare or non-existent, which would reduce their dependence on traditional agriculture.

Other scenarios also examine physiological modifications to be more efficient when it comes to recovering nutrients from organic waste, as demonstrated by the *Human Hyenas* project run by the designer Paul Gong. In order to combat food waste, this speculative project has come up with three tools combined with new bacteria, created using synthetic biology to adapt the human digestive system so that it resembles that of the hyena. With its different senses of taste and smell, the hyena, a scavenger, is able to consume and digest rotten food. This project raises the question of whether humans can adapt their body thanks to synthetic biology in order to solve major problems.

SUSANNA HERTRICH (°1973)
Jacobson's Fabulous Olfactomete (2014)
© Susanna Hertrich

In potential future worlds, some prosthetics could extend our sensory capabilities to detect environmental parameters such as air quality, water pollution and other ecological indicators. Individuals would be more aware of their environment, and could adapt their behaviour accordingly, thus helping to preserve biodiversity and our ecosystem. Susanna Hertrich's Jacobson's *Fabulous Olfactometer* project is a sensorial prosthesis for extreme environments. It takes its inspiration from a sense organ called "Jacobson's organ", which allows certain animals to perceive odourless chemicals. Two sensors worn on the forehead register fine particles and CO_2 levels. When a dangerous threshold is exceeded, gears are set in motion and the top lip is pulled upwards to modify the wearer's face, similar to an animal behaviour known as the "flehmen response".

ENHANCING OUR SOCIAL SKILLS

Some philosophers like Nick Bostrom, Michael Sandel and Julian Savulescu maintain that physical and genetic improvements could lead to a form of "moral enhancement", by reinforcing our capacity to be good, fair and kind to others.[33] For example, improving our cognitive capabilities could make us better able to resolve complex ethical problems with which we are faced as a society, while improving our physical capabilities could help us take care of other people better and contribute to general wellbeing.

For historian Yuval Noah Harari, the fragility of human beings is broadly offset by their capacity to work together with one another.[34] Being aware of this fragility could be an alternative to these technological improvements, allowing us to refocus on this need to be connected. In his research project, *Prosthetic X*, Isaac Monté has come up with a collection of prosthetics that can be used as aesthetic indicators of whether (certain) body parts do or do not work. They change as they react to personal social data, health parameters and external measures. For the Belgian designer, this series of prosthetics explores how non-invasive health-monitoring tools will give us an overview of social, mental and physical health. They will reinforce empathy, celebrate knowledge and combat the threat of solitude, isolation and the health problems of an ageing population. This project takes us into 2030, into a Europe where more than a quarter of society is aged over 60. These groups of individuals live healthy, safe lives, and have a better social life thanks to new digital tools that reflect the state of those who wear them. Users have the chance to modify their behaviour or access care thanks to signals emitted by these devices. This series of prosthetics creates a new form of beauty for the ageing process. If we might live to be 120, 60 is just the half-way point in our journey. *Prosthetic X* plays a part in active ageing and managing our healthy by providing early alerts. Each prosthetic can change shape, surface and colour according to the signal and by processing the user's data in real time. They are inspired by nature and the capacity that some animals have to announce their attraction, express their unhappiness or camouflage themselves. The designer has come up with three specific prostheses to enhance these social skills. Inspired by a peacock's feathers, *PX VII-Guiding curiosity* is programmed according to the wearer's interests. It flickers to draw attention and to trigger and encourage conversation when somebody who shares the same interests is nearby. *PX VIII - Avenue Explorer* fits in the hand and changes colour and reflects the light differently, like the skin of a chameleon, as the wearer gets further away from home. This second skin is made up of scales and masks the pigmentation of ageing. More importantly, it encourages the wearer to come out of their comfort zone and explore new areas conducive to meeting people and social interaction. Inspired by the glands of a frog, the *PX IX Speech matters* prosthetic improves conversation. Placed under the chin, it measures the vibrations of the voice. Reduced conversation is a sign of isolation. The larger the prosthetic is, the more conversation there has been.

ISAAC MONTÉ (°1988)
PROSTHETIC X (2019-2021)
© ISAAC MONTÉ & IN4ART

This speculative project is a technological "artificial data organ", made up of nine prostheses that react and adapt in real time to our inner health, our external circumstances and our social interactions.

Enhancing our ability to communicate with other people could improve our day-to-day lives and encourage social acceptance. Taking an inclusive, ethical and aesthetic approach, these devices would help us share subtle information such as facial expressions, gestures and nuances in our intonation with more accuracy, which would help create richer interaction, and better mutual understanding.
For example, linguistic implants could broaden our language skills, allowing individuals to learn and communicate in new languages instantly.

By making use of these advances, design can play a vital role in coming up with solutions that encourage inclusion, accessibility and communication. Subtle enhancements to brain chemistry could help to reduce social inhibition, making it easier to meet people and forge new relationships. This would help foster a society in which individuals feel more relaxed interacting and having conversations with strangers. Sascha Nordmeyer's Communication *Prosthesis* project takes a fun look at our relationship with others during social interaction. This prosthesis has been designed to facilitate communication by making it more explicit and forcing automatic facial expressions. The idea is to help people who are unsure of their social skills, and who are therefore forced to demonstrate greater intelligence and communication in all circumstances. In Didier Fiúza Faustino's project, the approach to the prosthesis and the face mask is a kind of philosophical exploration of meeting your other half. This mask seems to prevent contact, and looks like a prosthesis that controls kissing. However, in fact it forces the wearers to come together, to feel one another, to allow each other to slip into their inner world, at the risk of meeting their alter ego and losing themselves there. The structure of the masks positions two people at the ideal distance from each other, allowing them to "slot together", with a perfectly shaped and proportioned orifice.

SASCHA NORDMEYER (°1977)
Communication Prosthesis (a.k.a. hyperLip) (2001)
Photos © Communication Prosthesis Portrait Series
2009, Sascha Nordmeyer.

DIDIER FIÚZA FAUSTINO (°1968)
Doppelgänger (2011)
© Doppelgänger (M&M), 2011
Didier Fiúza Faustino

This creation explores the physiological and physical manifestations of sorrow like the lowering of our body temperature in our arms and legs or the tears appearing in our eyes. The design is deliberately "heavy", symbolising the weight of sadness. The covered face represents the human reaction of hiding our most vulnerable emotions. The silhouette reminds us how, in our deepest depths of despair, there is a revelation, an opportunity to meet your true self.

ENHANCING OUR EMOTIONS

In his novel, *Brave New World* Aldous Huxley explores a future society in which individuals are genetically modified and conditioned to adapt to their social role. The characters' emotions are controlled by chemical substances and conditioning techniques, eliminating emotional conflict and maintaining social stability. While science fiction explores the possibility of genetically modifying humans to strengthen their emotional skills, design could come up with devices that enhance empathy, emotional resilience or our ability to handle stress. Certain prosthetics could be designed to reflect emotional states or personal experiences. By detecting subtle emotional signals, these enhancements could help individuals to feel and understand their own emotions more deeply, as well as those of other people. This would boost self-awareness and empathy, as well as consolidating social and cooperative connections.

By incorporating these principles when designing technology to improve and enhance the human bodies, designers can help to create solutions that don't just respond to physical needs, but that also encourage an emotional connection with users. Prosthetics could be designed to reflect emotional states or personal experiences. For example, changing colours or textures could express joy, sadness, creativity or other emotions, thus offering a kind of direct emotional expression. It is with this in mind that Jasna Rok came up with the *Trypophilia* collection in 2022. Thanks to the concept of high-tech clothing, the Belgian designer has come up with empathetic objects that facilitate communication by offering humans the chance to forge more tangible connections between one another. This collection of sensitive clothing could allow us to make our emotions visible and facilitate their transmission. It acts like an augmented, intelligent skin, enveloping the wearer in an intimate, expanded perception of themselves (health, emotions, thoughts) and of the world around them.

JASNA ROK LAB (°1992) -
Trypophilia, Fright (2022)
© Jasna Rok Lab in collaboration with Stratasys and Travis Fitch
© Photo: Caroline Dethier

ENHANCEMENTS TO MAKE US MORE EMPATHETIC

By examining how speculative design could make us more empathetic, we will find out how it can broaden our understanding of other people, connect us with potential realities, and encourage us to anticipate and tackle social challenges. These devices of the future would involve recognising and celebrating the diversity of human experience as well as that of other species. Design can play a significant role in promoting empathy by creating experiences, products and space to encourage understanding and connections between people. For example, enhancing the nervous system could improve our powers of empathy. By detecting subtle emotional signals, these enhancements could help individuals to feel and understand other people's emotions more deeply. This would boost empathy, consolidating social and cooperative connections.

Developed in 2019, by lecturer Alan Hook, *Equine Eyes* is a prototype for a headset that can enhance our empathy towards other animal species. The project explores speculative methods to help designers understand other species so that they can design for and with them. The headsets simulate horse vision by taking in two live camera feeds, filtering them and rendering an immersive head-mounted display. The headset allows humans to experience a horse's vision. A horse with two large eyes, each one with a 180° field of vision on either side of the head. Their field of vision overlaps at the front, to give a cone of binocular vision.

Horses have panoramic vision, which means they can see objects at a wide angle without having to turn their head. Their peripheral vision is highly developed so they can detect movement and potential dangers around them. The headset also removes red from the colour range to simulate how a horse sees the world. In fact, horses have dichromatic vision, which means they are less sensitive to different shares of red, and more sensitive to shades of blue and green. This means that horses see their environment in a colour palette dominated by shades of blue, green and grey, while reds appear to be softer or duller for them. According to Alan Hook, the project highlights the importance of alternative and speculative research methodologies in exploring complex issues such as anthropocentrism, our cultural prejudices with regard to the anthropomorphisation of other species and our relationship with animals.[35] Through a series of different scenarios and experiments, the project promotes playing and embodiment as the most appropriate ways to understand animals. The prototypes propose the development of an "interspecies inter-subjective subjectivity"[36] to help us better understand how animals experience the world so that we can build more inclusive futures. The project explores a complex empathy without pathos. It is a technical empathy based on the creation of a community of visual sensitivity rather than on sharing emotions.[37]

ALAN HOOK (1982)
Equine Eyes (2019)
Photo *Equine Eyes, Prototype 006*
© Vincent O'Callaghan
© Photo: Caroline Dethier

AFFIRMING IDENTITY VIA ENHANCEMENT TECHNOLOGIES

In a hypothetical future in which it is commonplace and totally acceptable to enhance the human body, the possibilities for expressing and defining individual identity will be totally different. Human identity could become a major focus for designing bodies in the future. These enhancements could go further than mere physical improvements, with extensions of ourselves that we could customise, allowing individuals to express their identity in a unique way. Above and beyond standardised bodies and the ultimate superhuman, these external signals would reflect our cultural, artistic or personal preferences. The boundaries between the natural and the artificial, normality and deliberate adjustments, would become the subject of public debate.

In the cyberpunk world of the science fiction novel *Ghost in the Shell* by Masamune Shirow, humans are often equipped with advanced cybernetic enhancements. These enhancements play a vital role in defining characters' identities, because they affect their way of thinking, perceiving the world and interacting with others. Technological enhancements could blur the boundaries between the human body and technology. For example, brain implants or bionic prosthetics could be incorporated so closely with the body that they become an integral part of the individual's identity, calling into question the very definition of the beauty of the human body. Indeed, these future modifications to our appearance could be designed in such a way that they allow us to customise the way we look to a greater extent. Different materials, shapes, textures and colours could be chosen, allowing individuals to express their personal style in their own unique way. These enhancements could become a kind of body art, reflecting individual preferences and aesthetics. Morgan Chen's Social Prosthesis project came about during an artist residency at the *Hybrid Body Lab*, where research focuses on combining make-up techniques with miniature wearable technology. The expression "social prosthesis" was inspired by Mimi Nguyen's text: *Queer Cyborgs and New Mutants* written in 2003.[38] The trial suggests that technologies that enhance the human body go above and beyond the fusion of the biological with the artificial, and that they should fit in with a period's social and political backdrops.[39] The social prosthesis conjures up the social aspect of beauty, the changes and movements that happen when we change our appearance when we come into contact with other people. The designer uses prosthetic makeup techniques, which are often used in films to create cosmetic effects and enhance the skin and facial features. Designed to be worn during our social interactions, these silicone prosthetics are a tool for expression and narration. They form a kind of "prosthetic cosmetic skin" that fits the face and is made up of sensors so the shape and appearance change during our social interactions. *Social Prosthesis* plays with the concept of improving, masking or using make-up to change physical appearance as a "social prosthesis" of identity. We modify our appearance to try to protect and preserve ourselves, and we recognise each other socially via these physical identities that we present.

MORGAN CHEN (°1997)
Social prothesis (2022)
© Morgan Chen en collaboration avec Hybrid Body Lab,
Cornell University College of Human Ecology Engaged Research Grant.

These enhancements could offer individuals the chance to adopt different identities depending on the changes that they choose to make to their body. For example, somebody might choose enhancements to improve their physical or cognitive skills, which could change how they perceive themselves as well as how they are perceived by others. Alessandro Nassetti and Vincente Real's *Thalassic Masks* project offers a way of expressing contemporary identities via the face masks used during the Covid-19 pandemic. These medical products, born out of an emergency to fulfil a series of functions, are not designed to fit in with the urban environment and do not aspire to rethink human interaction and personal expression. In a not-so-distant future, air pollution and atmospheric changes could make protective equipment a more and more essential extension of the human body. To enhance these products, we need to create new pandemic and post-pandemic identities as well as rethinking the relationship between wearable technology and the human body. Inspired by marine shapes, the two Italian designers have combined techniques from biomimetic design, 3D printing and physiological analysis to come up with a new generation of masks. Thanks to their internal physical structure, organisms like jellyfish, coral and sea anemones are able to filter water, extracting all of its oxygen and nutrients. These sea organisms also often rely on their external appearance to hide and protect themselves. And so the way they look is part of their survival strategy.

By combining digital manufacturing and design techniques with data generated by experimental research, this collection of masks could be seen as a potential form of human evolution. Evolution, shaped not by the slow process of biological changes, but by the extension and enhancement of the body thanks to technology and the design of functional tools. These masks also reflect how dramatic world events change our lives and our identities.

FILIPPO NASSETTI (1984) & VINCENZO REALE (1984)
Thalassic Masks (2021)
En collaboration avec Stratasys, Haratech, Empa, UFG,
Creative Region Linz & Upper Austria
© Paul Farnhamæ

Enhancements to our personality could incorporate cultural symbols, patterns and identifying marks. Individuals could choose specific elements to reflect their cultural heritage, their beliefs or their affiliations, thus creating visual links with important aspects of their identity. In modern digital culture, we represent and enhance our online identity by creating an avatar. This could be seen as an enhanced extension of ourselves in the virtual world. Avatars offer users a way of expressing their individuality and creativity online. By choosing physical features, clothes, accessories and behaviours for their avatar, users can create a virtual image that corresponds to their vision of themselves or the image that they would like to convey to others. In her *Liăn* project, designer Jann Choy examines how we portray ourselves online, putting on a number of different faces, which we can change at any time. This experimental mask explores the relationship between our online personalities and our offline selves. Using coding and robotics, and taking inspiration from the art of Chinese opera, the mask reacts to online emotions in real time. If you publish, like or comment on something positive, the part of the mask that represents the positive area will inflate, and conversely, if it is negative, the corresponding area will inflate. *Liăn* is a kind of sensory prosthetic of our online emotions.

JANN CHOY (°1997)
Liǎn (2021)
© Jann Choy

In this journey towards an enhanced humanity, we have seen that technology plays a fundamental role in potential enhanced and improved futures. Technology that is evolving quickly, but that seems to be pretty well accepted by society. The relationship between design and technology is a dynamic, evolving one, which continues to shape our modern world, as it has done since the first industrial revolutions. However, even if a technologically enhanced human is already a reality, there are all sorts of questions about its legitimacy and relevance, feeding into the debate about the future of our humanity. Today, enhancements to our physical and intellectual capabilities are going beyond the fanciful dream of a mad professor, becoming a plausible future for our humanity. They are part of a new kind of evolution of our species, one in which design can play a decisive role. By recognising the role of design in future technologies around physical enhancements, we can fine-tune the end goal to go beyond individual improvements. With this in mind, design should be seen as a way of arguing for what makes us human.

The future of design in the field of human enhancements is a fascinating exploration that is at the crossroads between technology, ethics, medicine and creativity. Design could offer alternatives to individualistic enhancements, which run the risk of leading to a decline in social cohesion and the fragmentation of society. The future of "human design" will not just be focused on high-tech solutions, but also on a reasoned, less individualistic approach to performance. Indeed, never-ending developments in biotechnology, robotics, artificial intelligence and 3D printing are opening up new possibilities, but also raising complex ethical and social questions. This is why each and every one of us has a responsibility to try to answer these questions and to express our desires and beliefs when it comes to these future technologies that affect our body, both as citizens and as human beings.

It is no longer about knowing whether design can turn us into superheroes, but rather understanding what kind of superhumans we want to become.

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Le CID remercie les designers et les prêteurs / The CID thanks the designers and lenders

Alan Hook et la Ulster University, Amoena Medizin-Orthopädie-Technik GmbH. Bruno Aubert – SoleCooler, Cerhum, Charles et Ray Eames, Cheng Chang, Circleg, Dani Clode, Didier Fiùza Faustino, Dyson, e-Nable, Filippo Nasetti, Freyja Sewell, Govert Flint, Iga Węglińska, IOL Design, Isaac Monté, Jann Choy, Jasna Rokegem, Kuang-Yi Ku, Lanzavecchia + Wai (Francesca Lanzavecchia and Hunn Wai), Laura Deschl, Marc Sapetti, MHOX - Filippo Nassetti et Alessandro Zomparelli, Minwook Paeng, Morgan Chen, Musée d'art moderne et contemporain de Saint-Etienne Métropole, Nike, Orthopédie Protechnik, Paul Gong, Pleun Van Dijk, Professeur Alice Roberts, Sruli Recht, Rafael Gil Corderio, Rosie Broadhead, Sascha Nordmeyer, Scaled Tech, Susanna Hertrich, Wisear, Zygintas Papartis.

This online catalogue has been produced as part of the *Superpower Design* exhibition held at the CID - Grand-Hornu from 24 March to 25 August 2024. It is an extension of that exhibition.

The CID is a non-profit association of the Province of Hainaut.
With the support of the Fédération Wallonie-Bruxelles secteur des arts plastiques.