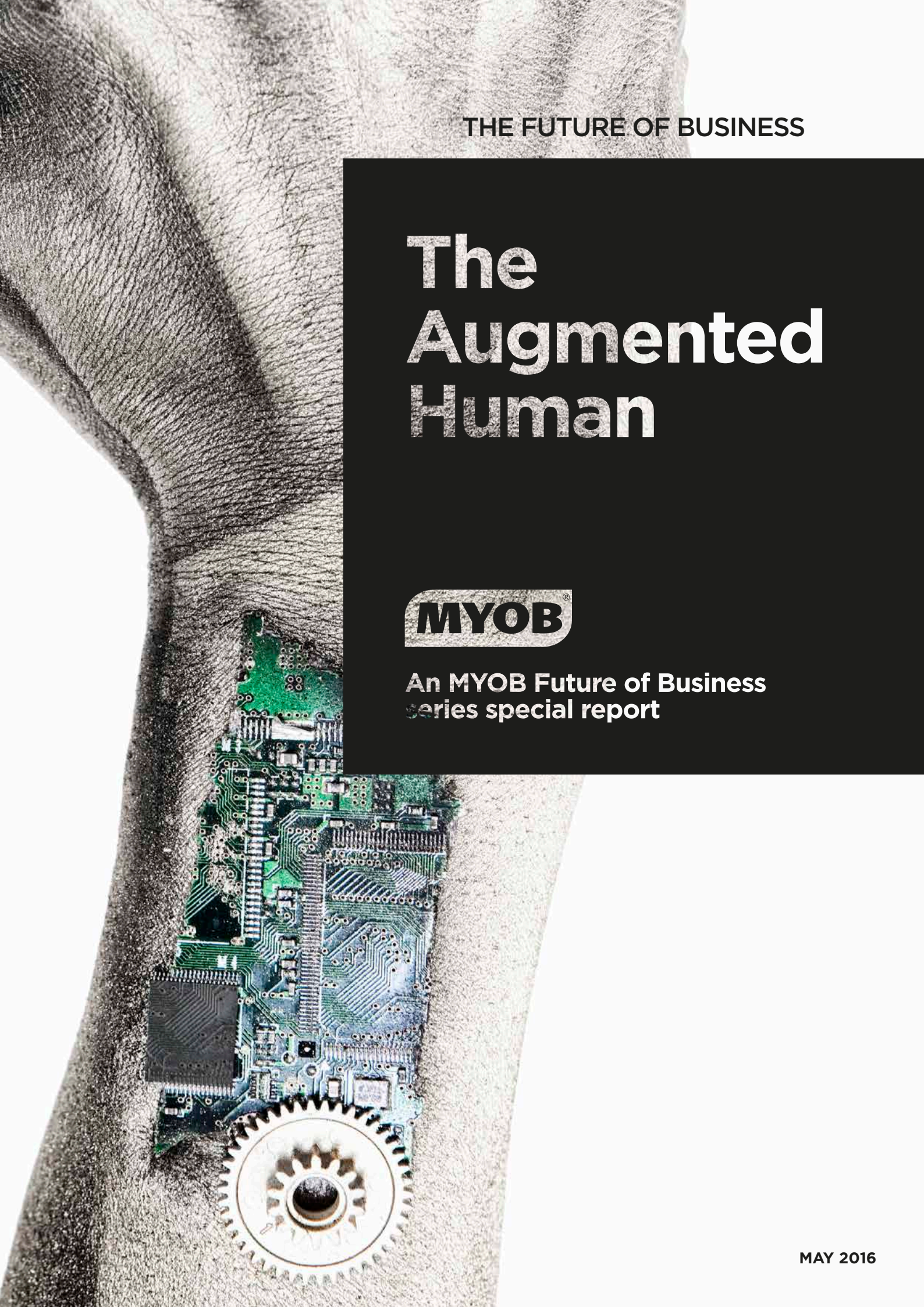


THE FUTURE OF BUSINESS

The Augmented Human

MYOB®

An MYOB Future of Business series special report

MAY 2016

Throughout humanity's history, people have been experimenting with ways to improve on the limitations of the human body.

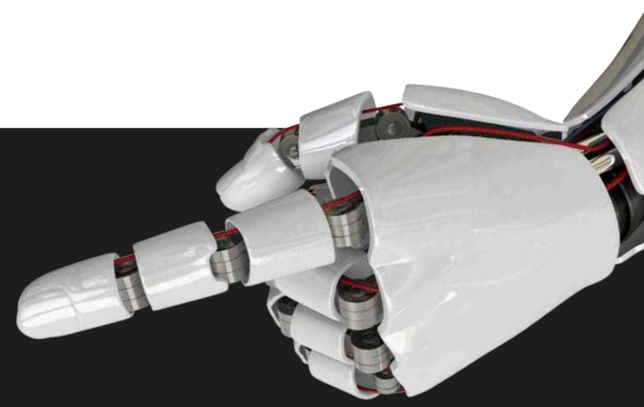
From the first person to pick up a stick to help them walk, through to developments in clothing and armour, prosthetic limbs, artificial joints and organs and the latest performance-enhancing drugs, people have worn and more recently embedded increasingly sophisticated body-enhancing technology.

Over the last century, our capacity to change the way we manage age and illness and improve our physical and mental abilities has been revolutionised. And as modern medical technology meets the information age, those abilities are ready to transform the way people live, interact and perform.

One of the areas where these technologies will have the most profound influence over the next two decades is in the world of work.

In the third installment of the MYOB Future of Business series, we look at how changing technology will mean changing ourselves. We'll explore the enhancements that – based on current trends and developments – will make a fundamental difference in the modern workplace. We'll look at new business opportunities and new experiences that will be opened up by advances in computing, science and biology. And we'll imagine a future where the brain and body will become increasingly integrated with digital and mechanical technology, to create the ultimate trans-human society.

Welcome to the Future of Business: The Augmented Human.



The Augmented Human

For a long time now, we've been opening up the human body and finding ways to physically augment it. At the same time, we've been getting better and better at designing and introducing chemicals and hormones into our systems – and often hiding their effects – to repair damage, prevent injury and, in particular, enhance performance.

In the last two decades, we've entered the information age, with the influence of digital technology transforming every aspect of business and many parts of our lives. At the pinnacle of what we are aiming to achieve through this technology is artificial intelligence. We are getting better and better at understanding the human brain and copying what it does. We are creating computers that are not only smarter, but able to think like humans – only at exponentially faster speeds and with instantaneous access to a near limitless source of information.

When that ability to understand what is happening within our own bodies from a physical and chemical point of view, as well as a deeper awareness of how the brain works, is coupled with advances in artificial intelligence we have the basis for the next evolutionary stage of humanity: **the augmented human**.

We've been adding artificial limbs, artificial joints, even artificial organs – making us, in many ways, more and more 'robot-like'.

Simon Raik-Allen – Futurist and MYOB Chief Technology Officer

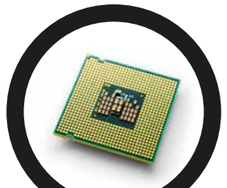
Wearables to embeddables

One of the most significant trends in information technology over the past few years has been the growing demand for biometric information from a wearable device. Arising from the fitness industry and enhanced by the smart-device revolution, these wearable biometric trackers have become widely accepted as a new standard of personal awareness.

As the technology has improved and evolved, this information is increasingly being combined with a range of other smart devices, most notably the smart watch, which provides many of the benefits of phones and tablets in a wearable format.

Although there have been some notable misfires, such as Google Glass, which saw the technology bump up against social attitudes, these devices are the first stage in a new phase of human augmentation.

With only small developments in the available technology, many of which are being developed now, these devices will be transformed from wearables to embeddables – tiny devices which will be placed within our bodies. These will be designed to track biometric information, direct the release of chemicals or the use of other enhancements, overlay our existing vision with a wide range of real-time data or different visual spectrums like infrared, heighten the sensitivity of our other senses to hear, smell and feel more, and provide a connection with our own personal artificial intelligence which will offer all the services we now get from our smart-devices through a direct and exponentially enhanced interface.



A new spectrum of perception

The very first embeddables are being installed now. Due to medical restrictions these are simple devices emplaced under the skin, allowing users to do things like feel the presence of a large magnetic or electrical field – a sense some animals possess but we don't.

These are strictly novelty items at present, but do point towards the areas where embeddables might soon make major advances.

Imagine, for example, an augmented shopkeeper. They are working in the back office when a customer enters their store. There's no bell on the door – rather they 'feel' the presence of the customer through a small nerve activated on the back of their neck or hand. As the customer walks around the shop, they are made aware of their movements through a map of nerves that lightly fire as they shift position. A blink of the eye brings up the linked store cameras in a retina display, showing what the customer is looking at as the storeowner gets up to go and greet them.

This sort of information that is fed to us, quite literally from our fingertips, will begin to change the way we not only experience the world around us, but how we interact with each other.

Enhanced intelligence

The computing capability required to manage our enhanced perceptions will be driven by a direct interface with artificial intelligence – either an enhanced version of our own brain and personality we can access, or a personal digital assistant available in the cloud.

If we return to our augmented shopkeeper, they are now talking to the customer who is asking about a particular product. The shopkeeper's Artificial Intelligence (AI) is listening in on the conversation and immediately notifying the supplier's AI, which is feeding back information on sizes, colours, order status and delivery schedules. The customer has used their own retinal camera to send an image of the product to their own AI, which returned images of what it will look like in their home in the various available colours.

After they agree on a purchase, the customer waves their hand, with an embedded account chip across the store's scanner, while the shopkeeper's AI instructs the supplier to dispatch the product by drone to the customer's home.

Changing your thinking

The rise in demand for embeddable technology will change the way we think of body-enhancing procedures. Your Mac genius at the Mac Store, for example, may need to be a licenced medical practitioner, able to perform the minor operation required to install the iPhone 25 directly into a patch of skull behind your ear. Although the idea of such body modification now may produce some personal squeamishness and certainly runs contrary to current medical regulations, the capability provided by this technology is likely to break down any barriers to adoption, as augmentation becomes more and more the accepted norm.

Like today, the area will be ripe for technological development from a range of large and small companies dedicated to bringing you the latest enhancements. Imagine a version of today's app store – the brain-app store or the body-app store – which you can connect to (using li-fi delivered directly into your retina by looking at a light-bulb) in order to download the latest developments in intelligence, mental performance, or simply entertainment.

Got an important business meeting in China? Download the language app and speak like a local with an accent add-on. Worried about offending your hosts at dinner while you clinch the big business deal? Connect with the app-store through your neural interface while you're riding the hyperloop train to Beijing and pick out the social etiquette app with the best reviews on Weibo. Want to buy a gift for your partner on the way home?

Follow the map displayed on your retina to the shopping district, and then connect them via the latest interface app so they can see the shop, feel the fabric of the clothes you are looking at and even smell the flowers on the counter.

Our level of enhanced perception, coupled with the capabilities of ever-powerful artificial intelligence, will be a fertile ground for business opportunity.

Marketers, in particular, will find a whole new world of possibility in the enhanced experience that our connected and heightened senses will bring, enabling them to do everything from deliver messages directly to people in images and information on the infra-red spectrum, to introducing subtle sensory changes in light, sound and smell as we shop, to appeal to our own personal preferences.

The sectors that have seen so much disruption through the current information technology revolution are once again likely to be at the forefront of change in the new wave of augmentation. For example, dynamic new businesses in the hospitality and entertainment industries could see huge potential advantages in human augmentation.

Your favourite new restaurant, might be a place called 'Think-Food', an establishment with no menus where the chefs prepare your meal based on the foods you've been thinking about that day and a cocktail list derived from your favourite chemical enhancements. Attending a concert could become an entire sensory performance, where you can share, see and feel different emotions and experiences depending on the zone you choose to stand in.

Improved performance

Alongside our enhanced mental capabilities and the ability to enjoy a wider spectrum of experiences, the rise of augmentation will change the way we manage our physical performance – largely through the control of chemicals and hormones in our bodies.

Embedded chemical pods, controlled by a neural interface, could be designed to release chemicals into our bodies to perform all kinds of tasks. The medical benefits of such a technology are enormous, from eradicating diabetes, to controlling infection or fighting the flu.

From a business perspective, these enhancements could also be incredibly useful. Feeling tired, but need to focus for the next few hours to complete the annual budgets? Increase the flow of stimulants and reduce the dopamine flowing through your body. Need a powernap now? Change your hormone levels and fall instantly asleep, with a range of chemicals programmed to be released in 20 minutes to gently wake your system. What about the elbow you injured when you came off your bike on the weekend? A localised analgesic will take your mind off that distraction for a while.

Managing the risks

Like every new technology we've introduced throughout history, there are – of course – downside risks and unintended consequences.

Combining the physical and the technological, and making them both accessible through the internet will require an enormously enhanced level of security. An embedded smart phone that's been 'bricked' by some malware might be a major irritation, but someone able to disrupt your artificial heart or hack the functions of your embedded AI to affect your behaviour could be a life-threatening risk.

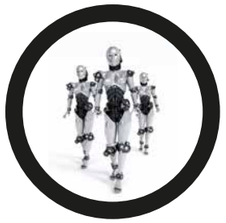
The social changes wrought by our own enhanced abilities, especially when it comes to issues like the ability to afford technology that will significantly improve or extend life, will require strong ethical management.

But the pace of change and the gradual evolution of abilities will give us time to face these issues and plan the way the technologies are integrated into society. Like cell-phone etiquette or social media standards, society will evolve new rules and norms, which will ultimately shape the technology and how it is adopted.

In many cases, too, the genie is already out of the bottle. The use of performance enhancing drugs in sport, for example, is now so widespread that we are likely within a generation of seeing major changes in the way their use is governed or controlled. This may eventually open up things like the augmented Olympics, where we compete to see what people are truly capable of at the limits of performance-enhancing technology.

Like any technology, there will be haves and have-nots and generational divides between the augmented natives and their future-shocked millennial parents. And there will be those that wish to opt out of the technology altogether on personal, social or religious grounds.

But ultimately, as we have seen in the proliferation of internet and smartphone technology throughout the world, there are also significant opportunities to share information and introduce new social and business opportunities to every corner of the globe.

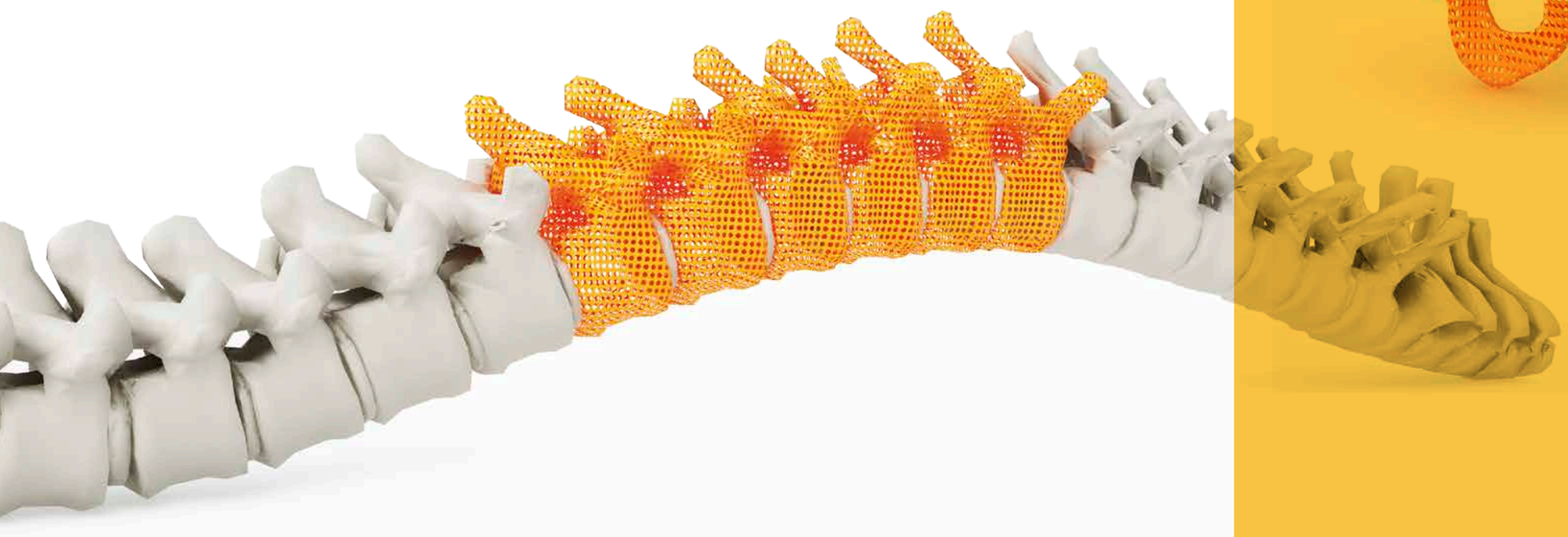


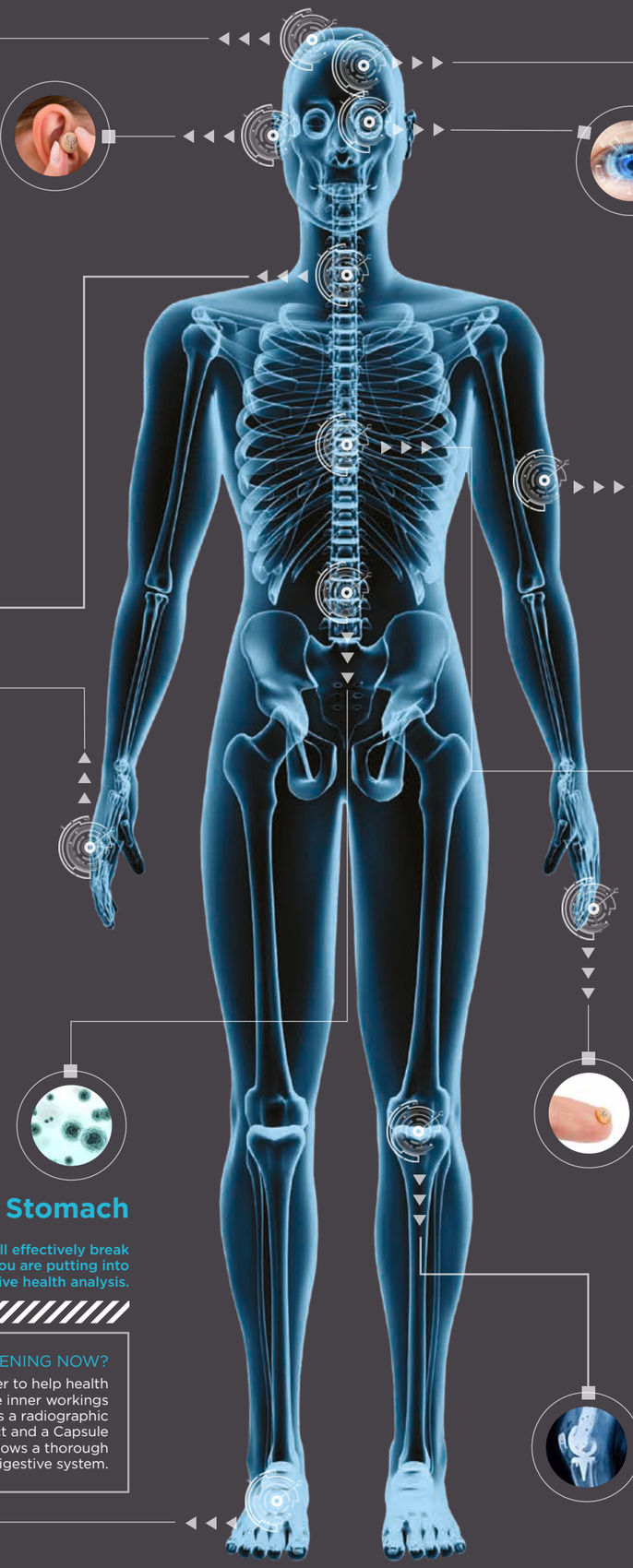
The rise of the post-human

With so many technologies now moving towards this end, the rise of the augmented human is almost inevitable. For business, this adds a whole new dimension to the information-driven economy which has already created so many opportunities globally. Our knowledge and capabilities will be enhanced, our physical and mental abilities will be raised to new heights, and the opportunities for us to experience, communicate and share will be unparalleled.

The existing technology industry will evolve to meet the demands of this new era and whole new industries that we can't begin to imagine now, even though we stand on the cusp of this revolution, will open up, driven by the disruptive forces of change.

Where this ends is ultimately the post-human future. We'll be blending more of our biology with technology. We'll be accessing more capabilities of ever-smarter artificial intelligence. We'll be relying more and more on these enhanced abilities. And, as cell by cell we replace and enhance our bodies and brains with technology, we'll gradually become more digital than biological until, ultimately, we will no longer be able to distinguish between the natural and the technological.





Skull

Skull implants will be manufactured by a 3D printer. Implants can be used as space for a centralised control panel or additional memory.

WHAT'S HAPPENING NOW?

Last year a Chinese infant became the first person to undergo a complete skull reconstruction thanks to 3D printing technology and in 2014 a woman in the Netherlands, who suffered from a chronic bone disorder, had the top section of her skull removed and replaced with a 3D implant.

Ears

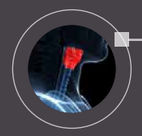
Bionic hearing will be run-of-the-mill for the augmented humans of the future with the ability to turn the volume of life up or down at a whim.

WHAT'S HAPPENING NOW?

Many bionic hearing gadgets already exist, including Soundhawk – the brainchild of ear surgeon Rodney Perkins. The weight of an earring, it fits in the ear and enhances hearing. Another variation of this technology are Cochlear implants, intended for people who are severely hearing impaired. Surgically implanted, they transmit signals to electrodes in the cochlea to stimulate the cochlear nerve.

Throat

Don't like how you sound? Want to learn a new language? An artificial windpipe and voice box will give humans of the future the ability to talk in any language, in any dialect, at any volume.



WHAT'S HAPPENING NOW?

Artificial synthetic windpipes can be transplanted into the human body with the aid of stem cells.

Hands

A microchip will be imbedded in your dominant hand with all your public details including name and place of work. With the ability to hold detail, simply shake someone else's hand for a quick information transfer. No need for business cards now.

WHAT'S HAPPENING NOW?

Many people have had microchips embedded in their bodies, from hobbyists to tech evangelists. One major microchip implanter estimated there are more than 10,000 "cyborgs" or humans with digital chips in them across the globe.

Feet

Bionic feet will also be a standard upgrade, giving people the ability to stand for days on end with no pain, increase the speed at which they move and also eliminate the need for protective footwear. With a human or more stylish robotic design to choose from they can be customised for each individual.

WHAT'S HAPPENING NOW?

Many variations of prosthetic feet now exist, including bionic options. One of the most high-tech is the Proprio foot, a prosthetic with a motorised, battery powered ankle which automatically adjusts the angle of the foot thanks to sensors embedded in muscle tissue.

Stomach

An inbuilt bio-med reader will effectively break down the components of what you are putting into your body to give you an extensive health analysis.

WHAT'S HAPPENING NOW?

Many tests already exist in order to help health professionals get a better look at the inner workings of their patients. The Barium Swallow is a radiographic examination of the gastrointestinal tract and a Capsule Endoscopy, or camera pill, allows a thorough examination of the digestive system.

Eyes

A permanent, customisable contact lens will allow people's eyes to have an inbuilt retina display. From perfect 20/20 vision to tuning into live-broadcast video, humans will have access to it all.

WHAT'S HAPPENING NOW?

Samsung recently patented contact lenses that can record footage, take photos and project augmented reality onto our eyes. The lenses would also allow users to connect wirelessly to smartphones. The controversial Google Glass used similar technology, displaying information in a hands-free eyeglass format.

Fingers

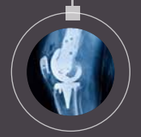
All index fingers will be bionic. They will have the ability to swipe through holographic images and fine tune, repair and charge other augmented additions to the body.

WHAT'S HAPPENING NOW?

Bionic fingers already exist in order to give amputees the ability to feel textures. They are also part of many finger and partial hand prosthetics, and can either be powered electronically or manually.

Knees

Bionic knees will be a commonplace augmentation, eliminating the standard wear and tear issues of the past.



WHAT'S HAPPENING NOW?

Leg and knee prosthetics have been around for some time – from primitive wooden variations to much more high-tech advancements. Bionic or spring loaded braces also exist, not only for medical reasons but to aid athletes.

Brain

A chemical switchboard panel will be fitted into the brain. You want to feel energised? Up those endorphin, oxytocin or serotonin levels.

WHAT'S HAPPENING NOW?

A British-born self-proclaimed "cyborg activist", Neil Harbisson, had an antenna implanted in his skull over a decade ago in order to perceive the colour spectrum beyond human vision, allowing him to see infrareds and ultraviolent via soundwave vibrations. Numenta, a company building computer memory systems and IBM, amongst others, have created brain-like programmable memory chips in recent years.

Arms

The wrist will feature a stylish inbuilt scanner system which will make it easy to not only scan items but will enable easy check ins and verifications. At the airport? Swipe your wrist. The gym? Office building? Need to get in to your house? Just swipe.

WHAT'S HAPPENING NOW?

A high-tech office block in Sweden offered tenants the chance to be chipped with a radio-frequency identification chip (RFID) in order to gain entry to the building last year.

Organs

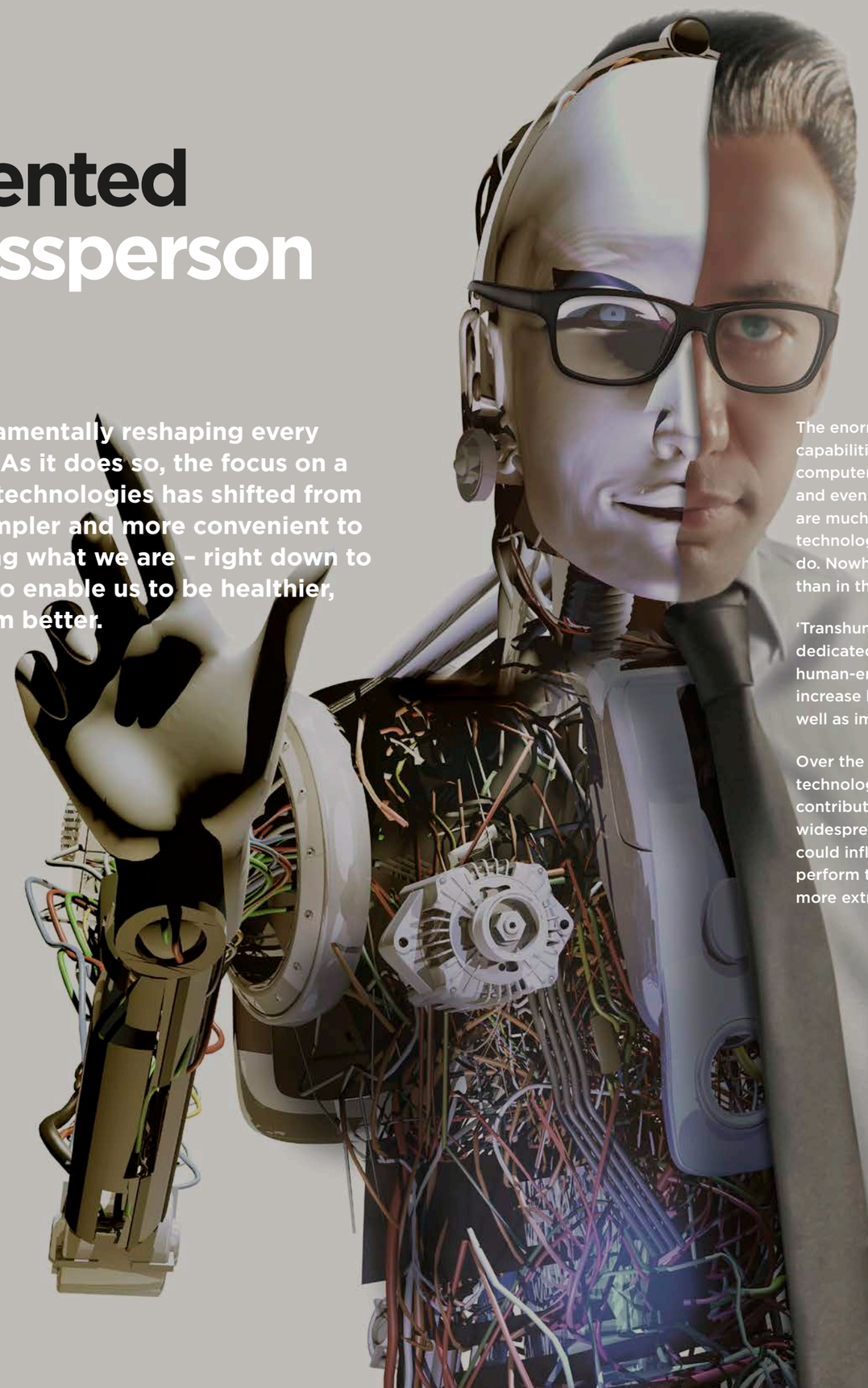
Organs will be easily replaced, with robotic, augmented versions. For example, the heart will become a battery-powered organ, easily maintained and eliminating the risk of heart failure or cardiac arrest. Artificial kidneys will replace the need for dialysis or transplants.

WHAT'S HAPPENING NOW?

Pacemakers are a well known device placed in the chest or abdomen to help control abnormal heart rhythms and many other bionic organs are in the early stages of development, from the pancreas, lungs, spleen and kidney. The bionic man, which came to life in 2013, exists as an amalgam of the most advanced human prostheses.

The Augmented businessperson

Technology is fundamentally reshaping every aspect of our lives. As it does so, the focus on a wide range of new technologies has shifted from making our lives simpler and more convenient to completely changing what we are – right down to the cellular level – to enable us to be healthier, smarter and perform better.



The enormous growth in our technological capabilities has given rise to fears that computers and robots will take over our jobs and even our lives. But in reality, the future we are much more likely to see is one in which technology is used to support everything we do. Nowhere is this more likely to be evident than in the workplace of the future.

'Transhumanism' is a growing movement dedicated to the research and development of human-enhancement technologies that could increase human senses, cognitive capacity, as well as improve health and extend life spans.

Over the next decade, enhancement technologies could make a significant contribution to the evolution of work. The widespread use of human augmentation could influence an individual's ability to perform tasks, or enable them to work in more extreme conditions.

Human augmentation would also improve effectiveness in routine types of work. Today, we use virtual assistants – our smartphones – to help us with workflow management. But what will this sort of augmentation look like in the future? AI is likely to form a key part of the workplace, helping us to train more effectively, access and share knowledge quicker and interface with highly complex and rapidly evolving systems. People will be able to sift through enormous amounts of information and perform mathematical calculations at super speed. Neural implants, visual links and even projected emotions will enable businesspeople to communicate more efficiently and effectively.

In partnering with advanced computer systems and using a wide range of technological and robotic supports, we also wouldn't necessarily become 'less human'. Innovation requires experimentation and creativity. Humans do these things well – but access to AI or other advanced systems could help us do it even better. Augmentation could be used to aid imaginative processes such as writing, composing music, or creating works of art.

The augmented humans of the next generation will be part of a new world, but one that is shaped by human drives, ambitions and emotions.

Transforming the workforce, today

The biological boundaries humans face are about to break down, with technology already transforming the way people are changing themselves to meet the needs of modern business.

Smarter

From cognitive enhancers to neural implants, scientists are constantly working on methods to improve the brain's abilities.

In the advanced world of medicine, smart systems that are the forerunners of tomorrow's AIs are already making it easier for doctors to diagnose patients quickly and accurately, and robots are assisting surgeons in performing technically tricky procedures.

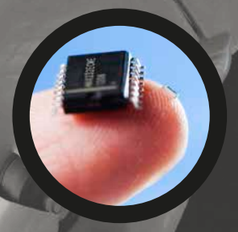
Smart drugs, called Nootropics, are growing in popularity among the workforce. The drugs are said to increase productivity and sharpen focus, without the intensity or side effects of a prescription drug.

Cochlear implants, a breakthrough in hearing technology, are also providing the basis for the development of neural implants, which in the future may open our minds to a wide range of direct interfaces with technological enhancements.

Stronger

Using the strength and endurance of robots to augment the abilities of humans is a rapidly advancing field of development. Breakthroughs in the development of exoskeletons for people with paralysis, to help them move, stand and even walk have already demonstrated the potential of the technology.

Like many advanced areas of technological development, this kind of augmentation is currently being explored and advanced by the military. However, designers are already considering how exoskeletons could help humans work more productively and safely. One area currently being considered is the construction industry, with predictions that within the next decade, we might be seeing exoskeletons on the building site, helping workers hold large tools, lift or shift heavy objects or in a safer more agile manner at heights.



More productive

For the HR professionals of the future, monitoring the wellness and engagement levels of a workforce will be possible in unprecedented detail. Embedded chips and monitors will provide instantaneous information not only on the state of employees' bodies but also their level of alertness, focus and attention. This could be especially useful in supporting workplace safety, helping manage the risks in areas where machinery, moving parts or hazards can make fatigue or inattention especially dangerous.

Technology is already available through the use of RFID (radio-frequency identification) chips embedded under the skin to directly interface with a workplace – to do things like gain office entry, operate the photocopier with the wave of a hand, or pay at the café – with office complexes in Europe experimenting with the technology as a form of added convenience and security.

Other body monitors, called nanomeds, are as small as a BB pellet. These sensors are embedded in a placebo pill that is swallowed. Once they reach the gut, they are activated by a combination of saliva and gastric juices. A small sensor that is worn on the chest picks up the signal from these nanomeds. The system is able to record a number of things and send the information straight to the user's smartphone or tablet, or the user's doctor.

As we augment our bodies in order to remain healthier for longer, our working lives are likely to be significantly extended. Using the unparalleled level of information we will have available about the health of our bodies and the stresses they are under, will enable us to better engage with the workplace of the future.

The technology to change our biology

The augmented body

Transhumanist Zoltan Istvan predicts that within the next decade half of all Americans will have microchip implants in their bodies, and that – for a price – biological hearts will be able to be replaced with mechanical ones. The artificial hearts will be Wi-Fi enabled and could be sped up and slowed down with a smartphone. The artificial heart business would eliminate heart disease, while the greatest challenge would be making sure they don't get hacked.

The Einstein generation

Istvan also predicts that the first child with augmented intelligence will be born in the next 10 years. Computer-brain interfaces that make use of wireless implants are already being developed by companies, such as BrainGate. Istvan said no matter what happens, genetic editing of the human embryo is here to stay. "Through these technologies we will be able to eliminate hereditary disease and improve human performance, but perhaps most importantly, we will be able to improve human intelligence and boost our own IQ – even potentially creating a new generation of Einsteins."

Internet to brain-net

In the next 10 years, we could see the gradual transition from an internet to a brain-net, where thoughts, emotions, feelings, and memories are transmitted instantly across the planet. Dr. Michio Kaku, author and professor of theoretical physics at the City University of New York says the movies of the future will be able to convey emotions and feelings, not just images. Scientists can now use computers to begin to decode some of our memories and thoughts. Soon, people will begin to experience what others are seeing and feeling, and historians and writers will be able to record events emotionally as well as digitally.

Around the world, scientists and futurists are already studying the technological developments that will allow humans to transform the way we live, work and interact.

Dr. James Canton, author and CEO of the San Francisco-based Institute for Global Futures has predicted that by 2025, there will be a massive Internet of everyone and everything – linking every nation, community, company and person to all of the world's knowledge.

He said this would accelerate real-time access to education, health care, jobs, entertainment and commerce. In medicine in particular, according to Dr Canton, the changes will be profound:

Reprogramming human biology

Dr. Ray Kurzweil, inventor, scientist and director of engineering at Google, says that by 2025, 3D printers will print human organs using modified stem cells with the patient's own DNA. This will provide an inexhaustible supply of organs without rejection issues. Damaged organs will be repaired with reprogrammed stem cells and we will be able to rewire human biology to avoid many diseases and slow and eventually eliminate the aging processes.

Revolutionising health treatments

Dr. Anne Lise Kjaer, founder of a London-based trend forecasting agency says the evolution of M-Health (mobile diagnostics, bio-feedback and personal monitoring) will revolutionise the treatment of a range of health conditions. Apps designed by medical professionals will provide efficient real-time feedback and treat chronic conditions at a much earlier stage. The apps would also assist mental health treatment, which would help people better manage their illness and ultimately improve work productivity.

"Humans and robots merge, digitally and physically, to treat patients who may be around the world. Robo-surgeons will operate remotely on patients. RoboDocs will deliver babies and treat you via a mobile."

MYOB