

Sci-Fi – Making the impossible possible



February 2014: Cross-disciplinary approaches and visionary entrepreneurs are driving scientific breakthroughs that could change not just our lives and work but our bodies and intelligence. Labs worldwide are opening up the vast possibilities of mind control and artificial intelligence, shape-shifting materials and self-organizing nanobots, cyborgs and enhanced humans, space exploration, and high-speed, intelligent transportation. These advances are no longer the realm of science fiction but moving rapidly towards commercialization and application, not in the distant future, but in many cases much sooner. Science is making what we thought was impossible, possible.

Neuroscience advances offer the possibilities of thought-controlled objects, and potentially other creatures, even as they offer greater potential to influence behaviors, decision-making, and illnesses. Taking control of minds and machines a step further, human-machine interfaces that could drive enhanced abilities are making rapid advances, whether offering soldiers superhuman strength or managing patients' health in real time. Wearable technology such as smartwatches, Google Glass, and health monitoring systems are already available – the next step will be taking them inside the body. Technologies such as 3D printing offer other possible body benefits, as soon you may be able to print a replacement for a missing or damaged body part.

Scientific advances will impact many aspects of our lives, for example getting around. Intelligent personal transportation could remove the “middle man,” i.e. drivers, allowing cars to drive themselves or take over to avoid accidents – and could be on the roads in the near future. A little further away is the high speed transportation envisioned by the Hyperloop along with low-cost (relatively) space tourism/travel.

Smart materials and production techniques will revolutionize production and consumption. From graphene and erbium to upsalite and martensite crystals, new materials are offering the potential for products that are lighter, stronger, and more energy and resource efficient.

It's an exciting age of scientific invention, although [The Economist](#) notes the speed of advances needs to be tempered by scientific discipline and challenge. Applications are limited only by imagination. Expect great debate around the ethics, financing, and distribution of public and private benefits of these advances – and the challenge of translating breakthroughs into replicable benefits.

The efficient and intelligent future of transportation & travel

Transportation equals freedom and control for humanity. It gives us mobility and since the introduction of mechanized transportation, the capacity, speed, efficiency and geographic coverage of transport systems has improved dramatically. While in recent decades the technology surrounding transportation has not changed at the same quantum pace as, for

example, nanotech, biotech and information technology, advances are now picking up. Driverless, intelligent vehicles and drone technologies offer the potential to reshape our infrastructure, cities and mobility patterns. What will be the impact on you and your business?

In Action!

Delivery drones: Are delivery drones the new unmanned [UPS](#) trucks of the skies? Delivery drones have been used by the U.S. Marines for years so the technology itself is not something new. However, as online shopping becomes increasingly popular and the streets more crowded with delivery trucks, drones could be a viable alternative to traffic congestion, making delivery more efficient and sustainable. [Domino's Pizza](#) has already developed the DomiCopter for [drone pizza delivery](#), while [Amazon's](#) Jeff Bezos has hit the news with his drone delivery ideas. However, he does point out that drone delivery will be years away at least in the U.S (and in Europe we suggest) due to strict air traffic control regulations. Delivery drones have though been spotted in China where local businesses are not subject to such strict aviation regulations. (Sources: [Wired](#), [TechCrunch](#)).

And you thought your car was safe? Hopefully it is safe on the road but as modern cars get increasingly computerized and fully autonomous security experts are warning that a new kind of cybercrime will emerge in the future. According to [CNN](#) *"car-hacking – where criminals can either remotely directly or take control of your car from their laptops – has become a bigger and bigger headache for car manufacturers and law enforcement bodies as in-car technology becomes more sophisticated."* At the Pentagon funded global "DefCon" hackers conference in Las Vegas in August 2013, one demonstration showed how it was possible to take control of smart steering, braking, displays, acceleration, engines, horns and lights of a 2010 Toyota Prius and Ford Escape model: All with just an old Nintendo handset. (Source: [CNN](#))

Look Out For...

Believing the impossible –The hyperloop: Elon Musk, founder of [PayPal](#), [SpaceX](#) and [Tesla](#), is no stranger to shaking up industries. He is dreaming big again with the "Hyperloop" – a new, superfast mode of transportation through an elevated tube built between two cities. Pods would be shot back and forth inside the tube at high speed reducing travel time from Los Angeles to San Francisco to 30 minutes, a 380 mile /615 km ride. Opinion on its feasibility is mixed, but Musk has vowed to prove the naysayers wrong by building a physical prototype. (Source: Various news agencies)

On-demand transportation: The technology surrounding driverless vehicles is developing rapidly. While today vehicles still require a driver, at some point he or she will become unnecessary. In the future, according to the [FuturistSpeaker](#), people will use their mobile devices to call a driverless vehicle in the same way as people hail a cab today whenever they need to get about. Without the cost of drivers, this type of transportation will be infinitely more affordable and for most people it will be less than the cost of vehicle ownership. So rather than buying a car, and taking on all the liabilities of maintenance, upkeep, and insurance, consumers will simply purchase transportation whenever they need it. Already a disruptive technology impacting many industries, driverless vehicle advances will likely be blamed for destroying countless jobs, e.g. truck drivers, taxi drivers, bus drivers, limo drivers, traffic cops, parking lot attendants, and ambulance drivers.

Changing the world of manufacturing and production – smart materials

Researchers and engineers have been experimenting with smart or intelligent materials for years. Some creations are replacing rare, hard-to-get and expensive materials, while others are changing how things are made as well as making products smarter and more intelligent. It may sound like sci-fi, but some of these artificially made materials have the ability to change their

properties by the application of any external stimuli such as stress, temperature moisture, pH, electric and magnetic fields, increasing potential applications and overcoming barriers to use in changing environments. Let's have a look of some of these new game-changing wonder materials.

In Action!

Smart materials offer massive possibilities: Wonder material graphene is the strongest ever discovered (so far), flexible, extraordinarily light and transparent. A single layer of carbon atoms can supercharge computer chips, optical circuits, lithium-ion batteries, and solar power generation but does it have a competitor? [Arizona State University](#) electrical engineering professor Cun-Zheng Ning discovered erbium chloride silicate, which could be used to improve the capabilities of the internet, the efficiency of silicon-based photovoltaic cells and the quality of solid-state lighting and sensor technology – in addition to the next generation of computers. (Source: [Science Daily](#)) If these two are not enough, atom-thick carbyne chains could become the world's strongest material if it can be made in bulk according to [scientists at Rice University](#). Many more exciting materials are in development so do check out shape-changing [martensite crystals](#), [shape metal alloys](#) and water absorbing [upsalite](#), all of which offer tremendous potential to enhance products, processes – and our daily lives.

Carbon nanotubes: Incredibly small, yet offering a plethora of different “species,” and each with its own structure and unique combination of electronic and optical properties, including amazing semiconducting properties. The material is being studied for its potential applications in many areas, e.g. as electrode materials for energy storage, as transparent conductive films, and as nanocomposite materials with novel properties. Carbon nanotubes are already being integrated into hundreds of different applications from green tech to clothing and medicine. In September 2013 the first computer, “Cedric,” built entirely of carbon nanotubes, was unveiled by Stanford University. It may not be fast but it is opening a door to a whole new generation of digital devices. (Sources: [Phys.org](#), [BBC](#), [Berkeley Lab](#), [TechNewsDaily](#))

Look Out For...

It's gone – disappearing electronics: Stockpiles of electronics are filling up homes and landfills. What if these electronics simply disappeared when no longer needed? Apparently that's exactly what Pentagon has in mind. However, they are not planning on making your personal electronics go away but on making lost electronics on the battlefield disappear, so the military can be more environmentally friendly, as well as protecting potentially important information. According to [USA Today](#) “*The Pentagon will pay a Silicon Valley-based research institute US\$4.7 million to develop a silicon/air battery capable of powering electronic devices and becoming “unobservable to the human eye” when activated to do so.*”

Materials changing manufacturing: Technological breakthroughs in, e.g., robotics, sensors and IT are changing the manufacturing industry. While some of these are important drivers of how things are made, nothing is impacting the manufacturing industry more than the materials manufacturers are using to make things. Cutting-edge materials such as fungal foam, electric ink, waste-to-energy thermoelectric, nanoSHIELD coatings, designer nanocrystals, mega magnets, cheaper and lighter carbon fiber, ultrathin platinum and bio-inspired plastic (Shrilk) are just some of the new materials that will make our homes, vehicles and gadgets more sustainable. Click [here to see the slideshow](#) from [Scientific American](#) about the use of these cutting-edge materials.

4D printing and self-assembling swarmbots: That 3D printing is still an immature technology hasn't stopped [MIT's](#) architect and computer scientist Skylar Tibbits from taking it to the

next level – self-assembling 4D objects. The process could be used to install objects in hard-to-reach places such as underground water pipes and to build furniture, cars and even buildings. (Source: [BBC](#)). Elsewhere at [MIT](#) are self-assembling swarmbots or M-blocks that are cube robots with no external moving parts. Armies of these mobile cubes could temporarily repair bridges or buildings during emergencies, assemble into diverse types of furniture and equipment as needed or swarm into environments hostile or inaccessible to humans, diagnose problems, and then reorganize themselves to provide solutions. (Source: [Kurzweil Accelerating Intelligence](#))

Technologies disrupting the medical world

People are living longer and the burdens on the world's health care systems are increasing. Costs are rising for providers, payers and patients, as healthcare remains expensive for many. However, healthcare is reshaping itself. Technology is creating new competitors, new services and new ways for consumers to be involved in their own health. With easier access to information people are no longer just satisfied with the knowledge they get from professionals and experts.

Patients are changing from being passive receivers of treatment to actively taking matters into own hands. Point-of-care is moving from hospitals and clinics to the home, into the hands of the patient and other caregivers as cutting-edge technologies improve self-monitoring and, eventually, self-understanding of one's medical conditions and lifestyle. Does this development mean we no longer need professionals for routine tasks? What are the risks? What does it mean for the health of your employees?

In Action!

Getting a new body part: 3D printing of artificial limbs and biomaterials is going mainstream. Examples abound of artificial limbs, dental implants and different types of biomaterials such as [kidney](#) or [heart tissues](#) being printed out in 3D. Wouldn't it be great if you could print whatever body part you need, whenever you need it and even more importantly with an affordable price tag? We are almost there. A South African carpenter who lost four fingers in a circular saw accident worked together with a Seattle mechanical theatrical props designer and eventually hit upon 3D printing as a way to develop prototypes quickly and to keep the final manufacturing cost down. For no more than US\$150, you can get a 3D printed [Robohand](#) that grab things with bendable fingers, which is more that many prosthetic hands do. (Source: [Singularity Hub](#))

All wired up! Self-tracking, the Quantified Self or Lifelogging is getting increasingly popular. Wearable technologies and a rising number of apps are fueling the movement. The data-tracking craze involves tracking the health of your body and mind by gathering all possible data about yourself, e.g. the food you eat, quality of the air you inhale, your mood, oxygen levels, as well as your physical and mental performance. It also means being responsible for processing the data and making your own assumptions. Does that mean we no longer need doctors? Probably not, but all these smart devices gathering data about you could disrupt the medical world as many of the devices could be making as good a decisions as a doctor. (Source: [FuturistSpeaker](#)). Today sensors are added to our phones, glasses, watches and clothing but in near future they might very well be implanted into our bodies. Examples of Quantified Self apps include: [Scanadu](#), [Inflow](#), [AskMeEvery](#), [MyFitnessPal](#), [23andMe](#).

Look Out For...

Medical glasses and artificial intelligence systems: Technology is making its way into the operating room, helping nurses and doctors perform their jobs better. For example, [Google Glass](#) has shown potential in surgery. A surgical team from [University of Alabama at Birmingham](#) (UAB) performed one of the first surgeries using a telepresence augmented

reality technology from [VIPAAR](#) in conjunction with [Google Glass](#). It is not always easy to find the right vein in a patient's arm but [Evena Medical](#) has released the [Eyes-On glasses](#) that can "see through" the skin helping medical professionals with the task. [Watson](#), IBM's artificial intelligence computer, has also been tested by US clinics in 2013. It has proven to be valid and valuable in the medical decision-making process: [IBM](#) has already trained Watson to help doctors arrive at better individualized cancer diagnostic and treatment recommendations in partnership with [Memorial Sloan-Kettering Cancer Center](#). It has also been trained to help speed up the claims review process with the health insurance company [WellPoint](#). (Sources: [PSFK](#), [Kurzweilai](#), [The Burrill Report](#))

DIY medicine – printing pills: What if it was possible to print your own pills? According to professor Lee Cronin and his team of researchers at Glasgow University in Scotland it is possible to turn a 3D printer into a sort of universal chemistry set capable of "printing" prescription drugs via downloadable chemistry. First, the team wants to print a simple drug like ibuprofen. The "chemputer" could give easier access to medication for people in developing countries who have limited access today. The downside? Not everyone in the current pharmaceutical food chain would like the idea of a cheap delivery mechanism for prescription drugs and of course there is a huge risk of illegal drug-making if the "chemputer" is accessible to the masses. Professor Cronin wants to expand the possibilities quickly, though. He says, *"As well as transforming the industry and making money, we could be saving lives. So why should we wait?"* (Source: [FuturistSpeaker](#))

Smart lenses: Life could soon be easier for diabetics. [Google](#) is currently testing technology that can measure glucose levels by using a "smart contact lens". It will measure the level of glucose in the tears utilizing a "tiny" wireless chip and a "miniaturized" glucose sensor embedded between two layers of lens material. The prototype in development is able to generate one reading per second and Google plans on integrating tiny LED lights that could light up indicating when glucose levels have crossed certain thresholds. For now it is working with the US Food and Drug Administration (FDA) to bring the product to market but is also looking for partners "who are experts in bringing products like this to market." (Source: [BBC](#))

Hacking the body and mind

The term "singularity," most commonly associated with futurist Dr. Ray Kurzweil, refers to a time of rapid and accelerating development of various sciences and technologies, including biotechnology, nanotechnology, artificial intelligence, robotics and genetics, when machine intelligence surpasses that of humans and irreversibly alters human existence. Ultimately, technological advances may enhance human capacity and intelligence to deal with radical change and complexity through new human-machine interfaces – dramatically impacting how we think, live and work in the future. Imagine a world where computers do all the logical thinking for us leaving us free to do creative and conceptual thinking?

In 2013 Kurzweil claimed that we will be uploading our entire minds to computers by 2045 and that machines will replace our bodies within 90 years! (Source: [Mail Online](#)) How can we go so far? Here are some of the inventions that have the potential to make these predications a reality.

In Action!

Robot surrogates: Henry Evans was paralyzed by a stroke at the age of 40. Today he uses head movements and a finger to communicate with a computer using experimental interfaces. He collaborates with [Georgia Tech](#) professor Charlie Kemp on using the [Willow Garage](#) PR2 robot as a surrogate. The robot surrogate allows him to directly move the robot's body, including its arms and head. It also lets him invoke autonomous actions, such as navigating in a room and reaching out to a location, e.g., for the first time in ten years he

is able to scratch an itch for himself and shave his cheek. While this is only a first step, it demonstrates how people with severe physical disabilities could use personal robots to gain independence. (Source: [TED](#), [Willow Garage](#)). Meet the Robots for humanity [here](#).

Restoring senses: Neil Harbisson is a cyborg. He was born without the ability to see color so he decided to “hack” his own body with a device – the “eyeborg.” The eyeborg translates color information into sound and now he effectively hears colors instead of seeing them. For patients blinded by retinitis pigmentosa (RP) which is a degenerative eye disease affecting one in 4,000 Americans a new eye implant has been developed. The [Argus II retinal implant](#) is like a cochlear implant (an implant that is attached to the brain's cochlear nerve and electronically stimulates it to restore hearing to someone who is deaf) for the blind. It looks like computing goggles such as Google Glass but it sends the images the eyeglass-mounted visual processing unit detects to a tiny electrode array that’s been implanted in the user’s retina. Though now available to the average American, “*These devices are expensive, even to manufacture; US\$10,000 is the very, very basic cost,*” Humayun, co-inventor of the device, says. Another example is an avatar system that can help schizophrenics control the voices in their heads which is being developed by researchers from [University College London \(UCL\)](#). (Source: [PSFK](#), [Healio Ophthalmology](#), [Singularity Hub](#), [Mail Online](#))

Look Out For...

Mind (and machine) control: In Western Australia the insurance company [RAC](#) has created an “attention-powered car” controlled by brainwaves: It slows down when the driver’s attention drifts off and speeds up again when attention returns. Leading car manufacturers, e.g. [Ford](#), [BMW](#), [Fiat](#), [Daimler](#), [Volvo](#) and [Volkswagen](#), are testing systems that take control of the steering wheel as well as other alert systems that activate when risks are detected (Source: [PSFK](#), [BBC](#)). Thought control is being tried on many levels: At the [Harvard Medical School](#) a team has developed a [non-invasive brain-to-brain interface](#) that allows a human to control a rat's tail. Researchers at the [University of Washington](#) have performed what they believe is the first [noninvasive human-to-human brain interface](#), with one researcher able to send a brain signal via the internet to control the hand motions of a fellow researcher. [Samsung](#) is also getting into game, teaming up with wearable computing expert Roozbeh Jafari from [University of Texas](#) to translate thoughts into computing tasks. It might be a while before you see a mind controlled Samsung device but keep watching. (Source: [International Science Times](#), [Singularity Hub](#))

Body strength: Energy is essential for all of us but for soldiers it can be the difference between life and death. In fact U.S soldiers have to carry so many batteries when on a mission that it impedes their mobility. To alleviate this problem, the army wants soldiers to use bionic knee braces that would harness the sun and kinetic energy to recharge their devices. They have no or little medical value but they don’t interfere with the soldiers’ mobility. Another promising complement to batteries comes in the form of flexible, wearable solar panels that could be woven into a soldier's uniform to generate power and feed it to devices. The U.S. army is also asking the technology industry, government labs and academia to help them build an [Iron Man](#)-style suit that could give troops “superhuman strength” and is aiming to get it out in the field in three years time! (Source: [Mashable](#))

In March: Look out for trends in action on Panic versus denial: The resource gap grows, the global risks rise – but who is listening?