



JFS Scholars' Journal 2019



Editor's Introduction

The JFS Scholars' journal brings you a fantastic array of work from our student scholars. This year the journal includes many articles on the topics of astronomy and technology. How fitting for the marking of 50 years since man landed on the moon! The scholars were keen to research how the use of technology can improve our future; to discover more about the nature of the universe and its relevance for human civilisation. This volume includes two articles from Year 10 which will be submitted as part of the Higher Project Qualification this autumn. We hope you enjoy our publication.

Miss Sassoon, July 2019

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Is there life out there in the universe?

Jessica Enoch 8ZC

Our universe is full of obscurities and fascinating galaxies and planets which are yet to be discovered; we have only discovered a tiny percent of our universe! For example, in the future, Mars could be an alternative planet to live on besides earth. Mars has an atmosphere, water, land and the right amount of gravity. Some scientists think that Mars used to be a civilised planet like ours millions of years ago but disappeared because its atmosphere wasn't strong enough and everything dried up (which explains why Mars is so dry and rocky).

The question, "is there life anywhere else in the universe" specifically interests me because I think it is astonishing to really see if there is life other than our own, to see how they cope with life and how they live! Some people think that it's impossible for other life to exist out there but that is impossible because we haven't even looked that far into the universe yet! There are exo-planets (planets which could handle life) out there, but we cannot get there because they are unfortunately too far away, and we don't know enough about them yet! There is a massive amount of universe yet to be explored as well and seeing we haven't gone in all the billions of galaxies, and seen all the other millions of planets, there must be life! However, what do you think, does life other than us really exist out there?

Aliens may not physically be what you expect. You might think that they are green creatures with big black eyes. WRONG! Aliens are living organisms, some so small they are undetectable to the eye, or

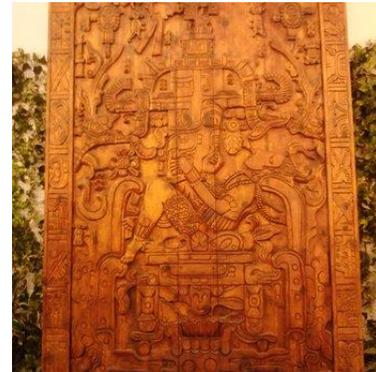
beings like us, just from a different planet. For all we know, there could be extra-terrestrial life (aliens) out there looking for other life other than theirs, like what we are doing, looking for them. What's weird are UFO's (Unidentified Flying Objects). These are flying objects in the sky which don't look normal and are reported to be suspicious by many people. Area 51, Nevada, is a UFO hot spot and a top-secret military base. Strange occurrences are said to have happened here such as alien operations and experiments. All activities going on at Area 51 are obviously extremely secretive, and so discrete that only certain people can access the area. It is also constantly patrolled by military officers and the US army. Whatever is going on in there must be too extreme for anyone else to find out about. Scientists working on the project to find life forms are determined to find evidence. NASA asked some scientists what they think about life other than ours existing out there: "I think that in 20 years we will have found one candidate that might be it," says del Genio. Rushby, on the other hand, says, "It's been 20 years away for the last 50 years. I do think it's on the scale of decades. If I were a betting man, which I'm not, I'd go for Europa or Enceladus."

Exoplanets are planets like earth which could handle us humans in the future / handle life. Unfortunately, we cannot go to them because they are from 2 - 100's light years away (a really long time!) The closest exoplanet found is Proxima Centauri B, which was confirmed in 2016 to orbit Proxima Centauri, the closest star to our Solar System (4.25 light years away) In order for a planet to be dubbed an exoplanet it must tick certain requirements needed for a planet which could be habitable one day. The planet should be in a stable habitable zone. This is a shell shaped region of

space surrounding a star in which a planet could maintain liquid water on its surface. Furthermore, seeing this exoplanet has only been recently discovered, we don't know if there is life on it. However, since it is surrounding a star, in the habitable zone; has water (meaning the temperature is the right amount) and an atmosphere, it could possibly support life. In November 2013, astronomers reported, based on Kepler space mission data, that there could be as many as 40 billion Earth-sized planets orbiting in the habitable zones of Sun-like stars and red dwarfs in the Milky Way, 11 billion of which may be orbiting Sun-like stars (SOURCE: WIKIPEDIA). This means that there could be life, but don't give your hopes up yet, scientists are trying to gather data about those planets, are still looking into them to see if they are the right conditions for us to live on / visit and whether they contain life.

Aliens have possibly attempted to send signals to earth. For example, the Wow! signal was a strange radio signal received on August 15th, 1977 by the Ohio State University's Big Ear radio telescope. The signal appeared to have come from the direction of the constellation Sagittarius. Astronomer Jerry R. Ehman discovered the anomaly a few days after the occurrence while viewing the record data from the telescope. He was so impressed by the result that he circled the reading on the printout and wrote the comment, Wow! The signal lasted for a total of 72 seconds, but has not been detected since, despite the numerous attempts of trying to pick up more signals. To this day, the Wow! signal remains the "strongest candidate for an alien radio transmission ever detected". Machines all around the world are functioning, trying to detect another sound like this, but nothing has been picked up yet. Perhaps the signal was just an interference with the

radio or maybe the signal was sent out because the sender was in distress and only sent it once.



There are other more historic indications. In certain caves, stones and Egyptian pyramids, there have been symbols carved onto it, which cannot be translated. Most of these signs go back as far as 100,000 years ago and consist of unearth-like beings and strange discs. There is a theory that the Mayans were abducted by aliens as carvings of mysterious objects were found in caves around the area where they had originated from and strange looking characters were engraved too, which could have been a warning sign before they disappeared.

In conclusion, it is still unknown whether there is life on other planets, despite amassed evidence of signals and carvings, together with signs such as water on other planets. Presently lots of research is conducted about Mars since it could be a habitable planet one day and there is water on it. However, it would probably be years until we find an answer since technology is advancing amazingly fast. For now, we can say the chances are, how long is a piece of string? I hope in the future life is found and the chances of that are over 50% and hopefully stays like that. Based on this information, I hope this essay persuades you to think about all the new ways how life could be out there. Overall, what do you think? Does life really exist out there?

Will we ever move to Mars?

Emily Spill 8ZM

We have sent space rovers to Mars so will we ever go to Mars and be spending our holidays there? Scientists are trying to find evidence of life and liquid. Could we ever move to Mars?

Mars is known as the red planet. It is the fourth planet away from the sun, one after the Earth. It's 142 million miles away from the Sun and takes 58 days for a spaceship to fly to Mars when it's close to Earth and takes 410 days for a spaceship to fly to Mars when it's furthest away from Earth. The surface is dusty, and it has volcanoes and canyons. Mars is made from crust, mantle and a core. An Earth day is 23 hours, 56 minutes and about 4 seconds however, a Martian day is 24 hours, 39 minutes and 35 seconds. There are 2 moons called Phobos and Deimos.

Mars is a long way from Earth even though it's closer than all other planets. Scientists must then have some reasons to investigate Mars over the other planets. One reason is that it's being researched as a 'back-up planet' is that there is historic evidence of liquid. As the climate cooled, liquid would have become unavailable and if there was life on Mars, it would have eventually died out. Scientists have also found methane which is a gas. This isn't the first time they have found it however 95% of methane of Earth comes from living organisms, that's why it's interesting to find this on Mars. Maybe there were living organisms and liquid on Mars. If there was evidence of liquid, maybe it could be recreated?

As well as distance there are some serious limitations when considering potential for life on

Mars: There is no food and water and the climate can get to about -73 degrees Celsius at midnight, which is similar temperature to Antarctica in winter. There is 95% carbon dioxide on Mars. There is very low air pressure so the air would be too thin to breathe. On Mars, low air pressure could make human eyes boil, make blood turn into froth and fill lungs with foam which would in turn cause internal drowning. The weather on Mars could be difficult for humans. Mars has a lot of dust storms and seasons are much more extreme. Mars has half the diameter of Earth which means it has less gravity. The gravity on Mars is 0.38 however on Earth it is 1. This means the gravity on Mars is about 1/3 of Earth. There is hardly any magnetic field in Mars so there can be harmful radiation from space. However, on Earth there is a magnetic field protecting humans from the radiation.



So, what would a day on Mars look like? A day on Mars would start with us waking up, if we eventually fell asleep because of the lack of air in the special houses or the itchiness of the spacesuits. After finally waking up we would usually go to the bathroom and go to the toilet and have a shower, however, that's going to be very hard if we're in a spacesuit. Later, we would have breakfast but there wouldn't be any shops or electricity. There also wouldn't be anywhere to get any food from as the ground is different to Earth's ground. Going to

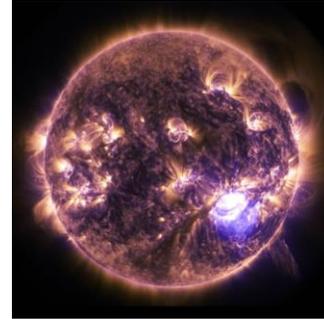
school would be another problem as it wouldn't be easy to write, especially if everything's floating around. The major dust storms and extreme seasons would mean we would miss a lot of days. There are a lot of canyons and it would be very dangerous to go to school by ourselves. It would be a very hard life if we moved to Mars. If we did have to use Mars because we could no longer live on Earth, there would not be room to get all humans on Mars. It's a backup planet for us but it would be very hard to live there and to get everyone on the planet.

We might raise the question of why scientists are not considering the Moon as this 'back up planet' After all it is much shorter in distance. The moon has no atmosphere. The solar radiation on the Moon is also fatal for humans. The surface temperature on the Moon has far more temperature extremes. It ranges between 130 degrees Celsius to minus 170 degrees Celsius. Relatively speaking Mars is more inhabitable than the Moon.



Although Mars and the Moon are very close, there is also another close planet to the left of Earth; Venus. Venus is Earth's twin sister as they are the same size and have similarities. However, Venus constantly has active volcanoes and the surface is so hot it could melt lead! We know from space missions that the surface of Venus has mountains, craters and thousands of volcanoes. There are also

some flat, smooth plains which would be the best place to set up homes. The planet is 465 degrees Celsius. It is so hot and there is so much carbon dioxide that it would be better to live on Mars or the Moon than Venus.



In conclusion, Mars wouldn't be the best planet to live on because of the freezing temperature, the extreme seasons and dust storms, the radiation from space and such low air pressure, which all means that we wouldn't be able to take off our spacesuits. Hopefully in the future, scientists can invent a way to deal with the spacesuit problem and if we really had to get off Earth, we would have somewhere to go.

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Day Zero: How can this be avoided?

Amy Shapiro 8ZO

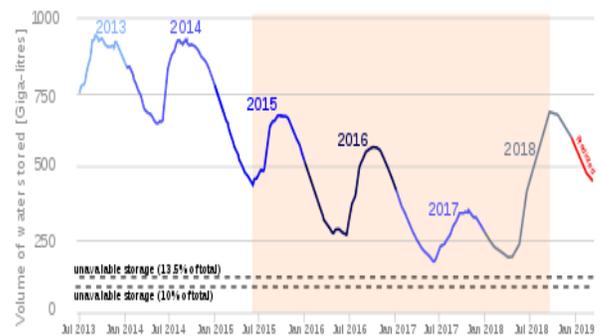
Many people will have heard about Cape Town's recent water crisis, and the impending Day Zero, but what really is it? Day Zero is the day when the taps in Cape Town, South Africa, will be switched off, and residents will have to collect their water from a communal collection point.

Water covers 71% of Earth's surface, so it's surprising that more than half the world's population endures water scarcity for at least one month each year. The reason for this is that 97% of that water is saltwater, which makes it unfit for drinking or use in agriculture. Of the 3% that is freshwater, over two thirds is frozen, and is therefore inaccessible to us. So less than 1% of Earth's water is available for all life, spread across the countries in lakes, reservoirs and rivers, and we are using it up faster than it can be replenished. 21 of the 37 major underground reservoirs are on track to be irreversibly emptied, and it has been predicted that by 2040, 20 more countries will be facing water shortages. So, what can we do to stop this?

Day Zero was originally scheduled in April 2018, but was pushed back multiple times, and although there is no date for Day Zero at the moment, it is still a looming threat to Capetonians. Citizens of Cape Town were under strict water restrictions, with only 50 litres each per day (the average American uses 375 litres), to try to meet the city's target of only 450 million litres a day. Citizens whose water consumption was above this amount faced serious fines. This meant that 1/4 of crops were abandoned and 10,000s of agricultural jobs were lost,

damaging South Africa's economy. There were many suggestions about ways to get more water, such as cloud seeding, and towing a hundred-million-tonne iceberg from Antarctica.

The main cause of the lack of water was the three-yearlong extreme drought in Cape Town, which is thought to be due to climate change disrupting the water cycle. This was exacerbated by a 50% population increase over the last decade. This is becoming an increasing problem worldwide as the overall world population is increasing rapidly as well.



Total water stored in Cape Town's six largest dams.

So how can water shortage be avoided? This is the question this article will answer. In the last few decades there have been increasing innovation of new technology to help extract and reuse more water.

Water desalination is the process of removing salt from seawater. Seawater has on average 35,000 parts salt per million parts water. The recommendation for drinking water is 1,000 parts per million, and the max is 5,000 parts. So, at least 30,000 parts must be removed to have safe drinking water. Desalination can be done in five different ways, but the most common are multi-stage flash (MSF) distillation and reverse osmosis.

MSF uses a method called distillation, which is found in nature, most commonly in the water cycle. Distillation is the process of purifying a liquid through evaporating and condensing. In multi-stage flash distillation, the seawater is heated until it evaporates into vapour, which separates the water particles from the salt particles. The steam is then collected and condensed into pure water. This process is then repeated numerous times so the maximum amount of water can be gained. This is a highly energy intensive solution.

A newer alternative, reverse osmosis, uses a semi-permeable membrane to desalinate seawater. The semi-permeable membrane lets small particles, such as water pass through it, but not larger particles, such as salts. In preparation, the seawater must first be filtered to remove any solid particles that could block the membrane. Multimedia filters (layers of granular materials such as anthracite, gravel and sand), cartridge filters (usually made from a synthetic yarn material) or ultra-filtration or micro filtration membranes can be used to do this. The water is then ready to be passed through the semi permeable membrane.

Normally, in the osmosis process, molecules pass through a semi permeable membrane from a less concentrated solution (such as freshwater) to a more concentrated solution (such as saltwater). However, in reverse osmosis, the pressure in the more concentrated solution (saltwater) is strong enough to overcome the naturally occurring osmosis, and the solution passes through the semi permeable membrane into the less concentrated solution (freshwater).

After the seawater has been filtered, high pressure pumps increase the pressure up to 1000 PSI (pounds per square inch). The semi permeable membranes are wound in a roll so that water can

travel between the sheets, and the water molecules can transfer through the membrane into the freshwater stream. These rolls are then enclosed end to end in a fibre glass shell. After the desired pressure in the seawater is reached, it is sent through these tubes and the water molecules are forced through the membranes into the freshwater stream, leaving a highly concentrated salt stream behind. The fresh water and saltwater are then collected separately, with the freshwater being sent for use, and the saltwater being released back into the ocean. This solution produces large volumes of wastewater and is not very efficient, but it is less energy intensive than MSF. Unfortunately, both systems of desalination require lots of machinery, so they aren't much help in a Day Zero situation. However, they are very effective, and there are already over 18,000 desalination plants worldwide.

A different solution is greywater (relatively clean wastewater) treatment. One way to treat this water is through a newer two stage process. The first stage is reverse osmosis, and the second stage advanced oxidation. Advanced oxidation is done by adding a small amount of hydrogen peroxide to the water and shining ultraviolet light at it. This splits the hydrogen peroxide into hydroxyl radicals, which are very potent forms of oxygen. This breaks down any chemicals that are still left in water after the reverse osmosis. This is also an energy intensive solution that requires machinery and therefore forward planning, just like the reverse osmosis desalination.

Another approach is to tackle wastage and conserve water. For countries with a lower budget, Michael Pritchard has invented a water bottle he named 'Lifesaver', that filters viruses and bacteria out of unclean water to make it sterile. The smallest bacteria are only 200 nanometres, and the smallest

virus, is around 25 nanometres. Lifesaver bottles have filters with pores of 15 nanometres, so nothing but water can get through. The Lifesaver bottles work for 6000 litres, and then shut down, so it can't be used. The cartridge can then be replaced, and the bottle reused for another 6000 litres. He has also invented a bigger version, in a jerry can, with the same technology. This will work for 25,000 litres of water, which is enough to drink for a family of four for three years.

A lot of water is lost every day through leaking pipes or taps. In 2017, in England and Wales, 3.1 billion litres were lost every day. A German company, Albstadtwerke, is using a piece of technology, named ZoneScan Alpha, which pinpoints leaks in the water pipes, so they can be fixed. In a test area of 60km, ZoneScan Alpha found 10 large leaks. The technology is now being used in an increasing number of cities and has dramatically dropped the amount of water wasted.

Water conservation at the local scale can positively impact agriculture. Mark Algra has invented the Aquatrap Project to help save water when growing plants. The Aquatraps are made by gluing the sidewall of a tyre to part of the inner tube (an inflatable tube inside a tyre). They are then buried in the ground, covered in soil, and seeds are planted on top. The Aquatraps hold water and the nutrients inside, which helps make faster growing, healthier and bigger plants. The results from Mark's test showed around a 50% water saving. The rubber also helps keep the soil warmer because it is an insulator, which is better for the crops. Lots of schools have adopted this method for their school gardens, and one school in Cape Town won 1st place in the interschool water wise competition for their garden made from Aquatraps.

The final option is the conservation and reuse of water, the solution that saved Cape Town. Capetonians lived off 50 litres per day, to try reach a city target of 450 million litres each day. They did this by taking short, 90 second showers, and reusing the shower water to flush the toilets. They also adopted the phrase "if it's yellow, let it mellow. If it's brown, flush it down," to make sure they weren't flushing toilets unnecessarily. In many places grass was replaced by astroturf, and rainwater was caught in buckets, bins and many swimming pools. This process can be very effective if done right, and does not need technology so it can be done on very short notice, but it has a big impact on citizens' everyday life.



Signs like this could be found in public bathrooms.

The best solution is clearly a mixture of these, to conserve and reuse water where possible, and treat greywater. The rest of the water needed can be made up from natural water sources and desalination plants. I believe that further government action is needed to avoid this dystopian sci-fi fantasy, becoming a reality.

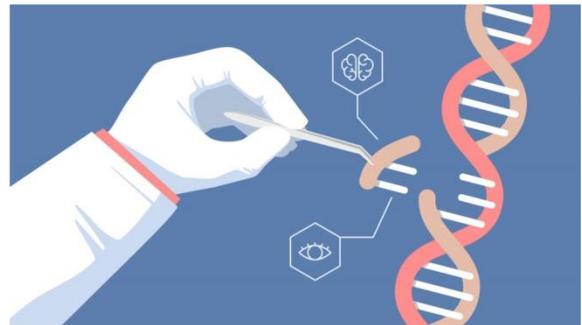
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The future of gene technology in medicine.

Maya Taitz 8AM

CRISPR is a revolutionary gene editing tool discovered by Francisco Mojica in 2005. Editing genes isn't a new idea, but the CRISPR method is much more effective and precise in comparison to traditional approaches. CRISPR stands for Clustered Regularly-Interspaced Short Palindromic Repeats, which is a natural part of the genetic code found in bacteria and archaea, a microorganism very similar to bacteria. The CRISPR method has the ability to change the genetic material of almost any organism, by cutting strands of DNA (deoxyribonucleic acid).



Scientists first discovered CRISPR in a type of bacteria that could slice through the DNA of invading viruses for self-defence. When being attacked, this type of bacteria would cut the virus's DNA, rendering it harmless. Scientists have taken this natural phenomenon and developed it into a tool that can be used to edit DNA. CRISPR does two things in order to edit DNA: it searches for a specific DNA sequence, and once found, cuts it. CRISPR knows where to cut the DNA from a copy of the sequence it's looking for, called a 'Guide RNA'. The sequence guides the Cas9 enzyme contained in CRISPR to the correct location, which then acts like a pair of molecular scissors and cuts the DNA

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strand. Once the DNA is cut, it will be repaired by one of two methods:

- The two loose ends join together, resulting in the loss of some DNA material. This means that the gene's function will be damaged.
- If replacement DNA is available/provided, it can slot into the gap created by CRISPR and repair the cut. With this method, a piece of the original DNA is swapped for a new one, changing the function of the gene.

An example of CRISPR being used today to improve something is a fruit called the groundcherry. A groundcherry is a moderately new fruit to be introduced to supermarkets; it looks like a small, orange ball enclosed in a leaf. Groundcherries used to be an extremely rare fruit since the plant didn't produce many, the taste wasn't the best and the fruit would fall off the tree before it was ripe. Scientists have used CRISPR to edit the genes of this fruit to ensure that more of the fruit would be produced, it would taste better (a bit like pineapples) and that they ripened properly. Now, groundcherries are in supermarkets all over the world, proving that when used properly, CRISPR can bring many new experiences to us.

Still on the topic of food, CRISPR will help us greatly in the years to come. The United Nations say that food production will need to double by 2050 due to the growing population. Scientists could potentially use CRISPR to ensure that plants can grow under harsh conditions, as well as being more nutritious from less of the plant. We could actually be seeing the results of these experiments soon as CRISPR is extremely easy to work with. It is also very cost-efficient, meaning that more experiments can be carried out while saving money.

Despite all the good things CRISPR could do for us, the technology isn't quite perfect yet. Scientists are still looking for ways to improve the technology

even more. Recently, they narrowed down the possible locations that CRISPR could go from 20 to 5. This will ensure that there will be much less chance of error when finding the DNA strand's location. It has also been used on two humans before, and at the moment there are no side-effects.

Around a year ago, a Chinese scientist called He Jiankui edited the genes of human embryos to make them resistant to HIV using CRISPR. He cut out a gene called CCR5, which can cause HIV as well as cholera and smallpox. The embryos were implanted, and twins Lulu and Nana were born soon after. At the moment, they are developing as normal babies however scientists believe that their brains may have been enhanced. Apparently, removing the CCR5 gene caused their brains to make connections and form memories more easily and rapidly than normal. Some scientists believe that the HIV-resistance will also be transferred to their children.

People have been developing CRISPR so much that they have modified it to change the DNA, not cut it. This form of CRISPR is called base editing, and it is able to change an incorrect DNA letter to the correct one. It was made just two years ago and has already been used in an experiment with mice. "It's the difference between retyping a whole 5,000 word document and using Word's "find and replace" to correct a typo," said a doctor.

In the experiment, the doctor's goal was to prevent a liver disease. By changing a C to a T in the HPD gene, the disease was completely eradicated from the mice. There were no negative side-effects and it didn't edit any other organs. Additionally, the mice were healthier and lived longer than normal.

CRISPR has the potential to improve our lives greatly. Scientists are researching utilising CRISPR for crop modification for enhanced taste and more robust growth. CRISPR could potentially be used to even remove the allergens from peanuts. Genetic diseases could also be eradicated with CRISPR since the faulty gene causing the disease can be repaired. CRISPR could also ensure that certain genes are passed on from generation to generation. Of course, CRISPR is just the tip of the iceberg since there are so many more things, we can do with this technology in the years to come.

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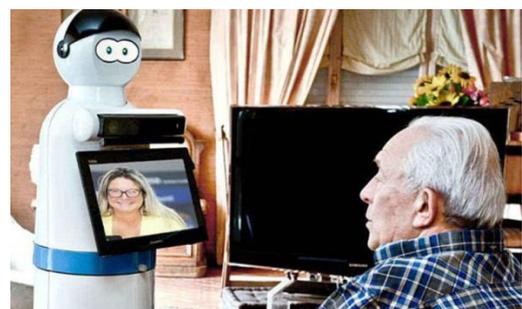
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How can non-medical technological advances help treat or cure illnesses?

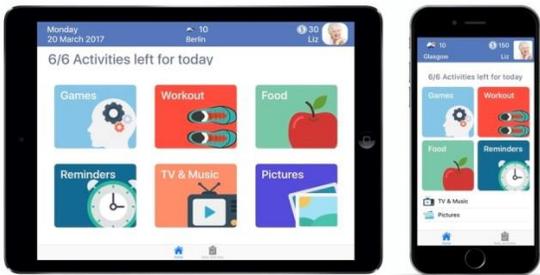
Sarah Trup 9AK

Throughout the ages, scientists and doctors have made significant progress in developing new medicines, procedures and cutting-edge medical equipment. However, alongside such advances, other exciting technologies are providing opportunities to help people manage or overcome illnesses. These include robots, apps and virtual reality kits. Already making massive and dramatic improvements to people's lives, this kind of machinery, often working hand in hand with medical treatments, can provide long-term relief for sufferers of certain illnesses, yet without the risk of side effects that certain procedures can bring. In many instances, it has the advantage being able to detect signs of illnesses years before current methods. Some believe it could replace human contact eventually, doubting its efficiency. However, others argue that it is safe, cheap and easy to use.



A key application of technology is the diagnosis of illness. As the population ages, diagnosing degenerative diseases is crucial. A study is currently being carried out to establish whether special sensors can record a person's gait and potentially

diagnose illnesses such as dementia perhaps a decade earlier than can be achieved through medical scans, such as MRI. This exciting research is being carried out at the Clinical Ageing Research Unit at Newcastle University. Although this study is in its early stages, it has analysed the gait of 125 people in the past two and a half years. As dementia is thought to be the biggest killer of our generation, we need to find ways of helping those affected, particularly as there is no cure in sight. This work is paving the way for larger studies aiming to diagnose dementia long before it was previously possible. Dementia affects motor functioning, explaining why one's gait is often affected by the condition. However, it often being less noticeable than other symptoms, not many studies have been carried out regarding it. This is why with the aid of technology, certain innovative and creative investigations that wouldn't have been previously possible can now be performed.



Another application is the use of artificial intelligence to treat mental illnesses. 'Mind Mate' is the app that four entrepreneurs have put together to help dementia sufferers, using memory aids, brain games and lists to help patients manage their conditions and daily lives easier. The app can also store key information about sufferers' lives which can then be accessed by medical professionals if they need to visit hospital.

Post-traumatic stress disorder and similar conditions can be treated using modern technology, such as virtual reality. This treatment is called 'Motion Assisted Multi-Modular Memory Desensitisation and Reconsolidation and aims to confront the trauma that has caused this condition. For example, military veterans can be taken back to the battlefield using virtual reality, using confrontation to help them face their fears. This is thought to be more effective than the few existing treatments, such as therapy to relive the difficult memories. 'Mario the dementia robot', working in a similar way to the app, 'Mind Mate', can keep patients' minds active and keep them company if someone else cannot be present constantly. Although it has been questioned whether it is an appropriate substitute for a carer.

China and the UK are investigating how they can use Artificial Intelligence (AI) when diagnosing Parkinson's disease. Rather than using sensors like Newcastle University, they are going to measure the severity of patient's symptoms with a camera that catches the way they move their hands. One of the main symptoms of Parkinson's is shaking, which usually begins in the hands, making every-day tasks a challenge. New advances in AI claim to potentially speed up a motor function test procedure from a tedious thirty-minute task to a matter of minutes, at the comfort of the patient's own home, using mobile phone technology, without the bother of them wearing sensors. Millions of people around the world live with Parkinson's and similar conditions. New technologies promise to make it easier to recognise, prescribe and treat the symptoms.

Clearly, technology is making a massive impact on patients' lives and the way they manage their

conditions, but it is important to acknowledge that it works hand in hand with traditional medicine and it is not an appropriate altogether replacement for it. Like anything, it has its advantages and disadvantages and does not work for everyone. In many cases, time and compassion are needed and that's where care and technology clash. In California, Ernest Quintana, a 78-year-old man, with chronic lung disease was told that he had just days to live....., by a robot. However, it illustrates how AI is not always suitable and should not be used in particular instances when human contact is more appropriate.

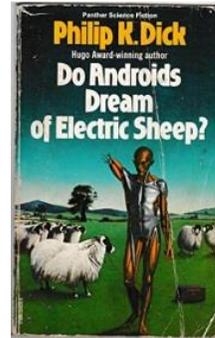
In summary, this technology has numerous benefits, but is still in its early stages of development. A machine will never be able to fully replace face to face conversations and the care and compassion that comes with but can help support long term sufferers of dementia and Parkinson's' in other ways.

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Do Androids Dream of Electric Sheep?

Daniel Spill 10AM



In 1968, Philip K Dick wrote a book called, "Do androids dream of electric sheep?" In this book, android characters (robots appearing human), display human attitudes, such as want, fear, and love. They also display a human-like consciousness.

Consciousness is defined as being a state of awareness, and responsiveness to surroundings, which the androids demonstrate, for example, when the final three androids to be killed, prepare for their hunter's arrival after the deaths of their three friends. They demonstrate their opinions freely without worry that they'll offend someone. Despite them showing off human like traits, could we, as humans, recognise them as an intelligent being, and consider them an extension of humanity?

Humans can consider androids an extension of humanity and recognise them as intelligent beings due to many reasons. One such reason is through AI fooling humans in the Turing test. The Turing test was developed in 1950 by Alan Turing and aims to see whether AI (Artificial Intelligence) can demonstrate behaviour equal or indistinguishable to a human. In order to carry out the test, there are two humans and one form of AI. All participants would be put in different rooms. A human participant would be told that they must guess which one of the other players is human based on responses. The conversation would be linked to a text only channel, so the AI and the other human player are on equal terms. If the participant guesses that the android player is human- that android

passes the test. The test is still used today to determine whether AI can gain true intelligence. If AI could fool a human about its true nature, then surely, we could consider AI as an intelligent being, for mimicking human emotions, and even possibly an extension of humanity if they are indistinguishable from ordinary humans.

Another example proving androids' human-like intelligence is that on the 31st July 2017, Facebook shut down two of their androids; Bob and Alice, as the robots were communicating in a new, unknown language to humans, instead of in standard English. This situation could convince humans to consider androids as intelligent beings, for creating their own language. As well as this, in October 2017, an android named Sophia was given a Saudi Arabian citizenship. This is the first time an android has been given citizenship by a country. Moreover, Sophia's AI program analyses conversations she has and extracts the data, which enables her to improve future responses to these conversations, further proving that she is an intelligent being due to her ability to adapt in different situations.



Through these examples it could be argued that humans are already considering androids as an extension of humanity. To add on, technology is advancing at such a rapid pace, that it is extremely likely that androids may be able to develop humanity in them, and when considering the current progress made now, on Sophia's citizenship and Bob and Alice's ability to develop a new language, these results are presumably going to happen soon.

On the other hand, there are reasons why humans can't consider androids as an extension of humanity and recognise them as intelligent beings. Firstly, it currently isn't possible for androids to make their own decisions due to their lack of but highly intensive programming. Whilst their current highly intensive programming allows for motor functions and speaking, they have a lack of programming deeming them unable to make their own decisions unless it is specifically programmed to make a set of decisions. As an example, although Sophia can



answer questions and make simple conversations on predefined topics, for example the weather, she is programmed to have a set range of answers, and therefore only really mimics her creator's beliefs.

Secondly, androids are unable to act with genuine empathy. Empathy is defined as the ability to understand and share the feelings of another by the Oxford dictionary. Androids can read emotions by identifying facial and verbal expressions, but androids do not have emotions of their own and therefore cannot share the feelings of another. In the case of Sophia, although she can display emotions such as anger and sadness, and read human emotions, she is unable to truly replicate these emotions. As androids are unable to truly care for others, they cannot be considered as an extension of humanity nor be recognised as an intelligent being.

Thirdly, as androids aren't human, they are unable to truly behave like a human. This is because they don't need to eat, drink, and sleep. Food would

damage the android, and they would not properly sleep even if they had a "sleep" mode, like computers. Due to this, androids will only be able to have lucid dreams if they were to sleep, as they would be unable dream, without knowing that they are dreaming. Due to this, androids would be unable to sleep without knowing they are sleeping, which isn't really sleeping!

Currently, robotics in universities has mainly concentrated on helping children with learning disabilities, such as severe autism, by developing animal and humanoid robots, for example Kaspar; a humanoid robot who was developed by the University of Hertfordshire. Kaspar has been developed to act as a social companion to improve the lives of children with autism and other communication difficulties. It is able to use a range of simplified facial and body expressions; respond autonomously to touch (due to sensors on its cheeks, arms, body, hands, and feet); and engage in several interactive play scenarios, which helps children learn fundamental social skills such as imitation and turn taking. There are many positive effects, some of which include these children becoming more confident, which could help them stay calm and socialise more. Humans can consider these robots intelligent beings and an extension of humanity but would need to have the ability to display complex facial and body expressions.

There are also commercial robotics which are sold as children's toys. These are advertised to adapt to each person and have their own personality, which leads to the possibility of robotic companions for humans. However, these commercial robots are limited in their AI, as they can only learn what has been programmed into them. This is unlike AI programs, such as Alexa, Siri, and Cortana to name a few, are consistently learning by having access to

the internet and their user's data. As they are virtual assistants they don't have a physical manifestation, so cannot be robots or androids. Commercial robots can't be considered an extension of humanity but could be recognised as intelligent beings due to their physical appearance and nature.



Robotic companions could also be used to tackle loneliness which is a key issue in the 21st Century. An example of a currently existing companion robot is the Kirobo Mini developed by Toyota, which has been designed to resemble a baby in order to make lonely people happier and provide companionship, especially for those in Japan, where they will have access to the robot and the birth rates are drastically dropping. This is because the robot will also act like a baby by wobbling, giving it a sense of vulnerability that Toyota hopes will "invoke an emotional connection". On account of the companionship they provide they could be considered intelligent beings and possibly an extension of humanity.

Although these robots could be beneficial to our lives, the press is constantly attacking robotics, with some claiming that robots will steal human wages. However, the press was also like this when the Great Western railway was proposed and provided the same reasons against building the railway as they did with progressing robotics. Despite this, there is a much darker side to robotics with ideas from famed scientists, such as Stephen Hawking, claiming that if AI were to break free from their

programming by exceeding human intelligence, humans would be threatened by androids. This would lead to humans being replaced by androids, as humans would not be able to evolve as fast as the AI found in androids.

To summarise, it is apparent that androids could be considered as an extension of humanity if both sides could show empathy towards one another and put aside their differences. By doing this, we could prevent major AI catastrophes that great scientists, such as Stephen Hawking, have predicted for humanity, as well as improving the economy by employing them. If the androids went through enough programming, they would be able to dream of electric sheep.

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Should Video Games be banned?



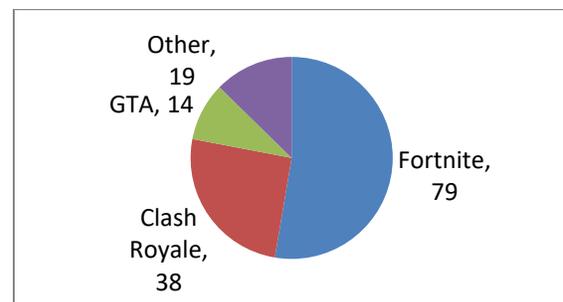
Liad Levy
9BF

Asking a sample set of fellow pupils at my school who play video games if they should be banned; the response was overwhelmingly low at 25%. Ask any parent how they feel about video gaming and you'll almost certainly hear concerns about all the hours spent in a virtual world and the possibility of antisocial or even violent behaviour. But are these concerns valid? Since 1958, video games have been a part of our lives. The games industry has evolved into one of the most lucrative markets in the world. Revenues reached a new peak of \$43.8 billion in 2018, up eighteen percent from the previous years and surpassing the projected total global box office for the film industry. Although the creation of video games has demonstrated tremendous technological advance, there have also been many downsides.

Firstly, scientists claim that video games make a person hungrier and are therefore more likely to become obese. Forty-five percent of America's teenagers spend more than two hours a day on average glued to a screen while 1 in 7 of them is overweight. Secondly, when playing video games, gamers will stay focused and ignore the outside world long periods of time, resulting in eye strains and pains along with other symptoms which are collectively called Computer Vision Syndrome. Thirdly, most gamers when playing remain seated in the same position for hours on end. This lack of movement causes stiffness and soreness in the back which can result in major back problems. Lastly, migraines (a recurring throbbing headache, which

usually start in one place in the head and eventually spread around the head), can cause vomiting. Video gamers are more vulnerable to this due to the intense concentration required whilst gaming, as well as the strain in the eyes by staring constantly at a screen.

My own primary fieldwork suggests that there might be a need to ban violent video games. I conducted a study surveying 150 students at my school. The results showed that 130 of 150 students preferred a violent game. These included worldwide sensations such as *Fortnite*, *Clash Royale* and *Grand Theft Auto (GTA)*. The banning of violent video games could possibly reduce aggressive behaviour.



Whilst playing a violent game the player's endorphin dopamine, a chemical which makes a person happy, is released when it's not meant to. This may possibly lead to being addicted to video games as the dopamine is misleading your brain. Furthermore a study by Brad Bushman at Ohio State University found that violent games decrease the player's empathy in real life situations as well as having desensitised emotions. This shows that negativity in the games and bad role models can shape perceptions and behaviour in people.

On the positive side, video games nowadays may not be viewed as purely bad, merely a piece of code that aides the body! In fact, many advantages come with video games such as co-ordination skills, improving attention and concentration, social skills

being enhanced and increasing your ability to multitask. Other benefits include connecting players in remote locations and allowing them to socialise online whilst playing. When a person plays a video game, they are not just staring at the screen, but also consistently move a controller which improves hand-eye co-ordination. Video games have been proven to be able to have the player's attention for the entire game. This improves the player's ability to concentrate generally on or off the screen. When gaming online, you are able to communicate with other players which may develop into a more meaningful relationship between people. This helps players meet and make new friends whilst strengthening their long relationship with an old friend. When playing an action game, for example, it is necessary to be very observant and attentive. This will require the gamer to move the controller whilst looking at the screen. This usually improves observation skills in life.

In conclusion I believe that ultimately, video games don't offer players anything apart from trouble. Even though the video gaming industry generates large amounts of revenues worldwide and provides jobs to people, I still think that the negative aspects of playing may outweigh the positive ones. As it has been proven that video games have the same likelihood of addiction as drugs, smoking and alcohol, it would make sense to me if the government should place interventions such as illegalising certain games, or placing health hazard statements regarding the misuse of the games similar to smoking and alcohol.

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What is feminism?

Asher Jayson 10AK

Feminism is defined as *"The advocacy of women's rights on the ground of the equality of the sexes."*¹ Therefore we must investigate whether women's rights are equal to men's? In this essay I will be discussing the definitions of feminism together with the notion of egalitarianism; the history of women's rights; the laws behind equality of the sexes to lead to a fuller discussion of whether it is relevant today.



Wider definitions include the term 'equality' rather than just 'equal rights'; *"the theory political of economic and social equality of the sexes."*² Does equality mean equality of opportunity or equality of outcome? If we use equality of opportunity then, feminism isn't relevant as every citizen in the UK has equal opportunity over 18. But some argue that due to people's beliefs women tend to leave work to care for children reducing their opportunity in the work place. Others argue that equality is about equality of outcome for instance Fortune 500 reports that only 24 out of 500 CEOs are female^{2a}. However, there might be genuine reasons why there is gender variation according to workforce. Such as in construction, which is predominately male. Populating employment roles with women just to create an equal outcome could be seen as sexist. Therefore the stronger of the two definitions is that of equality of opportunity.

An alternative name for the modern-day feminist could be 'egalitarian' which is "*the doctrine that all people are equal and deserve equal right and opportunities*,"³ this is a doctrine that could support the fight for equality men and women alike.

Types of feminism can be categorised in waves. The first wave took place in the late 19th C. and early 20th C. Its main objective was universal suffrage. The second wave primarily took place from the 1960s-90s; its primary aim was equal pay and equal chance over custody of children and it being illegal to discriminate on the basis of sex. The third and final (sometimes merged with the "fourth",) wave started in the mid-1990s and is more complicated to define. One component of it is the idea of social justice for all. It is about minorities in general as well as women.⁴ This component of third wave feminism seems to sit outside the definition of feminism.

The impact of these waves of feminism can be seen in British law. In 1970, a law was passed in the UK that made it illegal to pay more, give better work conditions or treat one sex better⁵. In addition to this in 1975, there was "an Act to render unlawful certain kinds of discrimination".⁷ These acts mean that there is complete political equality with the UK as they make laws towards men and women the same and they are treated the same in the eyes of the law. However, some may argue that this is irrelevant as society doesn't keep to these laws. Later in 2010, the equality act was passed which prohibits discrimination within the workplace.⁶ It simplifies and combines the sex discrimination, race relations and disability discrimination acts to make it easier for complaints to be acted upon. As of 2017 there is a record 208 female MPs in British parliament; however, this still falls short of 50% which means that women are underrepresented in making laws.⁸ How can there be political equality if there isn't equality in making the law that we all MUST follow? Moreover, many say that

there are barriers towards equality in parliament, including abuse, discouragement and discrimination as, "Women in politics face an extraordinary amount of abuse, especially on social media, partly because they speak up but also simply because they are women. This discourages women from participating in political debate".⁹ Many state that, "the centenary of women's votes could be a missed opportunity," for there to be equal representation within government. Also, some say that there are internal biases against voting for women. However, earlier it was determined that feminism is based on the equality of opportunity and there are no political laws against opportunity, especially in parliament. Thus, it must be argued that although there are no legal battles towards gender equality, there may be social barriers within law-making.

In conclusion, feminism is many different ideologies and it is represented by the different waves. Whilst feminism used to be about equality of opportunity and specifically women, modern day feminism: the 3rd/4th wave is an ideology that as a whole fights for equality of outcome and social justice for all rightly or wrongly.

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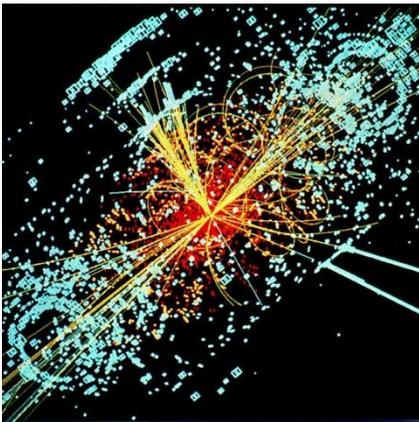
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End of the Universe?

Isaac Castle 9ZO

The end of the universe is a sad yet inevitable prospect. This mysterious event has led countless scientists to hypothesize on possibilities, and this article will explain the 4 most accepted theories. These are: The Heat Death, Vacuum Decay, The Big Crunch, and finally the Big Rip. These theories each have sufficient reasoning behind it, but lack of solid evidence allows you to weigh up the likeliness, and decide for yourself how you think the universe will come to an end.

The theory of Vacuum Decay explains the dangers of the unsecure Higgs Boson. As the Higgs Boson (responsible for mass physics) is metastable according to current observations (Mack, 2015), enough energy (a giant supernova for example) could change its properties in the location where the energy is released. Almost like changing the laws of physics themselves. It would be almost impossible that the new set of physics would support human life. The fact that it travels at the speed of light means that it is impossible to detect if it will ever come. For all we know, it could be coming now.



This theory is possibly compatible with the Big Bang. When the Higgs Boson changes the laws of physics, a new universe is created. We could be a universe expanding inside another universe because of vacuum decay, allowing for a cycle. This, unlike the Heat

Death, can provide a reason for the Big Bang. This theory is plausible, however the amount of energy needed to be concentrated in one spot, combined with the fact that the Universe is constantly expanding at the speed of light, meaning it might never reach us, means that this theory is not the most likely to ever happen in terms of probability. Furthermore, if the mass of the Higgs Boson does change, there is a 50% chance of it becoming stable rather than unstable.

The Big Crunch Theory is the opposite of the Big Bang and the expansion of the Universe. If the universe ever collapses under its own gravitational pull from a lack of dark energy, it is possible that the Universe could start contracting. This would result in everything being repeated backwards, until it finally contracts back into a singularity (smallest amount of mass possible) (Gribbin, 1990). This amount of concentrated energy would result in another Big Bang, creating a cycle of expanding and contracting universes. As one dies, another is born from the singularity. This is of course compatible with the Big Bang theory, as this theory was created more to explain the beginning of the Universe and not the end. This theory would require for a significant drop of dark energy in the universe; however there is no known reason for dark energy to decrease. Because of this, the Big Crunch is not one of the most likely possibilities, but if this were to be found true, it would make sense of how the Universe will end as well as simultaneously explaining its origins.

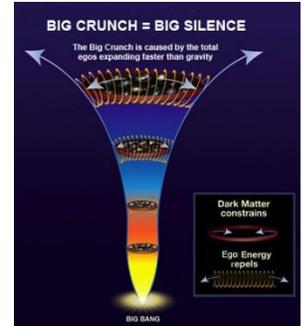
The Heat Death is the result of the dispersion of heat around the universe. Scientists do not know much about dark matter, except that it is the energy/substance responsible for the expansion of the universe. As dark matter does this, galaxies drift further apart. This means heat will naturally disperse equally around the universe. Because energy cannot be created or destroyed, stars will eventually lack the kinetic energy to produce heat. As the universe

expands further, more heat is being spread more thinly, leaving the Universe cold, unsustainable for life and micro-organisms, and subsequently empty (Hlozek,2013). This theory is called the Heat Death, which needs no proof, because if the Universe keeps expanding as it is now without any change, then this is the natural outcome. This is already happening slowly. This doesn't necessarily mean the end of the Universe, but there will just be completely empty space. This theory as opposed to some others does not explain the origins of the Big Bang. This factor is important as all the energy in the universe today came from the big bang, but there must have been something before that to create the energy and to give a reason for the explosion (if we look at it from a secular point of view).

The Big Rip unlike the Big Crunch, explains what will happen if dark energy keeps rising. Because dark energy has not been seen to decrease for any reason, we know that it must be rising because the universe would remain stable if it stayed the same. The universe will continue to expand, and eventually, this increase in dark energy will overpower the electromagnetic pull between objects and start ripping apart galaxies (NASA 2019). This will also go on to rip the Earth away from our solar system, and eventually also rip apart all matter into individual protons and neutrons. Composite particles will become elementary particles, leaving the Universe as a wasteland of subatomic particles, each one billions of miles away from each other.

This theory does not have any relevance with the Big Bang; it will leave the universe in a similar state to what the Heat Death might do. This is much more likely than the Big Crunch, as dark energy is already always increasing. One might ask that if the Heat Death and the Big Rip have the same requirements, which one will take place? The Heat Death is more of a knock on effect of the Big Rip, however the Heat

Death is still classified as an end to the universe because it will happen first, and even though it won't end the universe, it will eliminate all life with its lack of heat. The Big Rip would just be the final stage of this process.



If an external event happens, causing Vacuum Decay or the Big Crunch, the Universe will come to a close but a new one will be born out of it. For Vacuum Decay, the supernova mentioned earlier would have to be unthinkable massive, and given the chance that the Higg's Boson could become stable instead makes this unlikely. For the Big Crunch, despite the theory's solidarity (explains the universe's beginnings as well), its need for a decrease in dark energy makes this unlikely too. The reason why these theories are considered is because they both give an explanation to what made the Big Bang. If the Universe continues unaffected by external factors, the Heat Death and the Big Rip will happen. This will result in no "end" of the Universe; it would just be a barren wasteland, devoid of life. Although we do not know for certain, this will be the most likely end to the universe.

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