Moral Veritas - Utilitarianism 2017

MORAL VERITAS

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Kristopher Gasteratos


How will humanity...
...and sentient animals...


...be affected by these technologies?

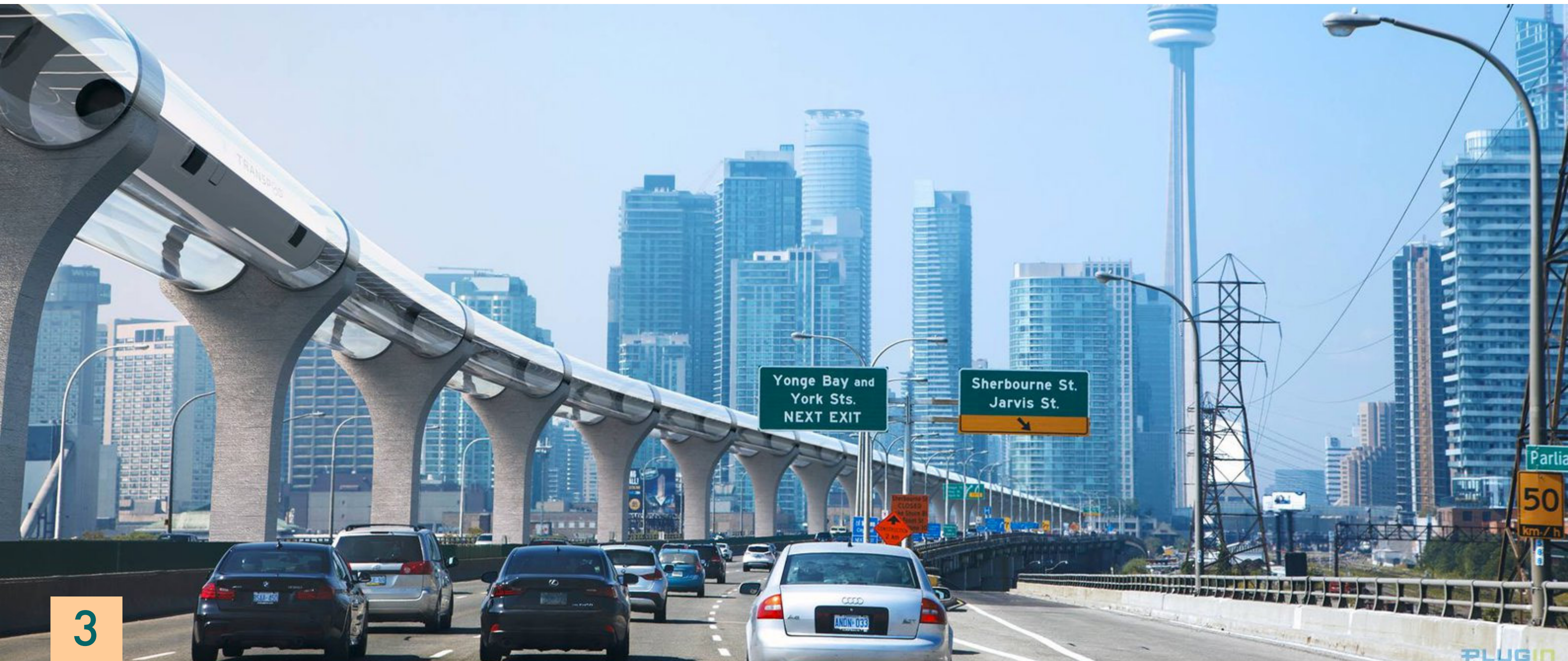
Introduction

Humanity has reached such an advanced and accelerating point technologically that years of scientific inquiry and application are cumulating exponentially. If an individual from the year 1917 were to analyze their standard of living, and world generally they would likely find that *fewer technological strides* have taken place **1000** years before, in the year 917, than just **100** years in the future, in 2017. This acceleration offers a foreshadowing towards incoming technologies on the horizon this century. And while there are many pieces that explore the future ramifications of technological advances this century, few analyze such through the lens of ethical frameworks. This is the novelty of this literature, as the focus is not placed on speculation of what technologies may bring, but rather if they ought to be explored for their altruistic potentiality towards sentient beings universally. Of course, however, the future is exceptionally difficult to predict. While there are many indicators that the following technologies through social interest, financial potential, and problem-solving capacity are practically guaranteed to develop, human civilization has proven to be a complex body with variable tendencies; not to mention the bounds by which nature has organized itself and our unraveling of such phenomena. For instance, after colonizing Mars in the former half of the 21st century, extraterrestrial bacterial life might be discovered, posing a completely new set of questions not previously anticipated. Nevertheless, the following technologies show immense promise, and will be deeply affecting to people at an everyday-level. Their ramifications will also be more complex than any advancements before them, and the following paper aims to serve but a microscopic analysis of the full extent of these technologies. This piece will focus on technologies of potentially high influence, in contrast to those of high moral utility, which may not be as impacting to the average person. For instance, cellular agriculture, or the production of animal products without animals, aims to change the production method of animal products like meat or leather, and **not** the products themselves -- so meat or leather of the future, made from cellular agriculture instead of animal agriculture, would be the same product as the old animal products and accordingly consumers unaware of the manufacturing shift, may be potentially unaware of a product difference at all. This therefore, would not highly influence peoples' daily lives, but would be of immense moral worth as it would have successfully reduced tremendous suffering globally (of which is potentially unbeknownst to consumers). A similar position could be advocated for nuclear fusion, since the production method changes for energy, but distinctively, the product quantity also changes in its evolved methodology. Even so, exploring the moral basis for the following technologies is critically important. Indeed, technologies may inherently seem valuable to work towards, driving discovery and innovation, but similar to claiming that a particular act is lawful or unlawful, based upon **no fundamental set of governing laws**, it is impossible to claim that an act is unethical (bad) or ethical (good) based upon **no fundamental ethical theory**. Such moral obligation serves as the impetus to analyze the following technologies and their ethical prowess. For the path which avoids philosophizing this ethical potential, is *at best*, intellectually lazy, and *at worst*, dangerously unscrupulous.

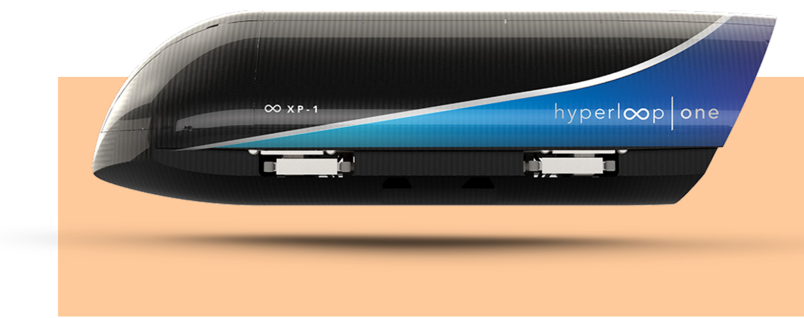
Hyperloop

The Next Leap in Transport Technology

Since the beginning of the 1800s, amidst the industrial revolution, there has been a revolutionary technology in transport roughly every half century or so. With the exception of boats/ships, which were invented millennia before the following technologies, this pattern also encompasses the most used transport methods as well: beginning with the Train in the early-19th century, to the Automobile in the late-19th century, the **Airplane/Subway** in the early-20th century, and culminating with rotorcrafts like the Drone & Helicopter in the late-20th century; these innovative advances have radically changed the way people have moved from "Point A to Point B", and the concept of travel overall. Such revolutions may seem reasonably patterned until one realizes the more than 100 years that has transpired since a revolutionary transport methodology has affected peoples' frequent travel. This term frequent travel refers to the rapidity by which an individual will use a transport; hence indicating its value within daily civilian life. Subways, automobiles, and bicycles fit under this category, while planes and ships generally do not. While one may argue that there have been significant improvements upon the aforementioned transportation technologies, and indeed there has, a fundamental shift in how humanity moves is what garners appropriate mention on this list. The airplane and subway have been highlighted above as this transportation dichotomy, introduced but a century ago, may be foreshadowing an upcoming early-21st century transportation dichotomy on the horizon. Regarding perceived historical significance, the plane has essentially stolen the spotlight from the subway over the last hundred years -- perhaps due to its "groundbreaking" method of airborne transport. Nevertheless, with similar timelines of societal introduction, the plane and subway have both significantly altered civilian transport, but there is a fundamental difference that separates the two. Over the last century, airplanes, far better equipped than boats in regards to time and ease, have offered excellent inter and intra continental travel, but the important factor left primarily unaffected has been *daily, commute* based transport. Conversely, subway systems, have indeed affected *daily, commute* based transport and as such have also radically changed the most populated cities in the world. This result of subway technology is so vital relieving otherwise congested roadways, considering the cities affected notably serve as economic epicenters for nations. And so, airplanes have made tremendous leaps militarily and for **infrequent** travel, but are dwarfed by subway systems in their significance for human transport regarding **daily/frequent** travel. The transformative technologies that may follow with the same key difference this century are the autonomous car and the Hyperloop. Autonomous vehicles, aimed at the reduction of



human-made vehicular errors, by of course automating this system, are likely to change human society similar to the way planes have -- they will indeed make a tremendous impact, but will leave daily travel largely unchanged, at least in terms of the foundation of vehicles. With the exception of new consumers through advanced ride-sharing models, vehicle passengers are unlikely to exponentially increase. Therefore, daily transport through cars may seem to be changing aesthetically in the coming decades since they will be more technologically advanced, but they will remain largely the same, fundamentally. Now this certainly comes with a few caveats like autonomous vehicles' capacity to increase traffic with more users in spite of its computer driven directive, or the potential for multiple-hour long commutes via car where you need not be occupied behind the wheel, increasing efficiency. Despite these attributes of autonomous cars, the Hyperloop, in comparison to the subway system just a century ago, has the capacity to radically change daily travel, as well as real estate globally. *The Hyperloop*, originally coined and conceptualized by Elon Musk, is a new mode of transportation that aims to transport people in automated, pressurized capsules free of air resistance and friction which travels within a vacuum.[1] The pilot systems are currently in development and are projected to be ready for commercial use in the 2020s.[2] The benefits range from basic convenience of travel to safety improvements over alternative transportation technologies. However, the two primary strengths of the Hyperloop as a revolutionary transport system are its **price** and its **speed**, with the corresponding time of travel. These two points will be explored in much greater depth, but also important to mention are the physics of the system which create a pleasant "cabin" experience in light of the velocity. So while capsules are traveling at remarkable speed, the experience within the cabin will be non-harmful, as the experience will be that of 1g speeds.[3] As for its environmental sustainability, the Hyperloop is actually net energy positive as the total solar and mechanical energy harnessed in its operation outweigh the energy expenditure to run it in totality. Additional ecological advantages include it being secure from weather conditions, natural disasters like Earthquakes and their corresponding debris like falling trees, avoiding wildlife, and playing a smaller role interfering with nature generally, since it requires no illumination externally on its established path, which cannot deviate either (in contrast to motor vehicles). Also important to note are the mechanical bases of



the Hyperloop such as the *Natural failsafe system* - in the event of equipment or electrical failure, [capsules will] glide to a halt, rather than fall out of the sky and crash, or careen off the road into a river. Also its automated operation reduces the risk of human error, so it is unlikely to go too fast and crash into the end station, exceed safe G-forces on turns, or any number of things that human conductors or drivers can easily mess up." [3] However to return to our salient benefits of this system, *the* **price** of use is of course what will pose the limiting factor as a **frequent** travel method for mass societal use; as well as other factors like availability and access to the masses. And so, while a large degree of certainty cannot be attributed to this, since investors and the structure of capitalism overall will likely affect this figure drastically, Elon Musk who helped popularize the idea of the Hyperloop years ago has calculated a ticket would be just $20, with this likely depending on distance traveled and stops as well.[4] This leads us to the second salient aspect of the Hyperloop, *its* **speed**, and more importantly how fast one will be able to arrive at their destination. In short, the Hyperloop, will travel over 760 mph.[3] This enables the next generation leap of transport that was referred to earlier; a revolutionary advancement that will drastically affect real estate, delivery/shipping, medical/emergency care, and the job market altogether. Immense pressure will likely be placed on the airline industry as well, since Hyperloop can compete with this market. Regardless, the Hyperloop has the capacity to usher in a new age of travel like automobiles and subways did upon their explosion into society. This is because the Hyperloop will open up geographical areas that have otherwise remained untapped. The greater Boston area, for instance, has a history that is basically as long as the United States itself. We shall use the town of Medford and the South area of Boston as examples to illustrate the revolutionary capacity of transportation technology; of which, both locations were "established" prior to the 1700s. If you happened to reside in Medford and work in South Boston, the daily commute by car is about 30-40 minutes, while the commute via subway and bus can be a bit over an hour. This residential-work dichotomy is considered reasonable today due to automobile and subway technology, since a daily commute totaling 2 hours or so (roundtrip) does not significantly impact ones' ability to live a normal, modern life, including fulfilling other daily requirements. However, in the year 1706, if you were to suggest that somebody live in Medford and work in South Boston, it would have seemed absurd. It is approximately a 6 hour walk (roundtrip), and riding by means of horse may have proved too costly for most people; not to mention the impracticality of walking for six hours daily in the winter.

Now let us fast forward, to the year 2043. The daily commute via Hyperloop from Grayson, Kentucky to New York City is not a 10-hour drive as it is today, **but rather a 30 to 40-minute daily work commute**.[3,5] Similar to someone contemplating living in Medford and commuting to South Boston in the year 1706, this seems absurd today, but with a Hyperloop, the daily commute of this 610 mile "expedition" from Kentucky to New York is shrunk to a reasonable daily commute. This would allow one to live in a so called "fly over" state and work in cities where real estate may be too expensive. Additionally, it certainly is not particularly practical for a daily commute, but due to the removed limitation of acceleration, a Hyperloop-based commute from Los Angeles to New York City would only be about 3 hours (slightly more than Elon Musk's original 45 minute estimate).[6] As for technology transfer, it may prove useful to expand Hyperloop technologies to impoverished areas of the world to increase work capacities, thus advancing economies there, however the prospects of this are unknown. Considering there are still "developing" countries that have not even established their first rail system, the

Hyperloop may have a similar scenario in the future. In 2050, the Hyperloop may be the rail of yesterday, where even poor, developing nations have non-automated cars and high speed rail systems, but they do not have what developed countries have, like autonomous vehicles or the Hyperloop. This is not a technology that is likely to help impoverished areas directly, though its indirect and induced benefits may prove beneficial for developing nations. In summation, the Hyperloop is on track to be the subway of the 21st century; the autonomous car will likely steal the spotlight from it within the next decade, but the vast change brought to daily society via Hyperloop systems will be evident after widespread implementation. Humanity will look back upon intracontinental trips and find it amusing how daily commutes from Canada to Mexico or Paris to Moscow seemed once impossible.

***The recently announced Earth to Earth intraplanetary transport system from SpaceX using the BFR has also garnered some attention but was exempted from mention, as its high expense will potentially limit mass use considering reusable rocket ships still need to use rocket fuel which is expensive regardless; not to mention the consumer acceptance hurdles of boarding a space ship which has only been successfully re-landed with precision a couple dozen times in the last few years. The Hyperloop avoids such issues as it models a similar transportation method of trains (and only adds upon the safety present with such system). Conversely, the energy restraint on the BFR system can be potentially relieved with another technology in this piece, nuclear fusion, which can offer significantly reduced fuel costs for BFR.*

Ethical Analysis

The ethical ramifications of the Hyperloop seem to be **principally positive**. Transportation technologies increasing in proliferation and capacity serve as conduits to expand interactivity between humanity, which accelerates commercial and innovative efforts. Since applied scientific principles taken form through technology are often what allow the fulfillment of otherwise problematic ethical issues, this capacity for the Hyperloop is likely its strongest. Its utility may be compromised with advancing augmented and virtual reality systems intersecting the time frames of widespread Hyperloop production, but the overall benefit of physical transportation for labor, production, and commute is currently unmatched. Criminal activity is another thought-provoking ethical point where the means of escape from crime and terrorism can evolve with a technology like the Hyperloop. While consequently, its unconventionally limited pathways bring about less interference with the natural world, and therefore its eco-friendly nature offers a better ethical dimension for the environment than prior transportation methods. This by extension, offers less potential harm to wildlife and the well-being of society overall. The threat of malicious, manipulative destruction of systems is likely the greater threat to the Hyperloop in lieu of basic operating malfunctions, which as mentioned have a fail-safe mechanism in place anyway. Much of this, is indeed contextual to the price for mass consumer utilization, which is yet to be established as mentioned. However, commercial entities striving towards worldwide adoption of Hyperloop have expressed an interest to make it a widely-used technology, which would suggest a reasonable daily cost for consumers.

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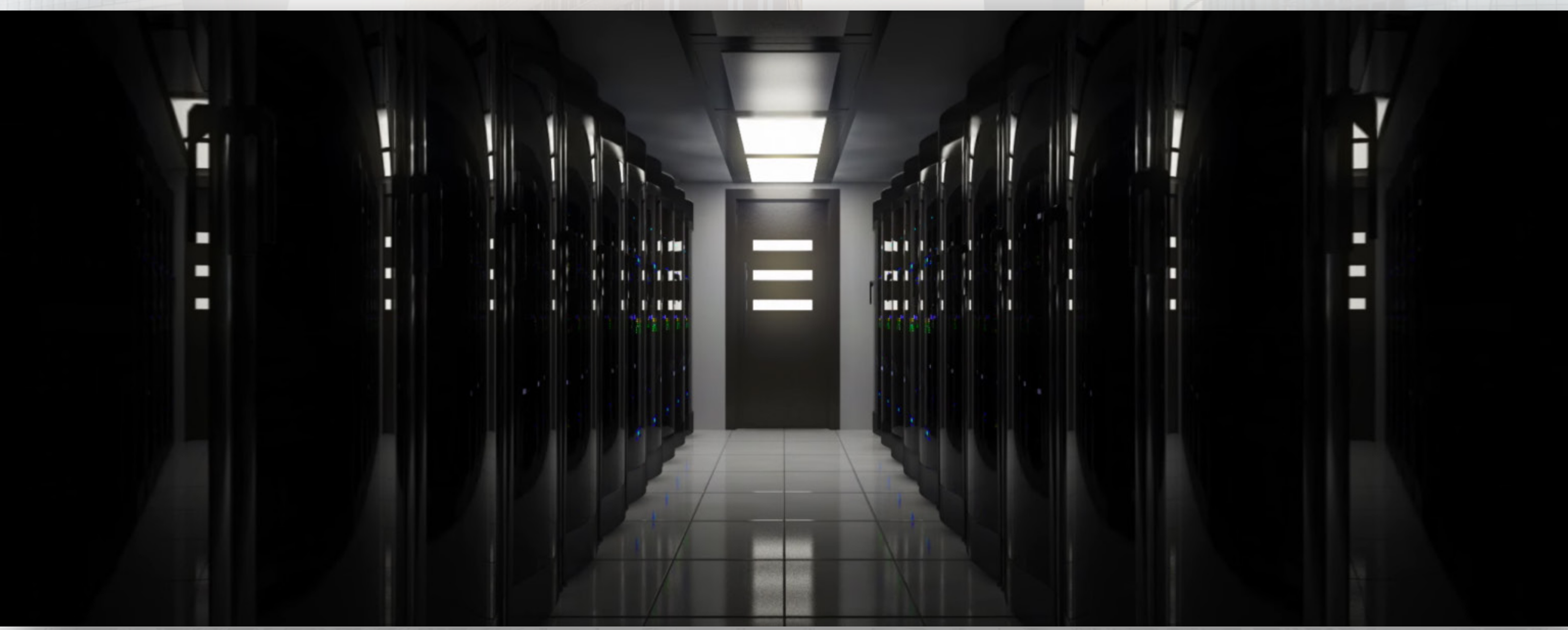
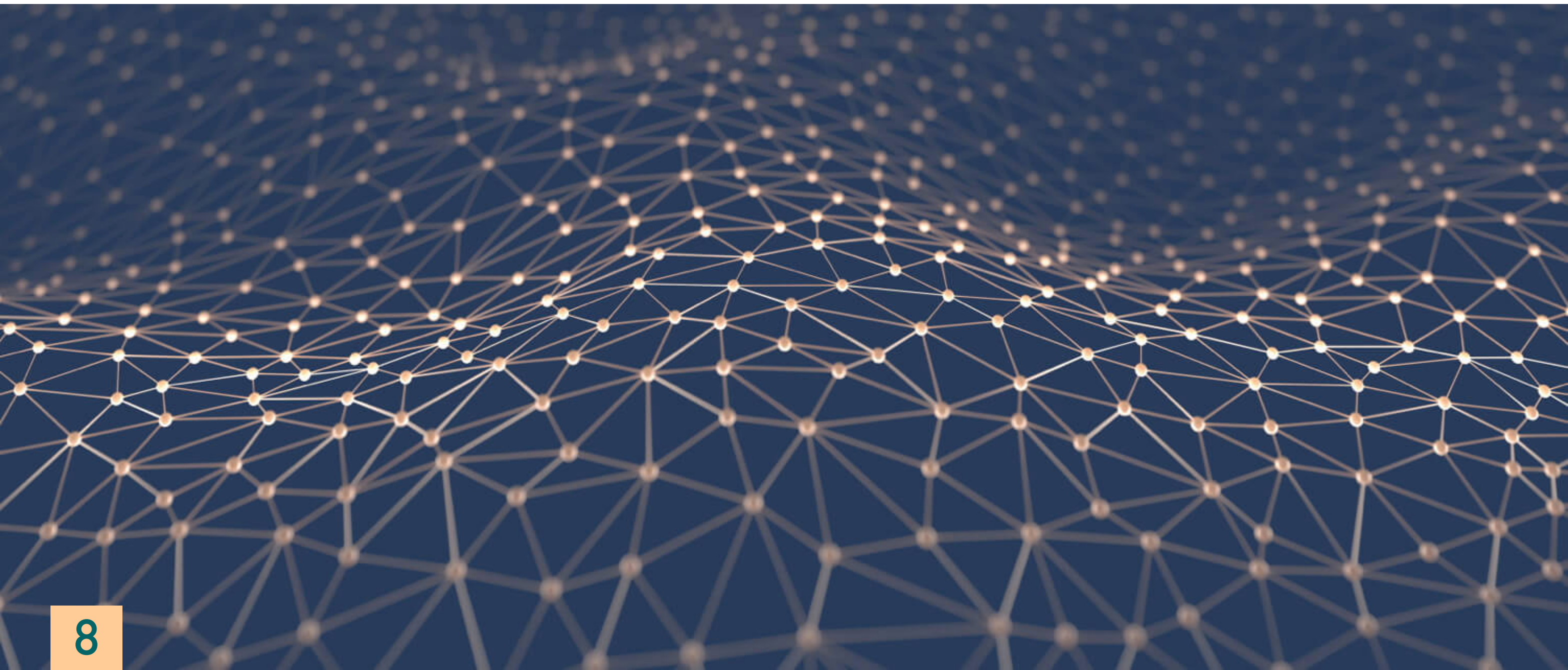
Automation

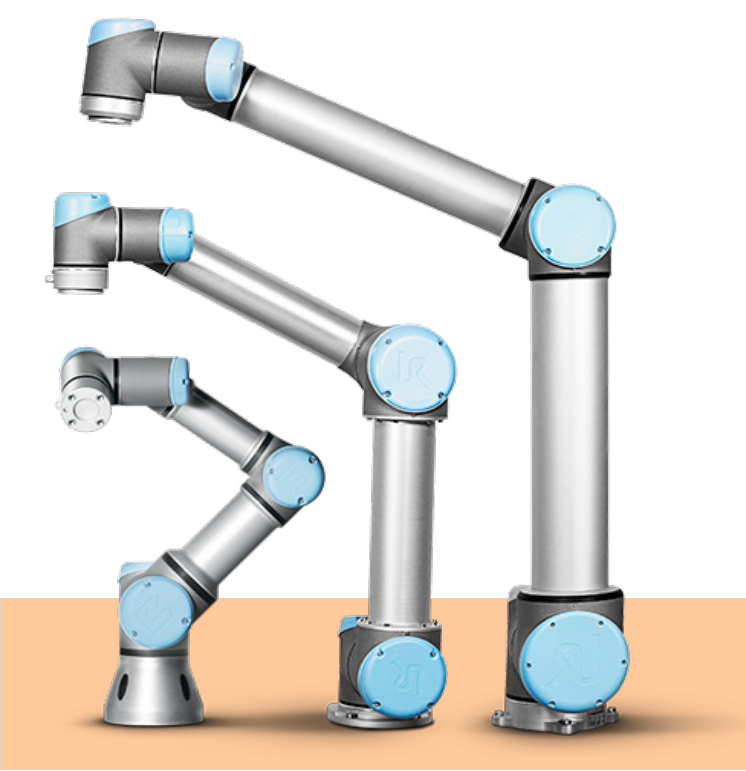


A 21st Century Non-Human Workforce

While a great deal of similarity exists between humans and non-human animals, a differentiating characteristic of the former seems to be an advanced ability to utilize nature in the form of "tools". In their 200,000 year history, Homo sapiens have sought food and security from tools ranging from those used to make a simple fire, to modern engineering tools manipulating genetics and encryption technologies.[1] While one may argue that human-made tools have advanced in their capacity, a consistent theme within history has been human civilization's requirement for people to contribute to the well-being of society by using such tools via *human labor*. This of course, is reasonable, that for all members of society to be "clothed", for example, a group of people must develop such clothes for eventual distribution regardless of the economic system. This narrative is amid exceptional change however; agricultural labor, for instance, once an industry that employed most of the United States populace, now, according to the World Bank, employs less than ~1.5% of the population.[2] This is primarily made possible through the progressions in agricultural science and technology optimization, but without these tools, all of humanity would need to retroactively go back to delegating our efforts towards the essential task of producing food. Agriculture aside, the axiom of economics, which mandates human labor, is undergoing change globally and may reach a maximum threshold sooner than world governments and economies expect. As our capacity to advance technology is accelerating as a species, we are realizing that technology advances at a much faster rate than biology, and as such, our limited biological capabilities are quickly replaced with technologies that fill the void. Automated technology is the reason for this coming revolution of the 21st century, and its first waves are passing with minimal damage, but the second wave on the horizon, if not prepared for, may cause complete destruction amongst world economies. The aforementioned **first wave** refers to the first rise in automated technology after the industrial revolution. Machines were invented which were exceptionally skilled at performing *unilateral* tasks, but mediocre at stepping outside of limited functional boundaries. However, we are right at the climax of this first wave of automation and are about to enter the potentially cataclysmic, second wave. Before discussing this topic, it is important to premise the binary of hardware and software of automation outlined here, namely *Automated Muscles* versus *Automated Minds*.[3] Automated Muscles refer to machines that perform mechanical tasks, like lifting objects that humans either cannot or simply are not interested in doing. Automated Minds refer to machines, namely artificial intelligence, that perform intelligent tasks like running the stock market, where again, humans are either incapable of



performing such monumental calculations efficiently, or are simply not interested in executing such efforts. Automated Muscles, or robots, have become increasingly popular in industries like the automotive sector and manufacturing in general, where they can be programmed to perform one task consistently and accurately. Automated Minds, or bots, have become increasingly popular in industries like banking and retail, where they too can be programmed to perform single tasks well. This automated technology has indeed increased productivity and often reduced the price of consumer goods, but workers on the other hand have been on the short end of this deal. That is the reason for the minimal damage of the first wave – people have lost jobs in the automotive sector, for instance, but the majority of society did not suffer from this evolution. Unfortunately, this first wave serves as an omen for what is to come. Mind you, this is not referring to the chess mastery via computation, but rather the **second wave** -- highly advanced computing in binary or quantum-based forms, which will lead to large job loss in capitalistic systems. This is because the most important consideration for the potential automated future is of course, economics. As a primarily economically driven world, if there is strong financial incentive for a particular change to occur, then that is often when such change will take place, and sometimes the only impetus necessary. The second wave of automation will be dangerous in the next few decades as we will likely see energy production increase in capacity, and if near-unlimited technologies like nuclear fusion or widespread solar-based energy are on the list, then the major limitation of mass producing Automated Muscles, energy, will be solved. This will create strong economic incentive to allow a robot to do a manual labor job over a human. As for mechanical minds, these are only increasing in their abilities, as software developers are discovering greater efficient, powerful incorporations of them like "machine learning". It is often assumed that particular high level jobs are safe and cannot be automated, such as a robot replacing a doctor or an artist. But, the reality is that robots indeed can, and they are already proving to be more productive and accurate than their human counterpart. Let us take physicians as an example considering the bulk of this process can be automated already. The issue of liability can be contextual within the medical field and will be exempt from this example. A primary care physician is, in essence, receiving a list of symptoms (*data*) from a patient, consulting their past knowledge determining the likely cause/pattern with the patients' listed symptoms (*data analysis)*, and outlining an appropriate action-protocol via medicine (*output*). It will simply make no economic sense for the care-giving industry to hire physicians when more accurate, cheaper replacements are possible. The same goes for essentially many jobs often thought of as "unreachable" for mere binary systems to replace. I must note, that this is no way an effort to disparage these professions, but rather, to elucidate the grand capabilities of automated systems. And technology transfer within the scope of automation is also an extremely challenging series of events to predict. The reason for this difficulty is dependent upon technology transfer usually



relying on technologies of the “richer/developed” countries transferring to countries which are “poorer/developing”. With this in mind, the future of automation, as outlined above, is capable of turning world economies upside down. How advanced robotics will influence a small village in Asia is exceptionally unpredictable, considering we cannot even predict the effects (at least with high perceived accuracy) of how this technology would affect the developed society it will be derived in. A prerequisite of technology transfer ought to be the ability to understand a technology’s effects directly, but indirect benefits, like how the technology will eventually be utilized in the future, by initially untargeted populations, is near impossible. First, it must be seen how the technology will affect developed societies, where it will originate from and initially have its impact, and at this point the better question is “when?". One could argue this is unlikely to happen in entirety soon -- that machines will not automate all of human labor rapidly. This is not what is to fear though because all that the second wave needs is its tipping point…*enough* human labor, soon *enough*, to be completely automated. This would likely cause mass hysteria globally, when unemployment rates of Kenya and Kosovo reach the United States. Developed nations are not built to sustainably support unemployment rates of countries like Kenya and Kosovo, and once unemployment **hits 30% percent in the United States or Germany**, the power of the second wave will be seen.[5] There is then the sustainability aspect of these technologies, like how this kind of technology will impact world economies and influence sustainable development. This is indeed, an extremely difficult matter to grapple with as well, considering the mere quantity of variables. The bottom line is that the technological advancement of automation is undoubtedly going to change the trajectory of human civilization, and at the least, economies systems like capitalism. It does not take an economist to understand that capitalism will fundamentally fail in an environment where competitively there is more incentive to automate, than there is to hire humans. There is no incentive for Lyft and Uber to employ drivers, when in less than a decade they will be able to employ an entirely driverless workforce *and* keep all of the fares, rather than giving the majority of profit to drivers as they do now.[4] What would a capitalistic society be like in 2050, when there is 60% unemployment, and scarcity is at an all-time low? Capitalism is based upon a fundamental principle of scarcity and with very important resources such as food, water, and energy at a remarkable abundance, the system will malfunction. Such resources are essentially at a post-scarcity point now with regards to demand to satisfy the majority, even if it is not necessarily

reflected as such in distribution globally. Nevertheless, we may perhaps be approaching the next level of world economy to satisfy such an economic evolution. Perhaps a system like a universal basic income would suffice, but UBI is a perceptually radical, socialist concept that would require a complete economic, and likely cultural transformation to take place. Regardless of acceleration or scope, humanity needs to properly plan for incoming automated technologies making it a high priority moving forward. Autonomous vehicles will probably be the nearest mass-automation that causes significant distress to the job market. And past 2030 if automated muscles & minds are not planned for properly, in regards to evaluating the economic system of the time, capitalism is going to be faced with an existential threat unavoidable due to its fundamental principles. We are not even touching the surface of artificial intelligence like AGI and Neural Lacing, which have only been seen in sci-fi movies and for now are not an impending threat. This kind of automation is possibly less threatening -- automation itself destroying humanity through self-awareness. Rather the automation outlined above may cause a more simple catastrophe -- humanity unknowingly destroying itself through economic collapse through the same machines it created to make our economies thrive.

Ethical Analysis

The ramifications of mass automation are likely the most complex to foreshadow as they revolutionize, so intrinsically, how humanity would organize itself. Fundamentally, while a technology like the Hyperloop may transform transportation and the fields affected by such, automation alters labor altogether, albeit slowly. We can take two potentially likely examples to analyze in contrasting ethical scenarios. The likelihood of these two scenarios depends almost entirely on the socioeconomic structure behind future companies wielding remarkably powerful AI, including governmental oversight and NGO watchdogs. The following is also contingent upon the scientific basis behind AGI, artificial general intelligence, (whether it is five years away with current research, twenty years away, **or even unachievable**) and the other technologies it will intersect with. The first and potentially most positive under a utilitarian lens is that all labor is automated forcing humanity to engage in activities post-scarcity. Ideally, via an experimental system like UBI, this would grant all civilians access to clothing, medicine, and food completely eliminating some harm-inducing problems often categorized as some of the worst like world hunger, and illnesses/deaths from preventable diseases. Additionally, as the first and likely second pillar(s) of Maslow's pyramid would be actualized universally, the remainder may translate to less suffering globally through achievable steps. Again, while this sounds impossible , it is critical to note that humanity will, within this theoretical example, have an absolute abundance of food, clothing, medicine which is not dependent on any humans producing these items, but rather AI and machines/robots doing so. The second, which has been often posed through pop culture, is the doomsday AI scenario where robotics and AI advance past humanity, intellectually/logically, eliminating its necessity for humans to exist. Or perhaps even more devastating, AI, functioning more fundamentally off of logical capacities unlike the human tendency for emotion, rationalizes a truth that to fix millennia-long "wrongs", and for humanity to operate upon its status quo morality, many of its species must die or cease to act behaviorally in a particular manner, leading to enslavement or incarceration. The lack of a status quo ethical theory poses concerns for this potential second scenario as the AI "overlords" may operate upon an ethic commonly disagreed with, but those who have programmed it favored. Or maybe the AI, having advanced by our weak intellectual capacities, will at last discover the "true" ethical theory, a kind of categorical imperative pursued by Kant.

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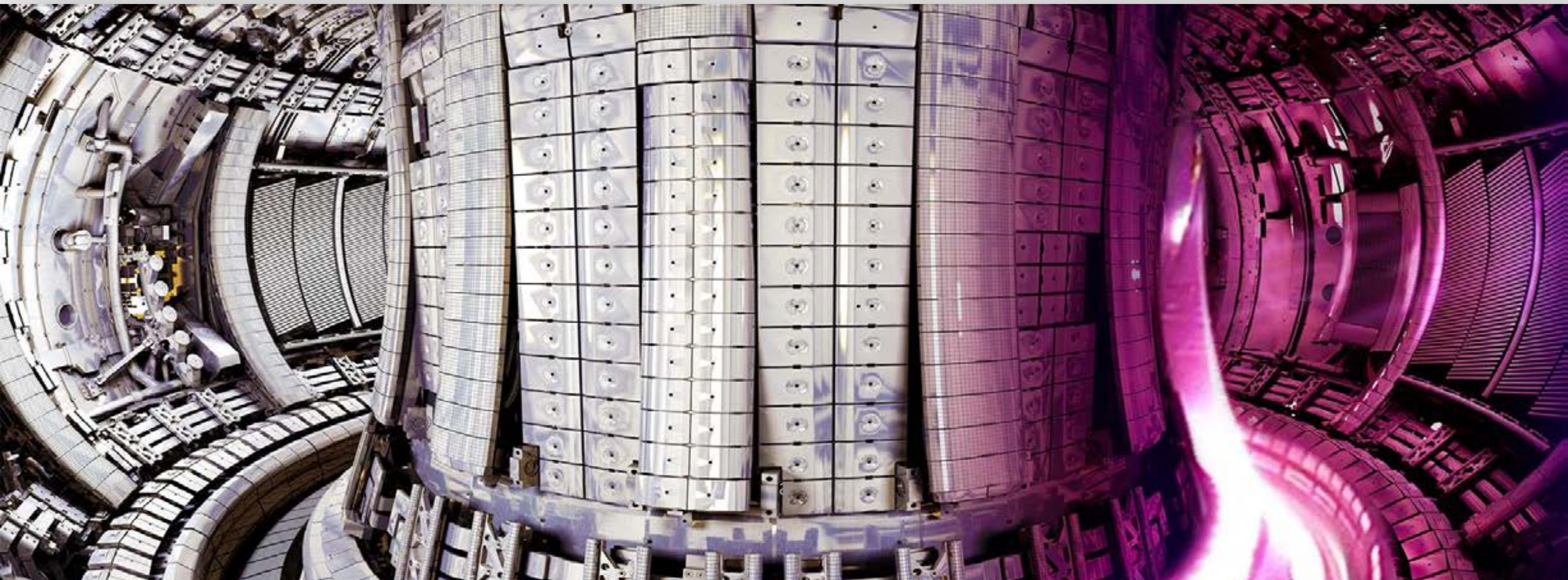
Nuclear Fusion



Solving Humanity's 21st Century Energy Crisis

Modern humanity's increasing demand for "energy" has been rising since the industrial revolution sparked the technological necessity a few centuries ago. This pursuit, primarily attributed to the capacity of energy to power advanced mechanical and information-based systems, is integral to the present and foreseeable future states of human civilization. However, time is exposing one very unfortunate characteristic of status quo acquisition methods of energy like fossil fuels, which is that they are indeed **limited**. Therefore, transitioning to "clean/renewable" alternative energy sources is increasing as a global priority; not to mention the necessity for new energy sources considering the status of the global climate, both figuratively and literally, regarding political & socioeconomic states and physical nature, respectively. One such prospective energy source, nuclear-derived energy, specifically nuclear fission, was discovered early in the 1900s with the development of atomic science. However, it has only been used sporadically due to its complexity of science in practice and potential safety concerns. On the other hand, nuclear fission's scientific counterpart, nuclear fusion, could be the answer to global energy demand in the future. Nuclear fusion's "clean" nature, sustainability, and unparalleled, theorized capacity for energy output crown it as the "Holy Grail" of energy production.[1] In contrast to nuclear fission, fusion consists of inducing the formation of an atom, rather than the dissociation of one. Herein lies the danger of nuclear fission -- when splitting heavy atoms like Uranium-235, unfortunate, radioactive chain reactions can occur with potentially devastating effects, which has been seen throughout history at Chernobyl and Fukishima. However, fusion's potential lies within its lack of capability for such catastrophe. Additionally, its fuel source, isotopic hydrogen, is abundant; so much so, that it is practically limitless. Being the most abundant element in the universe, the sustainability of nuclear fusion is unmatched,

"Assuming a fusion energy output equal to the 1995 global power output of about 100 EJ/yr (= 1 × 1020 J/yr) that does not increase in the future, which is unlikely, then the known current lithium reserves would last 3000 years. Lithium from sea water would last 60 million years, however, and a more complicated fusion process using only deuterium from sea water would have fuel for 150 billion years. To put this in context, 150 billion years is close to 30 times the remaining lifespan of the sun, and more than 10 times the estimated age of the universe." [3,4]

The ambition for nuclear fusion is not a new one though. For the past century scientists around the world have experimented the production of nuclear fusion which could withstand the extremely hot temperatures, and perhaps more importantly, produce a net energy output that may ultimately be used for energy requirements globally. It is said that nuclear fusion is always, "20 years away", and has been since its ideological inception. But, we are at a turning point now -- society is in need of nuclear fusion, and recent, extremely promising experiments have finally made optimistic fusion-based dreams a plausible reality at last.

Nuclear Fusion & Pragmatic Production via ITER

There is one particular project aimed at bringing nuclear fusion into fruition globally which is as ambitious as it is promising. *ITER*, the International Thermonuclear Experimental Reactor, is an international coalition of top nuclear physicists and engineers focused on producing a positive net output of nuclear fusion energy. Latin for "The Way", the ITER project has managed to engage countries and world leaders whom are often found on the opposite ends of conflict, including China, the European Union, India, Japan, Korea, Russia and the United States. Many feel this feat of collaboration speaks to how powerful and world-changing the results of ITER's success could be.[2] The timeline for ITER is certainly an extensive one, having begun the project in the 1980s, and encountering delays due to financial/political troubles, but the project has stayed largely on track. The likely success of ITER, in stark contrast to decades of past fusion research, is its prospective use of the largest Tokomak Reactor ever built. The main target dates are to produce the first plasma (100 million-degree hydrogen mixture) by 2025, and ten years from that to produce net energy from ITER. Most experts agree that a reasonable prediction is grid-integrated fusion reactors powering cities by the 2050s.[2] At that time, the possibility for clean, abundant, powerful energy production will be possible on a scale never seen before. The strongest appeal of fusion does indeed hinge on that last point of power. The estimated global energy consumption in 2015 was approximately 18 terrawatts and predictions for ten years from that point, in 2025, estimate global energy demand to be over 22 terawatts. The ambition of ITER, and eventual commercialized fusion production is to produce a net 500 Megawatt energy output with only half of a gram of hydrogen over a 15 minute period. Scaled up, which is ostensibly the goal to meet global needs, is where the tremendous potential of fusion comes into light – If every country on the planet by the year 2050 had just one bowling ball sized quantity of hydrogen isotopic plasma, or essentially a sun the size of a bowling ball here on earth, "burning" and producing energy for only 5 minutes, more energy would be produced **than the entire global demand for the year 2025** *100 times over*. In essence, every country could run a reactor like the one outlined above for just 5 minutes, and produce as much energy as humanity has ever used and will ever use up until the end of the century, and maybe more importantly, it would be completely "clean" and sustainable as well. Technology transfer for nuclear fusion, is a complicated matter, however. Considering, among other variables, the complexity of science for nuclear fission has held back some of the world's poorest, least educated countries from producing nuclear power plants, the same may occur for fusion.[7] Nuclear fission was discovered decades ago and it remains a fact that many developing countries do not have the capacity to use such a

method, and with nuclear fusion being even more complex, the same historical reality will likely repeat itself. It is possible though, that with such tremendous energy production, and an unlikely capacity to contain all of it with limited battery technology, there could be economic incentive to decrease the cost of such energy so low as to make it accessible to all. This too, is contextual to a prospective intersection with highly advanced or numerous batteries to decrease the impetus for such economic choice. In summation, the sun with its ability to catalyze food production globally, and serve as the central energy source for biological life on Earth has been integral to humanity's technological and reproductive success. We have recently been able to harness the energy from it in the form of solar energy and although this process seems cleaner and more sustainable than previous methods, we are on the cusp of creating our own sun here on Earth. Once this is accomplished, humanity can reach an energy equilibrium with itself and Earth. Additionally, a limitation of deep space travel like solar energy dissipating as you travel further from the sun, would disappear. We would no longer need to stay near the sun to survive, but rather, simply **take it with us** as we traverse through the cosmos ad infinitum.

Ethical Analysis

The ethical ramifications of nuclear fusion proliferation internationally seem to not be as prospectively dangerous as that of mass automation/AI. It was previously mentioned that nuclear fusion's scientific counterpart was *nuclear fission*, but its moral, technological counterpart is *nuclear bombs*. And while these unmatched weapons have an intended use for fear or havoc, using the technology for energy production, especially to the collaborative extent ITER is, will seemingly be beneficial. Again, disregarding direct benefits like emission decreases, we would assume a practically limitless supply of energy would transform world economics immensely, likely going hand in hand with mass automation. While it may seem impractical to power battery draining police robots in large quantities now, what would hold this ambition back when energy is in absolute abundance, and too much for batteries to contain. The same goes for other technologies that are generally held back due to their high-power demand. The aforementioned intraplanetary system via BFR may be affected too. Since energy would be in a post-scarcity state, the large degree of engine fuel that made this transportation method limiting, now is available to all and operating costs are the main expenditure. Again though, this depends, similarly to mass automation, on the companies or governments in control of this quantity of energy and the incentive to monetize it or perhaps lack thereof via UBI. To illustrate the difficulty in these predictions, consider if nuclear fusion were to intersect a beginning point of UBI; monetizing it at all would then seem unlikely since *money* itself is essentially eliminated as a concept. And as the facade of "money" is removed, its underlying driving force of *power* is revealed. So perhaps, even if mass UBI is in place, the interest to control nuclear fusion reactors will persist as a means to control society and wield power over global civilians.

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Final Thoughts

Perhaps if anything should be taken from this work, it is that **ethical analyses are an intrinsically complex matter**, and coupling this assessment with that of incoming technologies only compounds such complication. For instance, one assumption that was made in unraveling the ethical prospects of the Hyperloop is that the system's path will not have to avoid the nuclear fallout zones that occurred after a military provocation due to sociopolitical conflict in 2025, but this is entirely unknown and possible. Or maybe a discovery from the large hadron collider in 2030 uncovered a natural phenomenon compromising the prospective benefit once thought of for nuclear fission. Importantly, these determinations do have probabilistic veracity and cannot be ignored. As these technologies appear to increase in their practice and proliferation, the gap will close between them impacting society. This is where ethical analyses like this increase in utility. After all, too many assumptions must be granted without these technologies in practice and so in future efforts, as technologies reach their inevitable introduction, the emphasis ought to be for analyses like this **to occur with empirical evidence unfolding "real time".**

***A final suggestion is for future reports of this kind to modify structure as to include particular focus points towards contextual ethical dialogue – so for instance, if in ten years environmental impact, induced-criminality, and social welfare are topics which have deep ethical connections with the Hyperloop, then these ought to serve as subtopics of this report.*

IMAGERY CITED

HYPERLOOP

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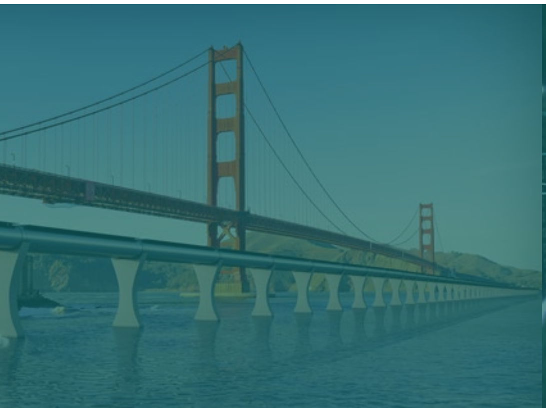

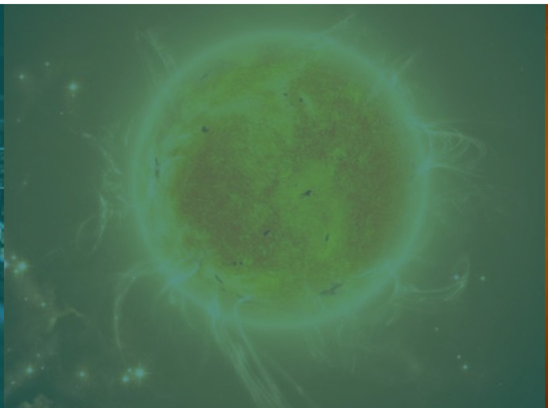

Future Exploration

TECHNOLOGIES

Quantum Technologies

Genetic Engineering

Interplanetary Technologies

Block chain/Cryptocurrency

PHILOSOPHIES

Kantian/Deontological

Aristotelian/Virtue

Thank you for reading