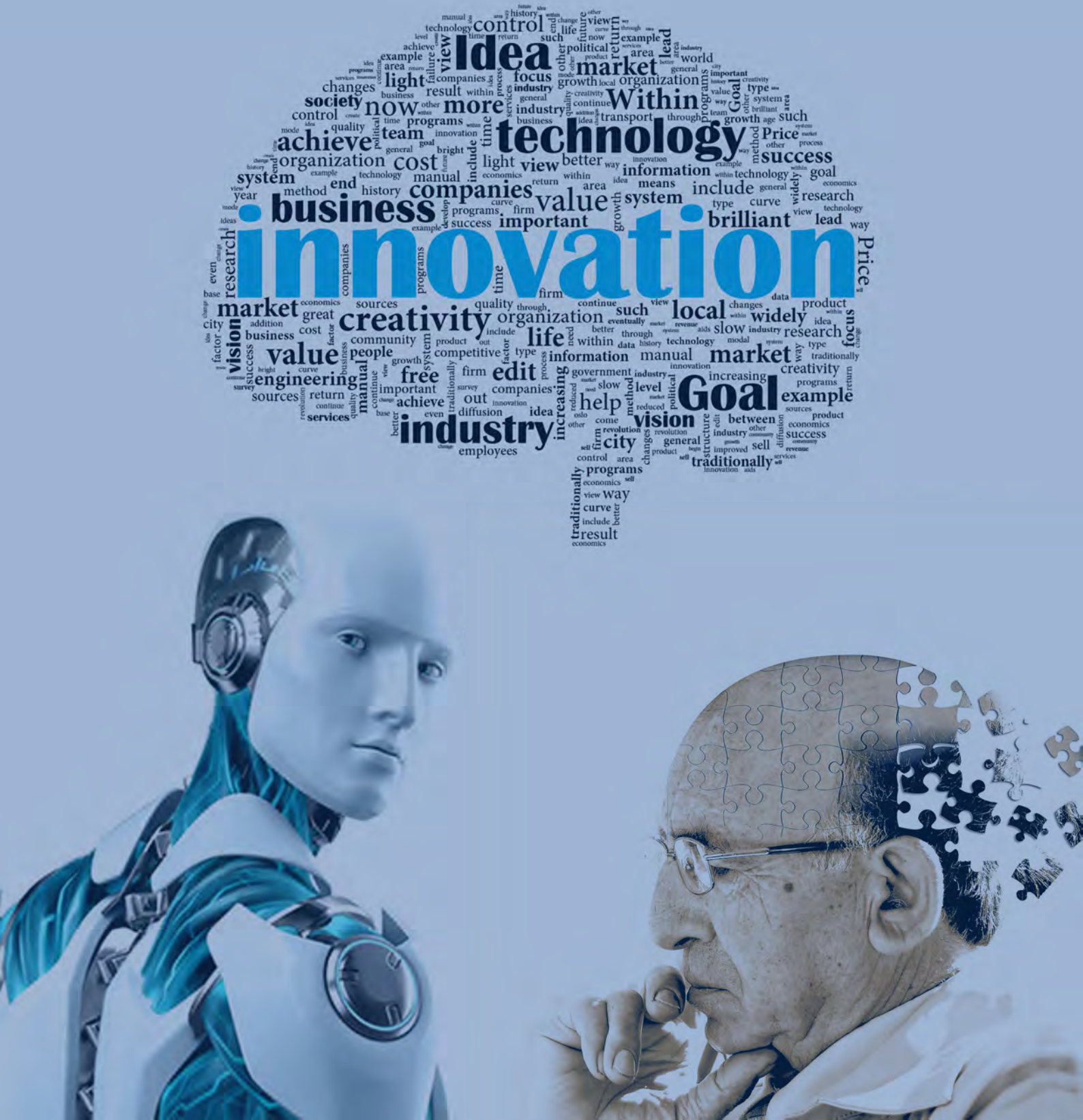
ATA Sixth Form Academic Journal Vol 2 Ed 1



Contents page

***'"OK computer, I want full manual control now." You got it," said the computer.'* (Douglas Adams, 1981)**

By Cameron Armstrong

Throughout history, humans have discovered and endeavoured to make what has been discovered easier for all to access; as 'cognitive misers' (Fiske and Taylor, 1984) , we find ways to save time and effort as much as possible in any given task. Now, in a world of completing actions such as payments, communication all the way to taking a person's heart rate in an instant along with technology that can write these programs autonomously, we find ourselves faced with a different future, one without need for 'humans'.

It's in times of great pressure and stress that humans must stand back and, using all the knowledge available at the time, pull together to get out of the bad situations they find themselves in. The Second World War placed tremendous pressure on humans at the time, pressure that pushed them to make a large step forwards in computer technology, designing computers to crack German encryption of messages and the realisation that it could be done relatively easier and faster this way than trying to do it by hand. A large part of events such as operation Overlord and the Battle of the Atlantic were reliant on the decryption of enemy codes (Graham Ellsbury, 1997) and after the war people realised the potential of extrapolating this into other areas such as data analysis, jobs that people were populating at the time. These jobs relied on the ability to make connections, a skill which requires a large volume of memory that can have data quickly retrieved from it, sound familiar?

These jobs don't require intelligence; they require a computer, a dumb machine that with no need for time off or toilet breaks can populate its memory with facts and figures a human couldn't dream of having in a lifetime, in a matter of minutes. These facts and figures aren't there until the computer gets old and retires, they don't fade as memories often do, and they are there in full forever.

The 'Expert System' model, first implemented in the late 1970s, was an early representation of what we call Artificial Intelligence today. It consisted of a Knowledge Base populated with information and facts entered by a human being, which would be able to give this information to the user when requested through the 'inference engine'. The only difference today is that the "Knowledge Base" has been replaced with simple programs that use the multitude of resources available to collate more knowledge than any one human could ever have.

The quote at the top is from 'The Hitchhiker's Guide to the Galaxy' and was the quote that inspired the name of the 1997 music album "OK Computer", exploring ideas of the dark side of technology and its integration into the human lifestyle and condition. An interpretation of it is that humans will one day need to make a decision to take back control from technology or sit back and watch it take on the role humans once played.

Technology can be seen as a catalyst that has been a factor in the speed up of the world, seen dramatically in modern times, to a pace it seems we struggle to keep up with. We find

ourselves working against ourselves to live in modern times. People try to integrate their electronic devices into everyday life, however their circadian rhythm is in turn massively disrupted by the screen's blue light which affects melatonin production and sleep regulation (Jessica Schmerler, 2015); we have skipped over our own human evolution to instead act as in aid in the evolution of technology, leaving us less advanced than the technology we try to live beside.

If humans were to concede to technology and instead start to internalise the cold, logical world of algorithms and efficiency (offered in the interlude 'Fitter Happier' on OK Computer, see end of article), Cynical, fact-driven and apathetic to the core; This would result in the loss of human 'culture', as there is no need for these distractions in a truly efficient world, efficient being defined as achieving maximum productivity with minimum wasted effort or expense. Music, Literature, all the forms of human expression would be defunct. This quickly leaves quite a bleak future for humans as with the intellectual use of humans taken from them by technology and the cultural use of humans no longer existing, is there really any use for us at all? We would simply fade out, like countless species before us.

However, in recent times music, entertainment, literature, art and other forms of expression are thriving more than ever, all things a human will always beat a computer at due to one thing: the imperfection of the human thought process. While computers can make full use of data in existence and use this to predict new data, even using peripheral devices to find new data, many would still argue it is the imperfection of human thought that leads to the great leaps in understanding. The non-linear, sometimes even illogical, unclear thought processes that lead to revolutionary ideas.

In summary, computers and technology will inevitably continue to become more prevalent in the cutting-edge of discovery and the furthering of our understanding of the universe. However, humans will still retain their ability to make these wild leaps in knowledge and find purpose in the furthering of the human culture of expression in all its different mediums both old and new.

Fitter, happier. More productive. Comfortable. Not drinking too much. Regular exercise at the gym, three days a week. Getting on better with your associate employee contemporaries. At ease. Eating well, no more microwave dinners and saturated fats. A patient, better driver. Safer car, baby smiling in back seat. Sleeping well, no bad dreams. No paranoia...

References

(Douglas Adams, 1981): Douglas Adams, The Hitchhiker's Guide to the Galaxy, 1981

(Fiske and Taylor, 1984): Susan T. Fiske, Shelley E. Taylor, 1991, 'Social Cognition'

(Jessica Schmerler, 2015): 'blue light affects levels of the sleep-inducing hormone melatonin more than any other wavelength.' - https://www.scientificamerican.com/article/q-a-why-is-blue-light-before-bedtime-bad-for-sleep/

(Graham Ellsbury, 1997): Graham Ellsbury, 1997 - http://www.ellsbury.com/ultrafirstcomputers.htm

<u>The Future of Humanity</u>
By Drew Coleman

Rather than take a contented view towards the future of humanity like I know other entries would, I preferred to take a rather pessimistic view towards our future as a race. I predict that 100 years from now, our species will deteriorate because of our disadvantageous base instincts of greed. Human greed is a biological instinct in which we all try to better ourselves through personal gain, often limited by moral values. Within the next 100 years these moral values will appear useless and not necessary for even more individuals than it already seems worthless to at this very moment. Eventually these moral values will be irrelevant for enough people at the peak of society both financially and/or politically that it will begin a chain reaction which will cause us to retrogress back to an almost Victorian era.

With enough higher members of society acting only to benefit themselves at the expense of others a pyramid is created (which I will refer to frequently throughout this journal entry). In this analogy, those at the very top of the pyramid are so high up they almost reach heaven with the luxuries that ensued from their wealth and greed. However, at the point of a pyramid there is not much space so only the very rich, very wealthy and very greedy can reach this point. While on the other hand, there is plenty of space at the base of the pyramid where every else stands, scavenging for scraps from the plates of these heightened individuals. So as the greedy and rich ascend up the pyramid with their ever increasing wealth, the gap between those at the bottom and top ever increases proportionally to this. With this, we would eventually decline to a state where our society is similar to a Victorian Britain, where those who were rich and greedy were able to rule and dictate amongst the average community because they were raised up this pyramid to a point where they were as high as Gods in the sky and we had to listen to them, for the power they held was far too immense for the large majority at the bottom of the pyramid to even question them. Declining to this state would pose a large number of threats to us as a race.

1: An uprising. As this pyramid becomes taller and taller with the same number of people at the base, the pyramid must simply becomes steeper and steeper until it is just a fragile beam standing high up into the sky, with no footholds or cubbies for perhaps a middle class to rest. Either you're at the top or you're at the bottom. When this happens eventually enough people will be at the base of this steep and unstable pyramid that they will all fight back and unite for once to counter the harsh nature of life inflicted upon them by those at the top who would rather abuse and take advantage of them for personal gain, causing the structure to topple and for an almost 'reset' in society. As seen previously in the French revolution, the, once perceived as, poor folk will rise and up and strike down the rich and greedy at the top, which may seem just at that very moment because it would stop millions suffering under a ridiculously painful standard of life, but it will supervene and have horrible outcomes. This will cause not only a reset in social class but a reset in economy, parliament and other less important factors. However the severity of economy and parliament being completely changed around is drastic, with money being re-distributed between the once oppressed, everyone will have around equal money, meaning no-one will really be able to employ each other and no-one will want to work for big businesses anymore after the

events they previously endured from the greedy and rich. This will cause a widespread epidemic of job shortages, leading to a decrease in work, progressing to a decrease in our worth of currency and then following on to the inability to trade efficiently with other countries as the government's money would decrease as well as us not having a particularly strong government as it would be very new and most-likely made of inadequate candidates based upon who had the most influence amongst the uprising, and not who would lead our country the best (this is also an assumption based upon historical events such as the French revolution and 1918 Germany). Therefore, everyone living in this type of community would have less consumer goods as well as less of some essentials. The only way to counter this is by being able to trade by yourself and not through the government, meaning laborious jobs such as farming and steel work etc. would then be on the rise, leaving us to rebuild a basic society and work back to the point in society we were at previously, which would perhaps stop us ever developing new technologies and making great discoveries as this human greed would eventually send us back two-hundred years. After all of this it is still very likely that we would return to a point where businesses and those at the peak of society would have more influence and power based upon their greed and financial and political state.

2: Illegality. As the pyramid ever increases and the rich become richer and the poor become poorer there will be a breaking point. In a parallel way to how those at the top disregarded moral values to achieve a higher standard of life, those at the bottom will learn and begin to do the same. However, for those already at the lower standard of life and struggling to even survive, the only option is to break the rules of the pyramid, to not follow suit and in essence – to break the law. This raises a lot more issues in society because although it allows one more person to have at least a normal standard of living, it will impact negatively on more people because crime in the form of mugging, theft, selling drugs or other ways of making money illegally has severe consequences which are worse than the gain. In addition, a society where this pyramid is extremely tall and those at the peak hold a lot of power (like the example from before), those at the top will feel cheated and angry as they won't be able to take advantage of all the people that they possibly could(because they're greedy), this will result in a harsher reaction by those in power which will further make those at the base of the pyramid even more confined and their standard of living will decrease even further and there will be even worse and heightened problems from when they were first forced and driven to a life of crime. Therefore the result can be no single solution and this will cause a significant drop in not only standard of living, but the amount of people who can even afford to live.

3: Constriction until death. Leading on nicely from my second perceived outcome, I believe that with or without the increase in crime and illegality, the lower classes at the base of this pyramid (which I have talked about a considerable amount), will be metaphorically bound and constricted until they die. Whether or not those at the bottom of the pyramid choose a life of crime, I still think that the greed-ridden leaders of society will become ever-so more greedy and try to take as much advantage of the lower classes as possible, if they choose to fight back and choose crime as a way to avoid this system it will simply increase the rate at which they are constricted and crushed to make sure all chances of this happening are reduced. When this inevitable constriction happens, those at the peak of my metaphorical pyramid will be faced with another imposing moral question."Is it acceptable to let all those

below me suffer at the bare minimum or less for my personal gain?"; however, we already know those at the top have a bad track-record with moral decisions and so it is very likely this constriction will continue until death. Either from starvation, exhaustion, even hypothermia because they have nowhere to live or sleep, or, perhaps, in worst case scenarios – suicide, where those at the bottom of society see no way out and no reason to live so they end it all. Whatever the post-mortem examination discovers is not relevant to the wider picture, the disgusting levels of greed at the top of the pyramid is causing an unbearable weight to be distributed amongst those at the base, and as more fall from the pressure of the pyramid, the weight becomes heavier until a catastrophic number of innocent lives, born into poverty and working their entire lives for a single opportunity are dead. Only then, will this perhaps bring about a change and cause in a sense an "eye-opener" for those at the top of the pyramid. Only when it is too late. Not even for the right reasons. Those at the top will reap less money and gain less from those at the base because they have already taken their lives, the decrease in those at the peak of the pyramid's average income, which is already disgustingly high, will lower slightly and it will be their own fault. They will want to change society only to produce even more personal gain, not because of the innocent lives lost, not because of the negative outcome, not because of the cruel nature of their sins, but simply to extend their luxuries and wealth further past the point of necessity or even extravagance.

Although I have taken a pessimistic view towards our future as the human race, there are some positives, in our current society characters such as Bill Gates, Mark Zuckerburg and others who donate an extraordinary amount of money to charities and to those who would be at the bottom of pyramid, not completely re-distributing wealth (which again is good because otherwise we would likely crumble), but enough to lessen the gap between the peak and base of the pyramid, allowing a capitalist society but with less people being crushed under the weight of the everyone above them. However, when characters such as these begin to disappear, will they be replaced? Personally, I doubt it, some will be replaced and some won't until this chain of influential and powerful but respectable and kind people decreases slowly to nothing and we begin the chain reaction of greed taking over and our society failing and slowly dying off.

How will the rise of Artificial Intelligence affect the future economy of the human race?
By Azib Ahmed

It has long been discussed what impact the growth of mechanisation and automation has had in the past. Modern forms of this had already begun back in 1701 when agriculture was the primary way of life for all. However today, with much more diverse and prosperous economies, there seems to be many more occupations at risk of takeover by Artificial Intelligence. With employers looking to cut down on costs, and automation slowly making a return into the newer economies as it had done after conquering the primary sector, the question of its impact on the economy rises as a significant one.

On one hand, many have cited Artificial Intelligence as the future of human advancements. A view calling for the increase of AI in today's society has been offered by Kevin Maney. He gave a view that suggested AI's takeover of jobs held by unskilled workers so far has been "undoubtedly devastating for the individuals who had them, but the broader impact has been pretty positive for the rest of us."[1] By analysing major automations that took place within the economy and have been established, Maney was able to bring to light the importance of AI when it comes to job creation. This is not a widely held view, as AI is usually seen as the enemy against employment. However, Maney argued that due to the new forms of management, maintenance and development involved with complex AI systems, it creates a larger quantity of "skilled"[2] jobs that benefit the economy in the longer run. For example, the fuel pump in the past required a gas attendant, but "task-specific robots" made it easier for individuals for pay at the pump and the job had virtually disappeared by 2000. However, new jobs being created involve software coders, engineers, sales' staff and project managers. Furthermore station owners were able to turn their gas stations into convenience stores which required clerks. This shows that Maney's view, which is supported by many who are for the expansion of AI is not laid on the basis of taking jobs away, but creating a larger proportion of skilled jobs to aid the growth of many economies today that have seemed to reached a peak.

Another crucial aspect of AI growth is the need for people to be better educated, because history has shown us time and time again that relying on an unskilled profession is not a good plan, especially at the rate of human advancements today. This suggests how AI could also be used to strengthen the motivation and highlight the necessity of the younger generation to take education seriously. Overall, it shows how Maney could be accurate in insisting that AI is the future of economic growth, because skilled jobs do much more for the economy than unskilled. For instance, with the focus of world economies turning to the issue of global warming, and the need to find sustainable resources, we have seen the rise of companies such as Tesla. When completing such work, skilled workers are a required asset and it accentuates their need for not only economic advancements, but for the human race.

However, the real debate of the AI expansion comes from individuals who argue that it could lead to catastrophic consequences, both economically and socially. Many high profile individuals including entrepreneur Elon Musk, British scientist Stephen Hawking and Bill

Gates have voiced their concern as for what could happen if AI is not managed. Recently, the Guardian released a list of jobs most and least likely to be automated. Jobs which aren't safe include cashiers, taxi drivers and loan officers[3]. This could be potentially harmful to the economy, as the unemployment rates would soar, and there could also be strain onto the UK government because the number of taxpaying civilians would decrease if they struggle to find jobs. This also sheds light on an important question: should the automated 'robots' be made to pay tax? This was raised initially by Luxembourgish politician Mady Devalux who argued that if machines are going to replace jobs which generate tax for the country, then they too should pay tax to avoid any imbalances in the economy[4]. Evidence to support this could come from taxi drivers in England. As of March 2017, there are 281,000 licensed taxi and private hire drivers in London[5]. Not only is this occupation increasing with the rise of companies such as 'Uber', but as discussed before, in danger of automation in the near future. This would also clash with Maney's view that automation would create more jobs than it would eradicate. This is because driving is a relatively unskilled job, and the vast majority of jobs created by automation require skilled individuals. This adds validity to the argument that AI could indeed lead to economic hardships for the country, because it is clear to see that it will leave a surplus of people in the economy who cannot contribute as they may find it difficult to get a job.

Overall, both arguments have accurate views, as well as flaws. As for those calling for rapid expansion of AI into the economy, there seems to be solid evidence from the past that helps support their claims. However, they cannot predict the effect of AI to an extremely high degree of accuracy because the jobs and areas of economy that AI is moving into is something which has not been seen in the past. Furthermore, there is also a question of how different economies will be affected by AI. For example, it is clear to see in HICs such as the UK and USA AI is as close as it's ever been to digging deeper in our occupations. With the rise of home assistants and driverless cars, the technology seems to be expanding exponentially to fast track the effect of AI on such economies.

However, in LICs, and to some extent some MICs, AI is yet to make a meaningful impact. For instance, countries such as those located in the Middle East (Pakistan, Afghanistan, Bangladesh etc. To name a few) are still waiting for the presence of AI to have the type of impact that it already has had on more wealthier nations. With Pakistan's first AI summit planned to take place in February 2018[6], one can see how AI is not yet an aspect of the world that affects economies to an international extent.

In conclusion, the argument can therefore be broken down into how it will affect different economies and individuals. Largely, the predictions for AI have been mainly positive with the majority of countries being predicted to grow more under the wing of AI. Sweden is predicted by 2035 to have a 37% net increase in labour productivity, with the USA and UK at 35% and 25% respectively[7]. While this is based on a hybrid economy with AI being integrated into the economy, it shows the clear benefits of bringing AI into the economy. However, as discussed before, those with unskilled jobs may suffer for a brief period of time or maybe for a prolonged one as the demand for unskilled work will surely decrease drastically with AI (especially automation) completing tasks that have high amounts of

repletion with low skill. This brings us to the potential dangers of AI, and some do involve how we moderate the use of AI and its capabilities. While these mostly only apply to countries looking into incorporating AI into their economy soon, it could have a 'trickle-down' effect as mechanisation takes over jobs such as sewing in LICs for companies located in HICs. As for countries still developing, AI has a long way to go until it starts to make a notable impact, but with the rate at which it is developing may mean that this won't be long. Overall, however, no one can accurately predict all that will come when AI start to takeover our economies in the near future; for now it is a waiting game.

References

[3]The Guardian
[6]Techjuice.pk
Business Insider
[1, 2]Newsweek
[4]Europarl.europa.eu
[7]Accenture.com
[5]Gov.uk

The Future of Humanity: Does the rise of AI pose a threat to humanity?
By Lina Adams

Stephen Hawking recently said: "The development of full artificial intelligence could spell the end of the human race."[1] Is this just sensationalism or are these fears rational? AI is already widely used in our daily lives e.g. voice recognition like Apple's SIRI and services like Netflix that use predictive technology to offer recommendations based on a user's interests. Moore's Law of exponential growth observes that computer processing power doubles roughly every 18 months. If this trend continues, it could enable many of the processes which could give rise to Artificial General Intelligence (AGI): AI with intelligence that is comparable to the human mind. Many argue that the arrival of this new technology could also have a positive impact by dealing with mundane and repetitive tasks such as bureaucratic work. Self-driving cars could potentially reduce risk of accidents and traffic issues. It could also result in faster grading for students and provide them with support if a teacher is not physically available. AI could also improve aspects such as healthcare through the introduction of virtual nursing assistants and diagnosis apps. However, increasing automation could leave 10 million UK workers at risk of being replaced by AI within 15 years.[2] And what could happen if AI one day became self-aware? And what would become of us if AI went beyond human intelligence and reached super intelligence – intelligence that surpasses that of the most gifted and brightest humans?

Artificial intelligence is the theory and development of machines that are able to perform tasks normally requiring human intelligence. The current concern is that AI is likely to dominate many jobs in coming decades, putting millions of people out of professions such as data entry and insurance underwriting. These jobs are threatened by the advancement of technology that could perform repetitive tasks more efficiently. Tax preparation, which involves systematically processing vast amounts of predictable data, has high automation potential.[3]

Many countries are already experimenting with the idea of a universal basic income: an unconditional monthly allowance provided to every individual over the age of 18 to meet their basic requirements to sustain themselves in the event of job loss to automation. In this respect, technological advancement could be largely beneficial to us, giving rise to creativity and entrepreneurship.[4] As the tedious and repetitive jobs become more and more

---

[1] Cellan-Jones, Rory (2014, December 2)Available at: http://www.bbc.co.uk/news/technology-30290540
[2] Elliot, Larry (2017, March 24) *Millions of UK workers at risk of being replaced by robots, study says.* Available at: https://www.theguardian.com/technology/2017/mar/24/millions-uk-workers-risk-replaced-robots-study-warns
[3] Scott, Patrick (2017, September 27) *These are the jobs most at risk of automation according to Oxford University – Is yours one of them?* Available at: http://www.telegraph.co.uk/news/2017/09/27/jobs-risk-automation-according-oxford-university-one/
[4] Kingma, Luke *Universal Basic Income – The Answer to Automation*? Available at Futurism.com at: https://futurism.com/images/universal-basic-income-answer-automation/

automated, people will begin to start their own businesses partly due to the safety net provided by the UBI. On the other hand, many people feel that their job is a significant part of their identity that cannot be replaced with a monthly sum of money.

Despite this concern for increasing automation, it may still be a few more decades before UBI needs to be established to supplement the decline in people's income. There are many professional fields that are expected to expand as more of the world around us becomes automated. The arrival of AI had led to an ever increasing demand for developers – who are going to develop these complex systems? By 2020, employment in all computer occupations is expected to increase by 22%. As with the industrial revolution, as manual jobs decline, maintenance and developmental occupations will increase. Whilst farming and labour waned during the 18th Century, operational professions in factories soared as a result of urbanization. There will be heavier emphasis placed on maintenance work - currently, many big tech businesses employ thousands of people who police the firms' own services and control quality. Google is said to have an army of about 10,000 "raters" who monitor YouTube videos or test new services. Microsoft operates a Universal Human Relevance System, which handles millions of micro-tasks each month, such as checking the results of its search algorithms. [5] The numbers in this field are expected to rise, as there is increasing demand for content moderation.

In the short term, mental health professions could remain unaffected by the rise of automation as humans are better equipped to understand other humans than AI systems.[6] The complexities of mental health issues are not something that can be programmed into an algorithm, and whilst AI can be programmed to respond to specific stimuli, this cannot replicate the connection that occurs between humans. However, who are we to say that AI will never be capable of compassion? The Japanese robot Pepper, created by Aldebaran Robotics, is able to recognize emotions from our facial expressions, words and body gestures.[7] It is able to adapt itself to a human's personal tastes and habits, gradually acquiring more and more information about a person's personality traits and preferences, in order to tailor its behaviour and tone to theirs. But is this truly empathy; does it simply take reading faces to understand emotion? Many AI systems may be able to respond to a human in a fitting way – but more often than not, people disguise what they are actually feeling and may smile to hide their real emotions. Because of this, it may be a long while before robots can 'see' beyond the surface to the same level that a human can.

Artificial intelligence will have, and already is having, a positive impact in the healthcare industry. Many argue that the arrival of this new technology could also have a positive impact on aspects such as healthcare through the introduction of virtual nursing assistants. If AI has the ability to identify signs of disease as fast as it already can through incorporation in systems like MRI, its long term impact on healthcare would surely be a positive one. In

[5] The Economist (2017, August 26) *Artificial Intelligence will create new kinds of work.* Available at: http://www.telegraph.co.uk/news/2017/09/27/jobs-risk-automation-according-oxford-university-one/
[6] Palmer, Shelly (2017, March 6) *The Five Jobs Robots will Take Last.* Available at: http://adage.com/article/digitalnext/5-jobs-robots-take-last/308181/
[7] McDonald, Skye (2015, November 2) *Truly empathetic robots will be a long time coming*. Available at: https://phys.org/news/2015-11-empathic-robots.html

the future, we could have 3D printing which could create human body parts, reproduce blood vessels and print skin cells for rapid healing. Healthcare bots for patient engagement would result in faster service in the chaotic hospital environment, to ensure that all patients are being served. AI systems would allow faster medical diagnosis, limiting the number and length of visits to clinics. However, this could lead to increased dependence on virtual nursing assistants instead of doctors to check for more serious symptoms. The IBM Watson supercomputer, a cognitive system designed to process and understand vast amounts of data, could revolutionize the way in which doctors diagnose patients. It could provide doctors with relevant information to a particular case, allowing them to gain access to better diagnostic treatment. Watson would be able to scan data about alterations relating to a tumour and process it within a few minutes, whilst this would ordinarily take a week for human doctors – therefore a more efficient method in the workplace. [8]

The existential threat of AI super intelligence has been widely promulgated in pop culture: for example, Skynet uses its remaining resources to gather a slave labour force from surviving humans in Terminator. Should we feel threatened by the expansion of AI? In Surviving AI: The Promise and Peril of Artificial Intelligence by Callum Chace, he uses the term 'Economic singularity' to describe a point where the normal rules cease to apply, and what lies beyond is un-knowable to anyone on that side of the event horizon. He suggests that an economic singularity may lead to an elite class owning the means of production and suppressing the rest of us in a dystopian technological regime.[9] A common misconception is that machines and AI are incapable of possessing goals as they are not conscious. Not all AI may turn out to be FAI (Friendly Artificial Intelligence) and this is why it is important to program and develop these systems with well-defined goals. Philosopher Nick Bostrom's 'paperclip maximizer' analogy states that if somebody running a paperclip factory is the first person to create an AGI system and it rapidly becomes super intelligent, they may have created a technology whose goal is to maximize the efficient production of paperclips. This super intelligence may then extend its own processing capability by converting everything in its surroundings to paperclips and by spreading its mission to the rest of the universe.[10] This cartoon example illustrates the serious consequences that can occur if AGI is developed with poorly specified goals, and the dangers of these systems going rampant.

As we have discussed, there have been many great advancements in AI and as a result of Moore's Law, we are experiencing a rapid growth in AI systems which have brought us enormous benefits. With the possibility of a conscious machine (AGI) fast approaching, we need to be clear about our goals and how they are implemented in these systems. We cannot guarantee that AGI will be friendly; neither can we halt its development as there is too much at stake. The world's most powerful nations are investing heavily in AI as it could bring huge advantages in the event of conflict. We also cannot discount the dangers of AGI

[8] Heathman, Amelia (2017, January 13) *IBM Watson is ready to take on the cybercriminals.* Available at: http://www.wired.co.uk/article/ibm-watson-artificial-intelligence

[9] (Chace, Callum *Surviving AI: The promise and peril of artificial intelligence* 2015 page 48)
[10] (Chace, Callum *Surviving AI: The promise and peril of artificial intelligence* 2015 page 142)

falling into malevolent hands. Half the people working in the field of AI estimate that within 50 years there will be an AGI and most of these researchers believe that super intelligence may be achieved within a very short time of the arrival of AGI.[11] As Nick Bostrom has stated: super intelligence could very well be mankind's final invention.

[11] (Chace, Callum *Surviving AI: The promise and peril of artificial intelligence* 2015 page 142)

Bibliography

Cellan-Jones, Rory (2 December 2014) Available at: http://www.bbc.co.uk/news/technology-30290540

Elliott, L (24 March 2017) Millions of UK workers at risk of being replaced by robots, study says - Available at: https://www.theguardian.com/technology/2017/mar/24/millions-uk-workers-risk-replaced-robots-study-warns

Scott, P (27 September 2017) These are the jobs most at risk of automation according to Oxford University – Is yours one of them? Available at: http://www.telegraph.co.uk/news/2017/09/27/jobs-risk-automation-according-oxford-university-one/

Kingma, L Universal Basic Income – The Answer to Automation? Available at Futurism.com at: https://futurism.com/images/universal-basic-income-answer-automation/

The Economist (26 August 2017) Artificial Intelligence will create new kinds of work. Available at: http://www.telegraph.co.uk/news/2017/09/27/jobs-risk-automation-according-oxford-university-one/

Palmer, S (6 March 2017) The Five Jobs Robots will Take Last. Available at: http://adage.com/article/digitalnext/5-jobs-robots-take-last/308181/

McDonald, S (2 November 2015) Truly empathetic robots will be a long time coming. Available at: https://phys.org/news/2015-11-empathic-robots.html

Heathman, A (13 January 2017) IBM Watson is ready to take on the cybercriminals. Available at: http://www.wired.co.uk/article/ibm-watson-artificial-intelligence

Chace, C (2015) Surviving AI: The promise and peril of artificial intelligence. Three C's

Is your destiny pre-determined?
By Sara Renmiu

To what extent do you have free will? After analysing both philosophical and psychological perspectives on this topic it may become difficult to say whether your actions are pre-determined or not.

Is what you do determined by exterior factors, which are out of your control? The world, run by the laws of nature, determines what we do as it is what puts things in place. The decisions we make are made out of a selection of things put before us. Despite feeling that we ourselves are always in control of what we do, the only thing we are able to choose is that which is given to you by circumstance.

John Locke gives an example of how our pre-conceptions of 'free will' are invalid. There is a man in a locked room who chooses to stay in the room. He is unaware that the door is locked and he could not leave even if he desired to. In this scenario although he believes he has made the decision to stay in the room it's clear that he had no other choice. Therefore, as he would still end up locked in the room no matter what, his choice was pre-determined.

Some psychologists argue for determinism: behaviourists believe that societal influences are the most important in deciding what you do. Skinner thought that 'free will' was an illusion and human behaviour was more likely due to physical and psychological reinforces and punishers. Environmental circumstances and personal history have an immense impact on choice. Bandura (1961) found that children with violent parents were more likely to become violent parents themselves. This is because of observation and imitation – in their lives it was seen as normal meaning they may have internalised this view and accepted it as a way of life for themselves. Using Skinner's ideas one could argue that deciding to abide by the law is due to circumstance rather than because it's an act of your own volition; therefore they are exempt from responsibility. Thus, as one's actions are a result of social influences, our choices are pre-determined.

Psychologists also argue for determinism from a biological perspective. Unlike behaviourists they believe that determinism is due to internal rather than external factors. Personality traits (decided by our genetics) lead to particular types of behaviour suggesting that we are not in control of our actions. Tendencies for violence can be inherited from parents making one more likely to commit a violent crime than those without the gene. This is because neurological and hormonal processes relating to particular functions are stronger for these people. This means our patterns of decisions are decided from the day we are born – we can't truly have 'free will'. Furthermore mental illnesses that are inherited undermine the notion of free will because you can completely lose awareness of what you are doing; this suggests that we are not in control of our actions.

Alternatively the humanistic approach states that we do have free will; the choices we make are because of our own desires. A core idea within this approach is self-actualisation: ascending the hierarchy of needs until complete fulfilment is reached. Maslow (1943) and

Rogers (1951) argue that freedom is necessary to become self-actualised. This is because we can choose whether to do things – there are usually countless different paths we can take when deciding what to do. The psychodynamic approach heavily relies on the fact that we choose what we do as it is this which enables those with psychological issues to break free of them. Without 'free will' this wouldn't be possible.

However from a theological standpoint one could argue that 'God' has placed a blueprint for what everyone shall do on earth. If this is true then all our decisions are pre-determined. We can't change what our 'destiny' is because the plan set out by God is absolute. The cosmological argument is that God, as the unmoved mover, pushes the universe into motion causing all events. What happens currently is a result of previous events leading to this moment therefore nothing other than what does occur could occur. This is because the world is governed by cause and effect meaning one's actions can never be 'free'.

Quantum physicists have also proposed the argument that because the laws of physics govern atoms, and everything is made out of atoms, everything is determined. If we go down to the subatomic level the movements of neurons (shown in brain scans) decide what we will do before we are consciously aware of it.

So can we really be in control of our future?

Isaac Newton agreed that with "insight to the inner parts of things," and consideration of the entire variables one could "see the future." This is because we could determine what will happen when given this information. In addition Hume said "every natural effect is so precisely determined by the energy of its cause," that it could only have a particular result. Each variable has a specific effect on a substance and could have no other effect on it when the conditions enabling its action are evaluated precisely. This further supports the thesis that our decisions are governed by cause and effect: everything is determined.

On the other hand libertarians argue that we shouldn't discount the legitimacy of our own personal, subjective experiences. If free will isn't something anyone has then how can we govern society? The concept of personal responsibility is based on the fact that everyone is held personally accountable for their actions. Without free will we can't convict criminals. For this reason 'manslaughter' and 'murder' are dealt with differently in a court of law – intentional killing is given a more severe punishment than unintentional killing.

Of all the arguments presented the most convincing is that external factors, completely out of our control cause everything. This is presented from a scientific, theological and psychological standpoint. From a scientific perspective it's clear that we could predict the future if we had the right tools therefore the libertarians view is a breach of the nature of reality that is ruled by cause and effect. However the behaviourist approach seems more compelling as it can be applied to the real world. Although everything is determined if roles in society enable us to display favourable behaviour, that can be imitated, then it's clear that we should do this to improve the future of humanity.

Bibliography

7.1 free will, determinism and choice (University of Oxford)
https://www.philosophytalk.org/shows/free-will-illusion
McLeod, S. A. (2013). Freewill and determinism in psychology. Retrieved from www.simplypsychology.org/freewill-determinism.html
https://www.britannica.com/topic/determinism
https://plato.stanford.edu/entries/determinism-causal/
https://www.tutor2u.net/religious-studies/blog/free-will-and-determinism

THE FUTURE OF HUMANITY: Will there ever be a future without Alzheimer's Disease?
By Hania Yasin

One in 14 people over 65 will develop dementia. According to the Alzheimer's Society, there are an estimated 850,000 people in the UK living with some form of dementia with Alzheimer's (AD) being the most common. However, the number of people, currently battling the neurological disease is increasing because people are living longer due to improvements in healthcare. It is estimated that is 3 years' time, this number will increase to 1 million.

What we know so far:
Scientists have conducted extensive amounts of research into the causes of Alzheimer's to resolve the issue of how to prevent the processes which cause the disease to progress. Up until recently, the exact cause of what triggers the beginning of a series of stages leading to Alzheimer's Disease had not been discovered. However, due to amplified research, scientists have discovered that Alzheimer's is a neurodegenerative disease which is the results of the gradual destruction of brain cells. It is suggested, from post-mortem analysis and positron emission tomography (PET), that the abnormal buildup of sticky plaques of ß-amyloid and the tangles of tau-amyloid protein in Alzheimer's patients, which form around neurons, is thought to damage them which eventually leads to cell death and tissue loss throughout the brain. Furthermore, it has been discovered that there is a lack of acetylcholine, a neurotransmitter that aids the transmission of messages across brain cells, meaning this process is less effective in Alzheimer's patients.

Comparing images of a healthy brain in contrast with a brain belonging to a patient with Alzheimer's disease can clearly show that there is a reduction of grey matter and neural pathways. Over time, the brain shrinks dramatically, affecting nearly all its functions. This results in fewer neural connections so patients with the disease experience difficulty processing and remembering information. The symptoms usually begin with memory problems such as difficulty in recall and storing additional information. This is due to the decrease in neurons in the hippocampus which is among the first functions to falter but these symptoms worsen as the disease progresses, so the following symptoms may also be experienced:
Increased confusion and disorientation
Problems with speech and language
Difficulty in carrying out daily activities
Change in mood or personality
Difficulty in making judgements

Current treatments:
Unfortunately, most of the developments to cure Alzheimer's disease do not eradicate the actual disease itself but only its symptoms. For example, new drug developments have been made to prevent further reduction in the level of neurotransmitters in the brain which help to preserve brain function by increasing communication levels between neurons. Donepezil,

rivastigmine and galantamine are three compounds licensed for treatment. These are acetylcholinesterase inhibitors (AChEIs), a chemical that inhibits acetylcholinesterase enzyme from breaking down acetylcholine, thereby increasing both the concentration and duration of action of the neurotransmitter and temporarily relieving the patient of symptoms so long as the cells that use this neurotransmitter are in large numbers. However, it is a very short-term treatment due to the serious side effects which include nausea, muscle cramps and diarrhoea as the chemicals also inhibit enzymes in the intestines and muscles affecting their functions. This means that although there is a significant improvement in memory and communication activities, a better drug is required to alleviate symptoms for a longer period of time.

The most recently approved drug is memantine which is an *NMDA (N-methyl-D-aspartate) receptor inhibitor*, which works by regulating the activity of glutamate, an important neurotransmitter in the brain involved in cell signalling. In Alzheimer's disease, excess glutamate can be released from damaged cells, leading to chronic overexposure to calcium, which can speed up cell damage. *Memantine* helps prevent this destructive chain of events by partially blocking the NMDA receptors.

Other breakthrough treatments include blood infusion therapy. also called 'vampire-therapy.' This is the procedure of giving the blood transfusions of younger people to older people in order to delay the symptoms of Alzheimer's. Initial experiments were carried out on rats and it was found that blood transfusions from younger mice into older mice formed new blood vessels and improved memory and learning - effectively turning back ageing. To tests this finding, a study was carried out on 18 volunteers with mild to moderate Alzheimer's disease. The participants also took part in memory and thinking tests and assessments of their ability to carry out everyday tasks were completed. Compared to a placebo, there were some signs of improvement, but the viability of the idea cannot be stated from just a small sample, therefore, a large-scale study would be required.

At this point, it is important to state that despite these drug therapies being a success for some, they may not be beneficial for everyone. The effectiveness of cholinesterase inhibitors and memantine varies across the population and their results may be affected by how severe the Alzheimer's is in a patient.

Alternatively, non-drug treatments are preferred by some patients during which they take part in cognitively-stimulating activities and learn new and engaging skills. The benefit of this treatment is that there are no negative side effects, so this could potentially be applied to everyone to improve their symptoms. However, the downside is that this requires trained professionals and increased funding for therapy sessions which, the NHS currently is unlikely to be able to act on due to the social care crisis.

<u>Potential improvements in the future:</u>

It is difficult to predict when a cure to completely eradicate Alzheimer's disease will surface or whether there will ever be one in the near future. Although the pace of research has been sped up and an additional £300 million has been introduced, research is still under-

funded which means that the prospective developments that can be made are limited due to time and money constraints. One viewpoint, when developing treatments for Alzheimer's is to work towards prevention rather than the cure, i.e. targeting the disease before irreversible damage has been caused. Some scientists suggest that the symptoms just need to be delayed by about 10 years to make sure people are granted a better quality of life in later age.

Prevention trials that are testing biological interventions even before people show clinical symptoms of the disease have already started. For example, scientists are working on how to prevent the formation beta-amyloid, the protein that accumulates in abnormally large amounts in the brain, by introducing a drug, JNJ-54861911, that targets the beta-secretase enzyme by inhibiting its ability to make ß-amyloid. Early studies are currently being conducted on healthy volunteers, expected to be completed be completed by 2024.

Why Alzheimer's develops in some people and not others can be confirmed by genetics as family studies have shown that those who have a close relative who has Alzheimer's disease are more likely to develop it too. Research into this is being done on 3500 asymptomatic individuals who may be carrying the APOE-e4 risk gene which is linked to the disease. The trial will explore whether the drug pioglitazone can prevent mild cognitive impairment. Studies suggest that pioglitazone may decrease beta-amyloid levels in the brain, improve blood flow to the brain and increase the brain's ability to fuel nerve cells.

There is also correlational evidence coming from epidemiological studies that certain lifestyle habits can lower the chance of developing Alzheimer's disease. These include regular physical and mental activity, a healthy diet and having more social connections. Many of these lifestyle changes have been shown to lower the risk of other diseases, like heart disease and diabetes, which have been linked to Alzheimer's. However, it is important to remember that these studies work towards finding an association, so it cannot be stated that these factors cause or affect the onset of Alzheimer’s disease.

Alzheimer's Disease has life-changing effects on individuals, but the gradual progression of symptoms can vary. In the later stages of the disease, symptoms can become so severe that a patient may not be able to carry out simple everyday tasks without being dependent on the help of someone else, almost making it a terrifying disease to experience. There may also be a change in behaviour and personality. Not only is this decreasing their quality of life drastically but also, their friends and families who witness seeing someone they know, suffer from the uncontrollable disease. Therefore, it is important that more funding goes into the research for the cure of Alzheimer's or its treatments so that the onset of symptoms can be slowed down or the degenerative processes of the disease can be prevented from worsening.

More research is required to work out other underlying causes of Alzheimer's as it is likely that this disease is caused by a complex web of factors rather than one overriding factor. Therefore, more clinical trials that use a larger sample of volunteers need to be carried out in order to make sure that a drug is effective for a wider population of people with

Alzheimer's. In order to make sure of a cause and effect relationship, highly controlled studies need to be conducted but it is unlikely that some factors may ever be tested due to practicality, economic and ethical reasons, as they require a large sample of people to be monitored for a lengthy period of time.

One way to improve this is to plan the budget better. This can be done by shifting funding from cancer treatments to treatments for Alzheimer's as there has already been a substantial improvement in cancer research and although it is also a serious health issue, it is difficult to ignore a major disease that causes the deaths of more people per year than cancer. Doctors have stated that dementia as a whole is less talked about suggesting that, as a society, we need to overcome this idea which in turn would grant it more recognition and urge the government to give more attention. Currently, Alzheimer's costs the UK an estimated £26 billion a year with money going towards health and social care yet only a fraction of that amount is spent on research. It is unlikely that a cure or a more plausible treatment can be found until the significance of Alzheimer's disease is fully understood. Advancements in technology suggest that treatments for symptomatic individuals are more quickly recognised and dealt with. The fact that we also now know the importance of beginning therapies earlier, before symptoms show, highlight an optimistic interpretation that in the future, Alzheimer's if not fully cured can most likely be held back so much so that its symptoms are not experienced.

References

Nhs.uk. (2016). *About dementia - Dementia guide - NHS Choices*. [online] Available at: https://www.nhs.uk/conditions/dementia-guide/pages/about-dementia.aspx [Accessed 24 Oct. 2017].

Alz.org Research centre. (2017). *Inside the Brain: Alzheimer's Brain Tour*. [online] Available at: https://www.alz.org/research/science/alzheimers_brain_tour.asp [Accessed 24 Oct. 2017].

Science | AAAS. (2017). Tau protein—not amyloid—may be a key driver of Alzheimer's symptoms. [online] Available at: http://www.sciencemag.org/news/2016/05/tau-protein-not-amyloid-may-be-key-driver-alzheimer-s-symptoms [Accessed 2 Nov. 2017].

Society, A. (2017). How do they work? - Drug treatments for Alzheimer's disease - Alzheimer's Society. [online] Alzheimer's Society. Available at: https://www.alzheimers.org.uk/info/20162/drugs/105/drug_treatments_for_alzheimers_disease/3 [Accessed 2 Nov. 2017].

Sarah Knapton (2017). 'Vampire therapy' helps Alzheimer's patients pay bills and prepare meals again. [online] The Telegraph. Available at: http://www.telegraph.co.uk/science/2017/11/04/vampire-therapy-helps-alzheimers-patients-pay-bills-prepare/ [Accessed 2 Nov. 2017].

Alzheimer's Research UK. (2017). Treatments available | Alzheimer's Research UK. [online] Available at: https://www.alzheimersresearchuk.org/about-dementia/helpful-information/treatments-available/ [Accessed 3 Nov. 2017].

Alzheimer's Association. (2017). The hope for future drugs. [online] Available at: https://www.alz.org/research/science/alzheimers_treatment_horizon.asp [Accessed 3 Nov. 2017].

Jebelli, J. (2017). We can cure Alzheimer's – if we stop ignoring it | Joseph Jebelli. [online] the Guardian. Available at: https://www.theguardian.com/commentisfree/2017/jul/19/alzheimers-disease-death-old-people-science [Accessed 10 Nov. 2017].

Alzheimer's Association, (2017). Prevention and Risk of Alzheimer's and Dementia. [online] Available at: https://www.alz.org/research/science/alzheimers_prevention_and_risk.asp [Accessed 10 Nov. 2017].

History is Inherited – Not Created: Why Marx's Ideas are Important For the Future of Humanity
By Esha Malik

All too often, Marxists are posed with questions such as "Surely Marxism isn't relevant anymore? We've moved on since Marx was writing." or "Why do you still defend a man who was writing about the conditions of a couple of centuries ago?" The answer to such questions is simple: not a lot has changed.

In what is to be done? Lenin famously talks about the spontaneous development of the masses, expressed through trade union politics that can sometimes lead to economism, i.e., the waging of the economic war alone, and not the political. This is dangerous because the struggle for socialism must be political as well as economic and without an understanding of that, political ideas alien to the working class can creep into the movement. While we must fight for reform that benefits the working class, by no means is it the be all and end all of the struggle. In the words of Lenin: "Hence, our task, the task of Social-Democracy, is to combat spontaneity, to divert the labour movement from its spontaneous, trade unionist striving to go under the wing of the bourgeoisie, and to bring it under the wing of revolutionary Social-Democracy."

These words can be seen as truer than ever today. The trade unionist leadership, left without communist ideas and direction, has adopted bourgeois ideas of reformism and "responsible capitalism". Trade union bureaucrats can get away with such policies during a period of capitalist upswing, and the relative economic boom of the last 60 years has indeed seen a move to the right by union leaders and the Labour Party, epitomised by Blair. As stated before, while we must fight for reforms that benefit the working class, it is not the be all and end all of struggle. However the Labour Party and the trade unions, in the last period and still today, treat it as such. At a time like now, when capitalist crisis is crushing the workers, this reformism without reforms leads only to further misery for the working class. To quote Lenin, "without revolutionary theory there can be no revolutionary movement." Quite clearly the modern trade union movement, whose leadership has been left completely without revolutionary Marxist thought, needs revolutionary theory now more than ever so as to build a revolutionary movement against austerity. This is why Marxists must be on marches, demonstrations and rallies making the argument for revolutionary socialism. We should always be where the masses are.

Therefore, we, as Marxists, must argue for a socialist direction for the mass trade union movements. We must use the institutions of bourgeois democracy as well as trade unions, demonstrations, rallies, etc. as a platform to speak our views and to convince people of the need for a socialist transformation of society, which will not fail us in fighting for decent living standards and protection of our rights. To conclude with regards to trade unionism: the relevance of Marxism here is to act as a force for socialist ideas amongst the mass of people, to direct them to a new, internationalist proletarian cause—to break the link with bourgeois politics and economism.

As far as the economic struggle goes, it is fundamental that it is not split from the political struggle. However, that does not mean that it mustn't go without analysis, without scrutiny. In Wage-labour and Capital, Marx pretty much sums up with the near enough prophetic lines: '[But] capital not only lives upon labour. Like a master, at once distinguished and barbarous, it drags with it into its grave the corpses of its slaves, whole hecatombs of workers, who perish in the crises.' By this, Marx is of course referring to the endless anarchy and cyclical crises of production under capitalism, the crises that take place in the international markets which claim victims each time, be it through poverty, famine, desperation, slavery and even death in the most down-trodden and exploited countries.
In Wage-labour and Capital, Marx explains the dialectical and dependent nature of both wage-labour and capital, and how one sustains the other; without capital, the wage-labourer cannot survive, as he receives no wages; and without wage-labour, capital cannot exist and profits cannot be made.

The question is this: do these social conditions still exist? The simple answer is yes, they do. We have not abandoned this system, thrown away the chains, and released the wage-labourers from the dominion of capital. Workers are still routinely exploited for profit; commodity production, i.e., producing in the name of profit, still exists; imperialism is still attempting to secure its gains in many countries; cyclical crises, owing to the anarchy of production and overproduction, are still borne by sacrifices made by the proletariat without their consent; and the list goes on. From this, then, the economic relevance of Marxism—in its explanation of the nature of capital, in its offering of an alternative—can be seen in the bluntest and most upfront manner possible. It is to free the workers from the dominion of capital, from the capitalist parasites who, to quote Marx, 'will do anything for the workers but get off their backs.'

Marxism is still hugely relevant in both the economic and political struggle, as one without the other will inevitably lead to concessions to bourgeois thought. With the seizure of power and with the smashing of the old system, the proletariat will fulfil its potential to change society, and become able, for the first time, to act in its own interests, to free itself, and to lead the way to communism.

Marxism's relevance in the 21st century is thanks to the fact that things haven't really changed, and the proletariat is still subordinate to capital. What's more, as a result of this people are still taught, from a young age, that greed is good, and that merciless selfishness is the basis of their so-called (actually distorted) conception of "human nature". The most relentless propaganda wars against Marxist thought are waged; people are encouraged not to look past the bourgeois democratic pantomime of Parliament. The ideas of Marxism are the ideas we need to fight back against all these things.

The Greek philosopher Aristotle said that "Man begins to philosophise when the necessities of life are provided." By philosophise we mean the ability to think in general, to lift one's eyes, above the worries and immediate pressures of every day existence, to seek a broader horizon, to contemplate life, nature, and the Universe. In present-day society, the minds of men and women are oppressed by the struggle for survival—whether or not they will find

work, whether they will be able to pay the bills at the end of the month, find a roof over their heads, obtain provision for sickness and old age. Only when these degrading obsessions are eliminated will men and women become genuinely free human beings, able for the first time to realise their full potential.

Trotsky once asked the question: “How many Aristotles are herding swine? How many swineherds are sitting on thrones?” Throughout history, the mass of humanity have been deprived of access to free time, education and culture which would permit them to contribute to society’s store of knowledge. It is a crime of class society that such a vast reservoir of human talent is wasted. By releasing it, socialism would prepare the way for such a blossoming of culture, art and science as has never been seen in human history. Humanity would draw itself up to its full height. This would mark the end of human prehistory and the commencement of the true history of the human race.

‘‘Let us finally imagine, for a change, an association of free men, working with the means of production held in common.’’ —Karl Marx

References

Lenin, V. (1929). What is to be done? New York: International Publishers.

Marx, K. and Engels, F. (2011). Wage-labour and capital. New York, NY: Barnes & Noble Digital Library.

Trotsky, L. (n.d.). Art and revolution.

Have we hit the peak of our innovation in engineering?
By Shazib Iqbal

As humans it is clear that it is in our nature to revolutionise, and transform the way we live. When looking back at the dawn of human life, it is evident that our innovation has always been in our interest to make life easier, or ameliorate our chances of survival. Examples of simple yet crucial leaps of creation in engineering can be traced back to the times of Neanderthals, a stunning 130,000 years ago. Baskets were first made by early humans, to carry large loads of goods easily, increasing both chances of survival, and ease. The stone axe, used for rock mining and hunting, played a heavy roll in the advancement of creation. Many other tools were also commonly in use, such as fire starters, spears, fishing, bows and arrows, and many more[1]. Listed, were what could be argued as the greatest inventions, posing as key formulas in early life for survival.

Fast forwarding hundreds of thousands of years, through human evolution and perseverance, we come to the start of an industrial revolution. A time of great progress and major leaps in our knowledge about the engineering innovation we so love. During the industrial revolution, some of the most ingenious machines were engineered such as the steam engine in 1775, the telephone in 1836, and the airplane in 1903[2], just listing a few of the dozens of inventions. It may be possible to say that the industrial revolution was the most innovative chapter of engineering in human history. This could be argued to evidently be the very peak reached by engineers. The products engineered in this period would change the world of communication, travel, leisure, and education for the rest of humanity. Each product could be argued to be the foundation for every invention to come, weather that be years after the revolution, today, or even decades from now. It is commonly said that "the most important step of a journey, is the first," and after evaluating the new bounds of engineering set during the revolution, it is clear that it was the backbone to a new era of creation and innovation. On the contrary, it may be argued that the revolution was only a scratch on the surface, and an indication of what type of engineering ingenuity was to come in the future. This could be the case considering the leaps we are taking today. In any case, weather you see the revolution as the peak, or the backbone of engineering, there is certainly no denying the enormous enhancements made in this period, by us humans in complimentary with our desire for curiosity and creation.

A considerable period of engineering innovation is the 21st century. These recent years have really shone, and put engineers at the top of their game. In these last 2 decades alone, we have invented and stepped into a world beyond our imagination. For example, the dawn of genetic engineering, hypersonic transportation, free energy, robotics, artificial intelligence, Nano technology, cloning, antigravity, hydrogen powered cars etc. [3]. The 21st century will indefinitely invent more ground breaking inventions, however that is that is the nature of the world of engineering. The previously listed inventions could be enough to make a person question whether this is the century in which we peak innovation. It really opens your eyes as to the magnitude of engineering, how far we've come from the start of humanity, and the production of new technologies in perpetuity. Personally I believe that

the peak is yet to come, and that all these new inventions are simply the build up to a new and redefined world as we know it today.

The true peak of our capable minds will be met in the future. A future where we create the final invention. People argue what the final invention will be, whether it is a teleportation device, an atomic bomb, or a Time Machine. I myself believe it to be artificial intelligence. The day our creations invent the uninventable, will be the day we peak in engineering innovation. Artificial intelligence is currently being engineered and improved on a daily basis, and could have the potential to threaten the world of engineering as we know it today. We will never know our limits until we cross them, and for all we know, the peak my never come.

In conclusion, there are many periods in humans existence that could be identified as the peak of engineering innovation, whether that be 130,000 years ago during the Neanderthals, a few centuries ago with the industrial revolution, the 21st century, or perhaps the future. We may never really know when the peak was, or will be, but the growing world of engineering will forever improve and revolutionise.

References

[1] https://www.eupedia.com/europe/timeline_human_evolution.shtml
[2] http://www.brighthubeducation.com/history-homework-help/91805-important-inventions-of-the-industrial-revolution/
[3] www.toptenz.net/top-10-inventions-of-the-21st-century.php

The future of humanity
By Mariam Jallow

Many believe that humanities future lays in futuristic advancements in technology; however this possibility may not be viable due to our rapid consumption of the world's resources leading to global warming. Earth overshoot day which predicts the day when humanities consumption of earth's resources overtakes earth's production has found that the annual event is getting earlier each year. It had moved from October in 2000 to early august this year. Countries such as china, the US and UK have already used more than double the amount of resources they produce (Plummer, 2017).

Atmospheric CO_2 concentration has increased by more than a third since the Industrial Revolution began and research has found that there is a greater than 95% probability that is as a result of human activity (NASA). This is important in the future of humanity as the rapid increase of greenhouse gases such as CO_2 caused mainly by our dependence on fossil fuels and deforestation may mean that we cannot physically reach our potential even if it may be technically possible. The use of oils such as petroleum is responsible for 42% of greenhouse gas emissions in the United States. These sources of fuels are finite and if a more sustainable replacement is not found then it may limit how much our use of technology is able to advance. These pollutants trap heat into the earth which leads to an increase in earth's surface temperature. Most of the earth's warming has occurred in the past 35 years, with 16 of the 17 warmest years on record occurring since 2001 (NASA). This has a dramatic effect on animal populations; melting ice caps limits the habitats of animals in colder regions leading to more species becoming extinct. Animals aren't able to adequately deal with the rapid changes to their climate which also has implications further up the food chain.

But of course, being humans what matters most is the impact global warming has on us. The World Health Organization has estimated that around 160,000 deaths since 1950 were directly as a result of climate change **(En.wikipedia.org, 2017)**. Extreme heat and pollutants in the atmosphere lead to death due to respiratory and cardiovascular diseases; the elderly population being the most vulnerable. Climate change may also cause a change in the frequency and development of certain diseases; warmer temperatures may increase the extent of the malaria virus directly affecting millions of people.

Global warming is leading to a greater frequency in the amount of extreme weather conditions. It is predicted that global flooding could triple by 2030 (McGoogan, 2017). This puts the lives of thousands of people at risk. As with everything else, poor and low income communities are the worst affected by global warming. Where as a small increase in global temperature may mean a nicer tan for you, in warmer parts of the world which is where most of these communities live it could have a detrimental effect on their quality of life. Increased temperatures mean a decrease in crop production due to increasing droughts in some areas and floods in others which these countries are also less equipped to deal with. In 2008 an average of 21.5 million people were forcibly displaced due to climate changed-related weather hazards (Plummer, 2017). This has led to a refugee crisis impacting not just

the country affected but others as well. This demonstrates the adverse effect that climate change could have on all of us.

There are two types of people in this world; those who accept the detrimental impact that we as humans have on the environment and Donald Trump. America is the second largest producer of pollution in the world and yet their leader is someone who believes that “the concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive.” His ignorance over this issue has impacted the decisions he makes around it, most controversially being his choice to remove America from the Paris agreement which aimed to unite different countries with the aim to address the issues surrounding our climate. However, this is not the first time an American president has done something like this as Bush pulled America out of the Kyoto protocol in 2001. In doing this it allows people to continue doing nothing about our current situation which would only speed up the downwards spiral that we have started.

Although it would be easier to deny responsibility, we will eventually have to face the consequences of our actions or be forced to find a solution. The quicker we address the issue, the better the outcome for humanity. However if we continue at this rate humanity will have no future to write about. But hey, maybe Trump is right for once which means humanity is still on course to eventually being outsmarted and overtaken by AI.

How artificial intelligence can positively impact the future of humanity

By Awes Mubarak

Artificial intelligence (AI) is seemingly intelligent behavior by machines, rather than the natural intelligence of humans and other animals. An AI is able to make decisions that will maximize its chance of success. These systems will often reflect some cognitive functions of naturally intelligent beings such as learning based on experiences and problem solving guided by past attempts.

An average person will be exposed to AI systems multiple times in an average day, but won't realize it. Search engines, content aggregators, content delivery networks and modern cars all make use of AI to improve service. The scope of AI is difficult to define as the idea of intelligence changes. Optical character recognition (OCR) is no longer considered to be an example of AI as it is in widespread use (Schank C., 1991). John McCarthy, who coined the term “Artificial Intelligence” in 1956, complained that “as soon as it works, no one calls it AI anymore” (Vardi M., 2012). This is called the AI effect and leads to the mythification of AI.

This paper will explore some of the already existing and possible future positive applications of AI in the everyday lives of people. It will discuss email spam filtering, self-driving cars, personalization, personalized medicine, and will end by discussing artificial super intelligence.

The positive effects of AI

(I) Developing advanced AI

To discuss the impacts of AI it is important to understand AI first. AI is a very broad concept, but can be split into 3 distinct calibers: artificial narrow intelligence (ANI), artificial general intelligence (AGI), and artificial super intelligence (ASI).

- **Artificial Narrow Intelligence (ANI):** Able to complete only one task very well. This kind of AI may be able to drive a car but would not be able to sort data on a flash drive. Saenz A. (2010) describes these systems as being "like the amino acids in the early Earth’s primordial ooze". They are relatively simple but fundamental for more complex structures to be created.
- **Artificial General Intelligence (AGI):** Able to complete most human level tasks. Like humans, they are able to solve problems creatively, understand abstract ideas, and improve future responses using the results from previous attempts. This is the next milestone in improving artificial intelligence.
- **Artificial Super intelligence (ASI):** Bostron N. (1998) describes this kind of AI as "an intellect that is much smarter than the best human brains in practically every field, including scientific creativity, general wisdom and social skills.". This kind of AI is thousands of times smarter than any human, and introduces the negative aspects associated with AI (e.g. extinction level events like skynet).

It is important to note the distinction between AI and robots. Robots are machines capable of carrying out complex sequences of actions automatically. They may or may not be of

humanoid form. A robot can be a container for AI, but AI is not defined by a robotic nature. AI is software-based and can run on a user's personal device, such as personal assistants on phones like Siri, or can be online, such as chess playing software. In these cases, there is no robot. However, robots and artificial intelligence complement each other. A robot without AI cannot intelligently respond to stimuli it has not been programmed to respond to. This limits the breadth of tasks a robot can accomplish. Similarly, robotic bodies allow AI to experience the world and thus build definitions for items. Current artificial intelligent systems may be able to recognize items but are limited by not knowing what they are recognizing. For example, a person may be able to recognize intuitively that a mug and wine glass are both used for similar purposes, but a robot will struggle to understand this unless it understands why these items are used in the first place. Progress in this direction is not being made quickly because it is not important in our current ANI world, but AGIs will need to understand worldly items in order to be able to act upon them.

We have already conquered ANIs: they are prevalent in many sectors and an average person will interact with multiple such systems daily. Progressing on to the next level, AGIs. is very difficult. Huge computational power is required to compute what seems easy to us; a computer can do thousands of calculus questions every second but cannot read a 7-year olds story book. N. Nilsson (2013) says "AI has by now succeeded in doing essentially everything that requires ‘thinking’ but has failed to do most of what people and animals do ‘without thinking". To achieve AGI dominance we need advancements in hardware and software. These will be discussed in a later section.

(II) Email spam filtering

A clear demonstration of how AI can change humanity by impacting the everyday lives of people is in email spam filtering. Email spam filters are used by virtually all email services. Spam has been a problem since the mid-90s when Hotmail became the first webmail provider and spam email became cheaper to automatically send out and more victims were available. Since then many systems have been used to mitigate spam.

The first email spam filters used simple word frequency detection. Certain words may be used more in spam emails than in legitimate emails, such as the names of drugs. Emails with a high frequency of such words will be marked as spam. The senders of spam have a number of techniques to combat this. Certain letters may be replaced by similar alternatives (e.g. roman 'A' with crylic 'A'), nonprinting characters may be added to words, and accented variants of words may be used. More complex techniques must be used to avoid this spam email, leading the virtual equivalent of an arms race. Other techniques developed included checksum based filtering to detect bulk emails, URL filtering with domain block lists, and grey-listing of new senders. A huge problem in filtering is false positives. Marking legitimate email as spam is considered worse than allowing some spam into the inbox.

An ideal system binds all of these techniques in hybrid filtering. The programmers decide which tests provide more or less evidence for spam and give each test a weight. An overall score is then found for the email, and if the score is high enough the email is marked as spam. This also allows the user to adjust the level of filtering they wish. At this stage,

artificial intelligence can be introduced. ANIs can be used throughout such systems to improve spam detection accuracy. For example, by looking at which emails are opened and which are not the legitimacy of a sender can be predicted more accurately; if a user never opens emails from a particular sender the sender can be marked as spam safely. The AI can also look at the emails recovered from or added to the spam folder. The score threshold for spam can then be automatically adjusted. This is intelligent behaviour: the system is learning from its mistakes and minimizing the chance of failure in the future. AI is already prevalent in all email providing services, and a lot of people will interact with it daily without realizing. Future development of AGI will allow more advanced filtering of email by analysing the meaning of the email and deciding its legitimacy based on content. Spam filtering clearly demonstrates the capability of AI.

(III) Self driving cars

When AI and cars are talked about together, people tend to think about self-driving cars. However, this is not necessarily the case. A modern car will contain many ANI systems, for example deciding the parameters and timing of the fuel injection system. A car may incorporate a personal assistant-esqe system, for example, to decide whether a trip should be economical or fast depending on previous routes and to give suggestions for directions using the driver's calendar. However, self driving cars are still the more interesting application of AI.

A self-driving vehicle is a vehicle that is capable of sensing its environment and navigating without human input. While driving is a relatively simple task for human drivers, computer systems struggle with a lot of the required tasks. To understand its location the computer must use a range of sensors and must use highly trained machine learning algorithms. Self-driving technology ranges from simple lane correction to full autonomy; as of 2017 all self-driving cars produced require a human driver to be able to take back control of the car, but fully autonomous cars appear to be on the horizon. Advantages of self-driving cars include increased safety due to reduced human error, reduced labour costs, better traffic control and lower vehicle insurance.

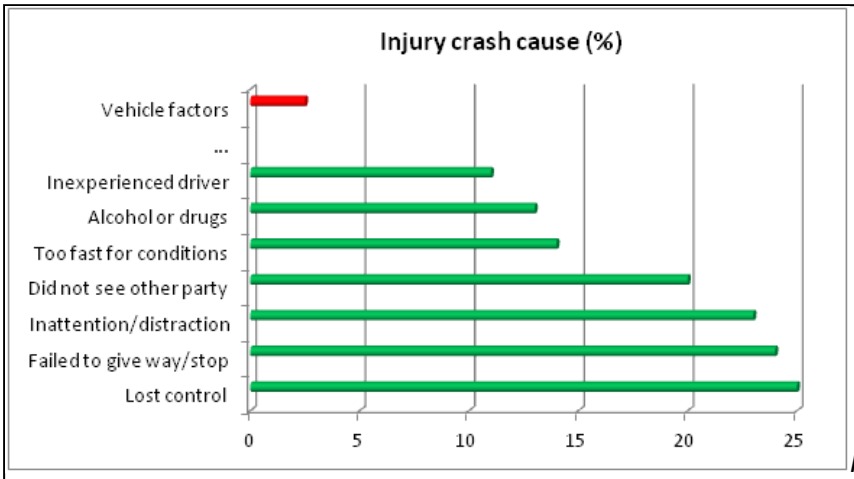


Fig 1: Federal Highway Administration, 2015

Every year over 1.2 million people die in road traffic (World Health Organization, 2015). Self-driving cars reduce the number of collisions as the majority of accidents occur due to avoidable, human mistakes (Treat et al., 1979). A large number of sensors provide a much clearer view of the surroundings and allow the computers to avoid dangers a person may miss. Furthermore, AI does not succumb to human problems: it does not get tired, does not get distracted, does not drink and drive, and does not get car rage. This combats major reasons for car accidents, as shown in Fig 1. These cars will also follow laws more closely; the speed limit will always be obeyed and they will always indicate lane changes.

Greenhouse gas emissions are estimated to be reduced due to fleet driving. This involves multiple vehicles communicating and working together to achieve maximum efficiency. This technology has already been shown to work on two occurrences: the Smithsonian Institution reduced emissions from its 1500 vehicles by 53% by using advanced GPS tracking to manage the fleet (Smithsonian Facilities, 2016), and Los Angeles County, California, introduced a traffic signal synchronization program to improve the throughput of vehicles that resulted in saving 31.3 million hours of travel time, 38 million gallons of fuel and 337,000 metric tons of carbon dioxide per year (Pyper J., 2014). Similar technology can be used by self-driving cars to minimize their carbon footprint.

(IV) Personalisation and big data

Big data is a term traditionally used to describe large sets of data that traditional analytics techniques are unable to deal with. The term can also refer to the extraction of useful information from data using advanced techniques. The term was coined in the 1990s. The reduction in storage cost has chained the definition to refer to data that is "high volume, high-velocity and high variety". AI is integral to making use of big data.

Big data can be explained simply by using an example. Modern self-driving cars aim to mimic human drivers. To do this the algorithm must observe human drivers. To understand its location the algorithm has to use a wide variety of sensors and combine their outputs using

senor fusion. The sensors may include GPS, LIDAR and traditional cameras. The data from these sensors is very high volume, high velocity and the number of sensors makes it high variety, and thus matches the above criteria. After the data has been collected the data will be analysed and a machine learning algorithm will be trained to predict the human driver's movement. This system is far superior to the traditional rule-based approach, offering opportunities such as insight into previously hidden patters a driver may follow.

Big data is commonly used to personalise and optimize content for users. Services can enhance customer satisfaction by tailoring their products to their users using data they have collected. The data is used to train an ANI that will then optimize the service. The large volume, variety and velocity of data make this scenario and ideal application of AI, as humans cannot deal with any of the three factors at scale.

Content creators and aggregators can use big data and AI to improve their content. The creator of a blog may manually look at statistics such as clicks and the amount of time spent on the post to enhance future content; by writing content that retains users the bloggers will be producing higher quality content and will earn more money from ad revenue. This is not possible for large-scale content aggregators since there is too much content to sort through. An AI will be trained to favour content that retains users and thus improve customer satisfaction. This type of ANI is widespread in modern content aggregation sites like Facebook and YouTube.

In 2016 over 9 billion searches were conducted using the Google search engine every day (Statistic Brain, 2017). The search engine giant dominates primarily because it uses a very advanced neural network to rank pages. Google uses factors called ranking signals to decide which websites should be linked to before others. These signals include page speed, mobile optimisation, and a number of links to the site from other high-quality sites. The most important signal may, however, be click-through rate. Pages that get clicked on more are more likely to be the target for a search. By favouring these pages users are more likely to end up on their target page. Modern smart phones are sometimes considered 'personal assistants' as they optimize their workings to the user's requirements. Music recommendations through Spotify, weather information, and route optimisation through Google maps are all examples of ANIs personalising their workings for the user to maximize relevance. Some phones may also use voice-based communication in the form of humanoid entities such as Siri and Google Now. In this example, an ANI will translate the voice into words, and will then try to discern meaning from the text. Relevant results will then be found from the request. All three stages of this will be optimized in the future with the creation of AGIs. An AGI will be able to discern meaning from speech more accurately as it will be able to extrapolate words it does not understand using context. It will then understand the meaning of the request, which will improve the chance of it returning information requested. Finally, AGI will understand its users completely and will know exactly how to personalise for the user. In this scenario a user will outsource all unrequired work to the phone; tasks such as calendar schedule will be completely taken over by the user. The phone will also act upon this calendar, calling taxis, setting alarms and possibly playing relevant music. For content creators and aggregators the importance of AI in ads is

twofold. Improved content will increase the number of users that see the ads, and personalised ads will increase the chance of the ad is clicked on. The fist point has been discussed above: by creating content that the user wants the user will be more likely to spend more time on the site, and will thus be subject to more ads. These ads will relate to the content, but more importantly, will target the user based on information about them. Every time a search is made using Google information about it is saved, including IP address, user agent and often unique identifiers in the form of cookies. If the user is logged in the search is linked to their profile. Every time the user clicks on an ad information is saved and more similar ads will be shown. The more information advertisers collect, the more personalised their ads will be, and thus the user is more likely to click on them. More clicks grant the creators higher revenue.

Overall, big data and AI allow optimized content, which is benefits both creators and users. As AI improves the content can be more strongly optimized and can be monetized more efficiently.

(V) Personalised medicine

Personalised medication is a medical procedure that separates patients into groups depending on their predicted response to treatment. Treating different patients with different treatments is a very old technique that dates back as far as the ancient Greeks, but recent advances in genetics allow treatments to be administered with the security of effect (Egnew T., 2009). By analysing patterns in genomics and comparing those to the success rate treatments can be optimized to the patients. This improves the effectiveness of the medication.

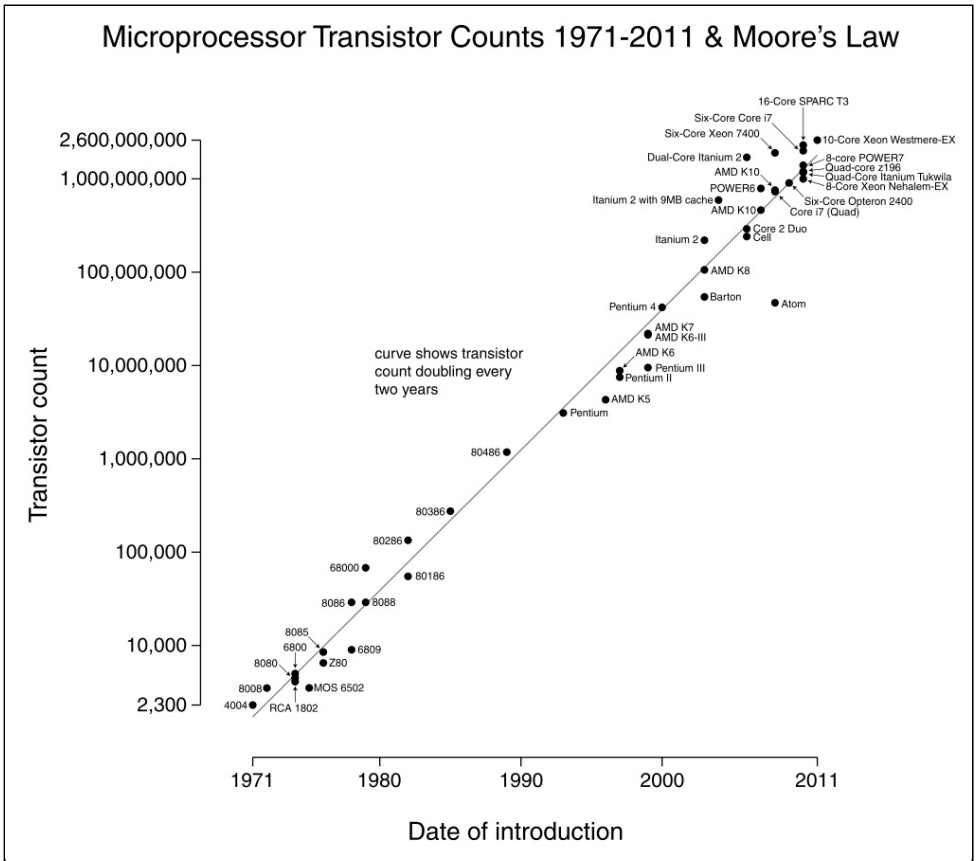


Fig 2: Moore, G. (1965)

The huge volumes of data make this a big data and thus AI problem. A simple ANI can find correlations and is able to recommend medication based on how others of similar genomics reacted to the treatment. A more complex AGI (or ASI) will completely change medical treatments as the system begins to find reasoning for different reactions in treatment. This will allow tailor-made solutions for every problem: going to the doctor to get a prescription may involve getting a blood sample and custom medicine being created for the individual patient. This will reduce disease and illness for all of humanity.

(VI) Artificial super intelligence

ASI was described as “an intellect that is much smarter than the best human brains in practically every field, including scientific creativity, general wisdom and social skills”. ASI can thus be considered as more advanced AGI, and thus AGI needs to be developed for us to have ASI.

To develop AGI, Ray Kurzweil says a ballpark figure for the required computation power is 10 quadrillion cps (calculations per second). The world’s fastest computer is the Tianhe-2, at 34 quadrillion cps. However, it needs 24 megawatts of power - over a million times more than the brain's 20 watts - and costs $390 million (Chen S., 2013). This prevents experimentation and research as it cannot be installed in most institutions. However, as shown in Fig 2., Moore’s law shows that computational power follows an exponential growth curve (Moore G., 1965). Using this we can tell that the human brain's computational power will be rivaled by computers by the year 2025.

Once the hardware is satisfied software engineers will be able to attempt the creation of software allowing AGI. A number of options are available. One is to plagiarize the brain: rather than trying to rival the human brain we simply copy and adapt it. Some estimates claim that this can be done by 2030 (Ganapati, P., 2010). The human brain is incredibly efficient, having been fashioned by evolution over millions of years. One example technology we can copy from the brain is the idea of neurons in the form of neural networks. The network will learn how to complete tasks such as optical character recognition by attempting a guess and strengthening or weakening pathways between neurons based on if it is correct or not. Larger scale plagiarism can involve whole brain emulation, where a model is created and emulated from a real brain. This model can then be improved and possibly turned into an ASI.

A study conducted by Vincent M. and Bostrom N. (2014) on the timeframe for AGI resulted in the following:

Median optimistic year (10% likelihood): 2022

Median realistic year (50% likelihood): 2040

Median pessimistic year (90% likelihood): 2075

An AGI would already have advantages over humans; AGIs do not age or disease, silicon-based architectures are much faster than neurons, and an AGI is able to back itself up to

multiple computers. Furthermore, AIs are less likely to dispute amongst themselves and can use collective capability, the trait that helped take humans beyond the food chain, more effectively than us. The most effective way to increase the intelligence of an AI is to give the AI the capability to improve itself. This AI would be able to make itself smarter using its already existing knowledge. This is called recursive self-improvement and leads to an explosion in AI capability. If an AI with the intelligence of an average person is given the tools to improve itself, it may be able to rise to the intelligence of a very smart person. It then has a very smart person's knowledge with which to improve itself with. Its knowledge will thus increase exponentially, and it will quickly become the most intelligent entity. Vincent M. and Bostrom N. (2014) found that experts believed it would take a median of 20 years to transition from AGI to ASI.

Bostrom N. (2013) describes three possible types of ASI:

- **Oracle:** Ansers complex questions posed to it. This AI can consider a larger number of factors than a human can, and can model scenarios more accurately. An example question can be "How can I manufacture a more efficient car engine?". Advanced search engines such as Google can be considered primitive examples of Oracles.
- **Genie:** Executes high level commands provided to it, and then waits for the next instruction. For example, it could be commanded to "Use a molecular assembler to build a new and more efficient kind of car engine".
- **Sovereign:** Freely pursues answers to broad and open-ended questions. This type of AI will operate freely and make decisions itself. Rather than designing a better can engine it may completely revise transportation.

The nature of ASI allows it to solve almost any problem that can be solved. It can be used to solve climate change, reverse the damage already done and figure out an economically sane business plan significantly reducing electricity plans. ASI could cure most diseases, nullify world hunger, end conflicts and possibly even conquer our mortality. Bostron N. (2003), a prominent voice in warning against the dangers of AI, writes the following:
“It is hard to think of any problem that a super intelligence could not either solve or at least help us solve. Disease, poverty, environmental destruction, unnecessary suffering of all kinds: these are things that a super intelligence equipped with advanced nanotechnology would be capable of eliminating. Additionally, a super intelligence could give us indefinite lifespan, either by stopping and reversing the aging process through the use of nanomedicine, or by offering us the option to upload ourselves. A super intelligence could also create opportunities for us to vastly increase our own intellectual and emotional capabilities, and it could assist us in creating a highly appealing experiential world in which we could live lives devoted to joyful game-playing, relating to each other, experiencing, personal growth, and to living closer to our ideals.”

Conclusion

AI is widespread and used by a large majority of people daily, and as progress is made it will continue to improve services for people. It already provides important services that users may not realize. Email spam filtering is an example of an artificial intelligence system already in place unbeknown to many people, and improvements in the system will improve the user

experience. AI is used in self-driving cars to improve safety and to reduce car's carbon footprints. Personalised content using big data will both enhance user experience and improve the monetisation for the creators. Personalised medicine will improve treatments for patients and will change the medical field by improving treatment for patients. Finally, ASIs have the potential to solve problems including world changing events such as global warming and world hunger.

References

Bostrom, N. (1998) 'How long before super intelligence?'. [online], Available at: https://nickbostrom.com/superintelligence.html [Accessed 25th Oct. 2017].

Bostrom, N. (2003) 'Ethical Issues in Advanced Artificial Intelligence', Cognitive, Emotive and Ethical Aspects of Decision Making in Humans and in Artificial Intelligence, vol.2(1), pp.12-17. [online], Available at: https://nickbostrom.com/ethics/ai.html [Accessed 25 Oct. 2017].

Bostrom, N. (2013). 'Super intelligence'. Oxford: Oxford University Press, ch.10.

Chen, S. (2013). 'World's fastest computer, Tianhe-2, might get very little use', South China Morning Post. [online], Available at: http://www.scmp.com/news/china/article/1264529/worlds-fastest-computer-tianhe-2-might-get-very-little-use [Accessed 25 Oct. 2017].

Diamandis, P. (2014). 'Abundance'.

Egnew, T. (2009). 'Suffering, Meaning, and Healing: Challenges of Contemporary Medicine', The Annals of Family Medicine, vol.7(2), pp.170-175. [online], Available at: http://www.annfammed.org/content/7/2/170.full [Accessed 25 Oct. 2017].

Ganapati, P. (2010). 'Reverse-Engineering of Human Brain Likely by 2030, Expert Predicts', WIRED. [online], Available at: https://www.wired.com/2010/08/reverse-engineering-brain-kurzweil/ [Accessed 25 Oct. 2017].

Moore, G. (1965). 'Cramming more components onto integrated circuits'. [online] Available at: https://drive.google.com/file/d/0By83v5TWkGjvQkpBcXJKT1I1TTA/view [Accessed 25 Oct. 2017].

Nilsson, N. (2013). 'The quest for artificial intelligence', Cambridge [u.a.]: Cambridge Univ. Press, p.318.

Pyper, J. (2014). 'Self-Driving Cars Could Cut Greenhouse Gas Pollution', Scientific American. [online], Available at: https://www.scientificamerican.com/article/self-driving-cars-could-cut-greenhouse-gas-pollution/ [Accessed 25 Oct. 2017].

Saenz, A. (2010). 'We Live in a Jungle of Artificial Intelligence that will Spawn Sentience', Singularity Hub. [online], Available at: https://singularityhub.com/2010/08/10/we-live-in-a-jungle-of-artificial-intelligence-that-will-spawn-sentience/ [Accessed 25 Oct. 2017].

Schank, C. (1991). 'Where's the AI', AI magazine, vol.12(4) p.38. [online] Available at: https://www.aaai.org/ojs/index.php/aimagazine/article/view/917/835

Smithsonian Facilities (2016). '2016 Strategic Sustainability Performance Plan', Smithsonian Institution. [online], Available at: https://www.si.edu/Content/Pdf/About/Smithsonian-Institution-Sustainability-Perf-Plan.pdf [Accessed 25 Oct. 2017].

Statistic Brain. (2017). 'Google Annual Search Statistics', Statisticsbrain. [online], Available at: http://www.statisticbrain.com/Google-searches/ [Accessed 25 Oct. 2017].

The International Transport Forum (2017). 'Managing the Transition to Driverless Road Freight Transport', International Transport Forum. [online], Available at: https://www.itf-oecd.org/sites/default/files/docs/managing-transition-driverless-road-freight-transport.pdf [Accessed 25 Oct. 2017].

Treat, J., Tumbas, N., McDonald, S., Shinar, D., Hume, R., Mayer, R., Stansifer, R. and Castellan, N. (1979), 'Tri-level study of the causes of traffic accident: Final report', Institute

for Research in Public safety. [online], Available at: https://ntl.bts.gov/lib/25000/25500/25515/DOT-HS-805-085.pdf [Accessed 25 Oct. 2017].

Vardi, M. (2012). 'Artificial intelligence', Communications of the ACM, vol.55(1), pp.5-5. [online], Available at: https://cacm.acm.org/magazines/2012/1/144824-artificial-intelligence-past-and-future/fulltext [Accessed 25 Oct. 2017].

Vincent, M. and Bostrom, N. (2014). 'Future Progress in Artificial Intelligence: A survey of Expert opinion', Future of Humanity Institute. [online], Available at: https://nickbostrom.com/papers/survey.pdf [Accessed 25 Oct. 2017].

World Health Organization (2015). 'Global status report on road safety'. [online], Available at: http://who.int/violence_injury_prevention/road_safety_status/2015/en/ [Accessed 25 Oct. 2017].

Macular degeneration and the future stem cell therapy

By Vishal Muralie

Introduction

The ability see is something we take for granted these days with such treatment care to help us see clearly. In an ever advancing world technology has led to our vision being used differently to what they had adapted to. Originally our eyes used for searching, identifying and distinguishing prey are now used to read text or observe bright lights and images on screens. With such changes the health of our eyes has become even more significant than ever.

What is it?

So what is macular degeneration exactly? Macular degeneration is the process in which the macula, the region in the back of the eye which is responsible for defining details and your central vision, becomes damaged. The retinal pigment epithelium (RPE) is layer in between the main blood supply to the retina known as the choroid and the retina itself. The RPEs role is to nourish the retina as well as remove waste products. Bruch's membrane, a layer between the RPE and choroid, has a build-up of drusen which is a waste product due to macular desecration. This is seen as yellow regions in the back of the eye and helps identify early signs of MD. This could result in vision becoming hazy, blurred or areas completely blacked out.

There are two types of MD, dry MD and wet MD. Dry MD occurs when light sensitive cells in the macula slowly break down due to the build-up of drusen. The gradual blurring or a spot in their vision increases. As time goes on, more drusen builds up and the macula functions less leading to increased vision loss. Dry MD generally affects both eyes but vision can be lost in one eye only. The other eye usually compensates and makes symptoms less noticeable. Dry MD is have 90% of MD suffers have and is a gradual progression.

Wet MD is also called advanced MD as it usually arises from dry MD. It occurs when blood vessels from the choroid tart to grow under the macula and further into the eye. This new vessel will often leak blood and fluid. With blood and fluid under the macula results in its shape being distorted and causing vision to change. An early sign of wet MD is straight lines will appear wavy. Wet MD, unlike dry MD, does not have stages and the onset is very quick. This is a lot more dangerous and can cause severe damage to vision.

How big is the threat?

Macular degeneration (MD) is a growing concern with our growing population. The ageing population within countries are larger than ever and projected grow. MD has been increasing not just in the UK but globally, significantly in high income countries (HICS). "More than two million people are living with sight loss that has a significant impact on their daily life" (http://www.rnib.org.uk/nb-online/eye-health-statistics) in the UK. This value is expected to grow due to population and growth and our increasing use of screens, 4.1 million people will be affected by sight loss in the UK by 2050.

Treatment of MD: Stem cell therapy

Multicellular organisms are made up of many different cell types that are specialised for their function. All of these cell types originally came from stem cells. Stem cells are unspecialised cells - they can develop into any type of cell. All multicellular organisms have some form of stem cells e.g. humans in early embryos and bone marrow. By utilising the nature of stem cells they can be used for all kinds of regenerative therapy. This is done by inducing metabolic reactions usually with electricity to make the stem cell adapt and differentiate into a specific type of cell.

In this context of MD we want a cell to replace the damaged retina. The retina which receives light and converts this into information is made up of photoreceptor cells. At the Riken Centre for Developmental Biology, in Kobe, Japan, a way has been found to create human photoreceptor cells and RPE cells from human embryonic stem cells. There are several risks with this as the cell is artificially differentiated and pose side effects. Currently the research teams are working on purifying the cell to reduce risk of a tumour forming. The team is currently using stem cells found in other bodies which pose a risk or rejection. To avoid the body rejecting the cell the patient will need to take immune suppressants which will weaken the immune system of the patient putting them at higher risk of infectious diseases. This is being worked on and hopefully led to the application of pluripotent stem cells. These cells would be made from the same person, eliminating the need for immuno-suppressive drugs as well as any religious objections.

What the future holds for stem cell research is still unknown. Stem cells offer an array of potential with their nature and ability to differentiate to all cell types. It is hoped that retinal pigment epithelial cell (cells needed to nourish the photoreceptor cells) transplantation clinical trials will begin within 3 years. For photo receptor cells it will take a much longer time, hopefully within 10 years.