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HIGH WYCOMBE

SCHOLA REGIA GRAMMATICA

RGSHW Academic Journal

Inaugural Digital Edition

Welcome to the inaugural edition of the RGSHW Academic Journal.

My intention for this Academic Journal was to provide my peers with the opportunity to showcase their academic talents, beyond the subject specifications, in a collation of their interesting ideas and insights: this, and more, has been achieved.

Only a few weeks ago, Year 12 students were invited to write an article on a topic they found interesting. Since then, twenty-five articles have been written, all of an exceptional standard, covering a wide breadth of thirteen different subjects within the four main academic areas. From these, ten articles were selected for the printed version of the Journal, using the four core principles: originality, insight, depth, and coherence of argument.

However, due to the high level of all of the articles, such that they all embody these principles, all twenty-five have been published here, in the digital version of the RGSHW Academic Journal.

As well as sending out thanks to the Year 12 students who wrote articles for the Journal, a special thanks must go to Mr Eve, who generously spent a weekend proof-reading all of the articles, and to Mr Noyes, who has helped throughout the process.

Looking towards the future, it would be great to provide students in the Senior and Junior school with the opportunity to write articles for the Journal, such that their ideas and interests can be displayed alongside their Sixth Form peers.

I hope you enjoy,
Robert Bowker.

Contents

Disclaimer: all of the opinions expressed are those of the individual writers and are not representative of the views of RGS High Wycombe

STEM (science, technology, engineering, mathematics)

Humanities and Social Sciences

Arts and Sports

Languages

The Complex and Often Overlooked Relationship between Philosophy and Biology.

By Toyan Aydin

On the 29th August 2000, Adam Nash was birthed by Caesarean section to an apparently perfectly normal American family. In reality, the Nash family were fighting a very private internal battle, and one where the odds where strongly pitted against them too. Adam's sister Molly, who is six years senior to her brother, was born with Fanconi anaemia, an extremely rare genetic bone marrow failure disease that is only curable with a bone marrow transplant. This disease affects around 1 in every 130,000 births and in 2000 the average life expectancy for people born with the condition was 30 years.

Molly was diagnosed with Fanconi anaemia when she was six years old and the Nash family were informed that due to her blood type the hospital was unsuccessful in finding a donor, and that one was unlikely to be found in the near future. In a final attempt at securing a future for their daughter, the Nash family took a decision that would prove controversial and provoke discussion in biology and philosophy classes alike. They decided to conceive another child, this time using preimplantation genetic diagnosis alongside *in vitro* fertilisation, so that the baby's umbilical cord stem cells could be transplanted into his sister and she could be saved from the disease, while being free of it himself.

Preimplantation genetic diagnosis involves the fertilisation and screening of the genomes of multiple embryos before much foetal development in order to essentially find an embryo with desirable characteristics. In order to create multiple embryos for genetic testing, the ovaries have to be artificially stimulated using hormones to produce several eggs at the same time. Because a significant number of a couple's embryos are likely to be affected by a genetic or chromosomal abnormality, a large number of embryos need to be created for the best chances of success. The eggs are retrieved and fertilised with sperm by a relatively standard procedure of *in vitro* fertilisation. Eggs that are successfully fertilised are grown in a laboratory for 5-6 days into a blastocyst of around 100-150 cells. At this stage trophectoderm biopsy (the cells which will form the placenta) takes place. The cells are tested to see if the embryo from which they were removed contains the abnormality that causes the genetic condition, and only those embryos that do not have the specific genetic condition that was tested for will be transplanted into the woman's uterus. Usually one embryo will be transferred to the uterus at any one time to avoid the possibility of multiple births (more than one baby in a pregnancy).

Any suitable remaining unaffected embryos will be frozen for later use, and those embryos that are affected by the inherited condition are allowed to perish or couples are asked if they would consider allowing these embryos to be donated for research and training.

For all its expense and inconvenience, preimplantation genetic diagnosis does not escape the moral objections that many have to abortion. It is true that no foetus has to be destroyed, and the tested embryos are not harmed. Yet, embryos are created that the couple never intend to use, and chances are that no one will "adopt" the un-implanted embryos that carry the unwanted mutation. Hence, those who think that human life, from fertilisation forward, shares the moral status of living persons view PGD and abortion in the same light: as practices that disregard (or at least devalue) the sanctity of life. Some argue that the halting of the development of certain human genomes makes a mockery of a true parent-child relationship, as they see a dystopian future in which parents select their children based on what physical characteristics they desire from their child, jeopardising the moral connection to making the most of what 'nature' bestowed upon them. Possible future implications putting family relations at risk are also considered; an argument upon which the film 'My Sister's Keeper' starring Cameron Diaz was based. The film focuses on a 'saviour sister' conceived as a genetic match as an organ donor for her older sister suffering from acute promyelocytic leukaemia. Feeling worthless as a person due to being forced by her parents to donate multiple organs to her sister, she sues the family for medical emancipation and the rights to her own body. From this point of view, it is also obvious why a dark and morbid future in which children are birthed only to have their organs harvested is seen by some. Furthermore, spokespersons and advocates of disabled people's rights have pointed out that the idea of selecting embryos without serious genetic mutations conveys the message that people with disabilities are less highly valued than those without.

The majority of bioethicists, however, while acknowledging that claims of prejudicial devaluing has merit, contend that the possible psychological harm done to persons such as those with disabilities does not justify restricting the

reproductive freedom of couples who wish to reduce their risk of having a child with a disability, or who want to simply extract cells from the umbilical cord of a new child in order to save their dying son or daughter. In response to the argument of 'saviour siblings' being labelled as or themselves feeling 'worthless', whether these 'saviour siblings' are children for families that already wanted another child or not, one thing is for certain: the real morally incorrect thing to do here would be discriminating against genetically-selected children, as they too are humans that are a part of society just the same as a disabled person is, or anyone else is. In the case of someone who was birthed not because the family wanted another child but because they had to have one to save their ill child, the situation is no different to an unplanned pregnancy that is not terminated— if the upbringing of a child is within a family environment of love, the circumstances of conception should not matter.

Adam Nash was dubbed "Little Frankenstein" by the New York Post when he was born in 2000 because he was conceived specifically to save his sister, Molly. Today, back home in Colorado, Adam has a driver's license and helps disabled children ski. His sister — once weeks from death due Fanconi anaemia — is debating whether to focus on oceanography or graphic design in college.

What is intermittent fasting and what are the benefits of it?

By Ahmed Al-ani

Intermittent fasting is a phenomenon that is taking over the world. Currently it is one of the most popular health and fitness trends for weight loss, but it has many other benefits. Intermittent fasting is an eating cycle alternating between eating and fasting, or you can call it a diet focused on when you eat rather than which foods you eat.

There are a handful of different methods of intermittent fasting, where every single one splits the day into eating and fasting periods. Practically everyone 'fasts' everyday while they sleep. Intermittent fasting can be done simply by extending the period a bit longer. This can be achieved by missing out breakfast and eating your first meal around noon and having your last meal at 8pm. If you do this, you are basically fasting for 16 hours a day. This would also include an 8-hour eating allotment. This method is the most popular of all the other methods. This is called the 16/8 method.

Although many people believe that fasting is difficult, intermittent fasting is actually less demanding. Even though no food is allowed during the fasting period, water, coffee, tea and other non-caloric beverages are perfectly fine to consume. There are some methods that do allow small amounts of food during the fasting period.
Intermittent fasting is regarded as a relatively new fasting technique; however, humans have been doing it for thousands of years. From time to time it was done due to necessity, when there simply wasn't any food available. Occasionally people following religions including Islam, Christianity and Buddhism practice fasting-like methods and have been doing so for a very long time - not to mention animals and humans that fast when unwell. Clearly, there is nothing abnormal about fasting and our bodies are prepared to handle periods of time without nutrition.

A multitude of different processes in the body occur during periods of famine. A variety of hormones, genes and important cellular repair processes have to allow our bodies to maintain themselves during these times.

When fasting, our bodies reduce blood sugar and insulin levels, and there is a drastic increase in levels of human growth hormone. Many people do intermittent fasting in order to lose weight, as it is a very simple and effective way to restrict calories and burn fat.

Lowering insulin levels helps weight loss. The body does this by breaking down carbohydrates back into glucose, and this can be used as energy for the cells or converted into fat and are stored for later use. Insulin is a hormone that allows cells to take in glucose.

Insulin levels drop when a person is not consuming food. During a period of fasting, it is possible that decreasing insulin levels causes cells to release their glucose stores as energy. Repeating this process regularly, as with intermittent fasting, may lead to weight loss, not to mention that the actual act of fasting is a reduction of calorie consumption.

Some research also suggests intermittent fasting can help protect against diseases, including heart disease, type 2 diabetes, cancer, Alzheimer's disease and others. Type 2 diabetes is increasing at an alarming rate. Its main feature is high blood sugar levels in context to insulin resistance. Anything that could reduce insulin resistance can help lower blood sugar levels and therefore protect against diabetes type 2.

As mentioned before, intermittent fasting has been shown to have major benefits for insulin resistance and lead to an impressive reduction in blood sugar levels. In human studies on intermittent fasting, fasting blood sugar has been reduced by 3-6% compared to non-fasting blood sugar, while fasting insulin has been reduced by 20-31%. While researching this topic I came across a study on diabetic rats that showed that intermittent fasting protected against kidney damage, one of the most severe complications of diabetes. What this is implying is that intermittent fasting may be highly protective for people who are at risk of developing type 2 diabetes; however, for those already diagnosed with type 2 diabetes it could result in a very dangerous situation.

Intermittent fasting also promotes better health by fighting inflammation and reduces oxidative stress. Oxidative stress takes part in ageing and many chronic diseases. It involves unstable molecules (free radicals) reacting with important molecules such as DNA and damaging them. Intermittent fasting is a method to reduce the speed of ageing. This technique has been practiced by Buddhist monks for many reasons, including the benefit of looking younger.

Additionally, many other studies on intermittent fasting show that intermittent fasting can help fight inflammation, another factor of all sorts of common diseases. While acute inflammation is a normal immune process used to help fight off infections, chronic inflammation can have serious consequences for your health. There are many experiments that show that inflammation may be involved in the development of chronic conditions, such as heart disease, cancer and ulcerative colitis. Many people, including myself, have begun intermittent fasting and similar methods as they can help decrease levels of inflammation and help promote better health for individuals suffering from chronic illnesses. As a sufferer of ulcerative colitis (inflammation in the small intestines), I honestly believe that fasting has helped me personally with my levels of inflammation and made me feel healthier, which has improved my overall health.

The bottom line is that intermittent fasting is a practice that has been associated with a wide multitude of potential health benefits, including weight loss, as well as improved blood sugar control, heart health and brain function. From water fasting to intermittent fasting and calorie restriction, there are many different types of fasting that fit nearly every lifestyle. When united with a nutritious diet and healthy lifestyle, incorporating fasting into your routine could benefit your health.

Interpreting potential benefits of studying Tardigrades.

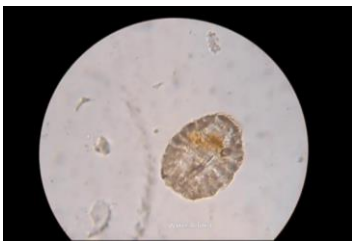
By Cheong Bosco

Tardigrades, also known as 'water bears' by German zoologist Johann August Ephraim Goeze, are eight-legged micro-animals that were first discovered in 1773. Most of its species feed on the fluids from plants and microscopic invertebrates. Due to the near unparalleled resilience intrinsic to their bodies, Tardigrades can theoretically be found anywhere on Earth, ranging from Volcanos to the depths of the ocean. Depending on the specie, a Tardigrade's length can vary between 0.05mm to 1.5mm, with most measuring to less than 0.5mm, but all tardigrades are born with a full number of cells and do not undergo cell division, instead growing in size along with the cells. Tardigrades that have been discovered are all currently ranked under three main classes: Eutardigrades, Heterotardigrades and Mesotardigrades. The main difference between Eutardigrades and Heterotardigrades is the reproductive system, and scientists are unsure of the existence of Mesotardigrades, as there was only one specimen that described the class which was lost in an earthquake.

These Invertebrates are known to survive in the toughest of harsh conditions: in the ice of the Antarctic, in mud volcanos, sand dunes and the deep sea. They can also be found in the most common environments: in soil, moss and beaches, a seemingly limitless number of habitats that they can live in. In 2007, a rocket containing live tardigrades was sent by a European researching team into outer space and orbited the Earth with the tardigrades exposed to the cosmic radiation and deoxygenated environment of space for ten days. The researchers found out that after the ten days, the majority (68%) of tardigrades survived this duration in the vacuum.

Tardigrades have also been found to be capable of withstanding pressure six times greater than that at the bottom the Mariana trench (about 1000 times the standard atmospheric pressure), being frozen in liquid helium at 272 degrees Celsius for 8 hours, and even being exposed to radiation 1000 times stronger than a dose of radiation that can instantly prove lethal to human beings or most other living organisms for a relatively long time. In any of these extreme conditions, once the tardigrades are rehydrated and in an oxidized environment, they 'rejuvenate'.

This is achieved by their ability to enter what is called tun state, which is primarily for anhydrobiosis, meaning "life without water". When this occurs, tardigrades can remove up to all but 3% of their body water, shrinking to one third of their original size and drastically decreasing their rate of metabolism, essentially becoming very inactive. It is also thought that in a tun, special molecules are synthesized to replace the body water lost and prevents molecules such as DNA that are sensitive to the intracellular level of water from unfolding or becoming unstable. There are also processes tardigrades undergo to survive depending on the condition. Some examples are: at low temperatures (cryobiosis), cryoprotectants are released to alter the way that water crystallizes within cells to reduce damage done; at low levels of oxygen, the body swells and becomes turgid to float above liquid and reach for oxygen.



Current studies of the tardigrade genome show a protein named Dsup, short for "damage suppressor" which acts as a shield for DNA against radiation and a three additional copies of DNA repair genes compared to an average animal cell. When Dsup was incorporated with human cells, it reduced the damage from X-ray to human DNA by about 40%. In the future, it is believed that the protein can be transplanted into live humans or implemented into a spacesuit, where exploration further into space can be done with minimal effects from cosmic background and solar radiation.

The understanding of key components that enables tardigrades to have such resilience in multiple extreme environments should be increasingly significant. This is because the entirety of the human population is entering a stage of earth where close to irreversible damage has been done to the natural environment, where aside from the necessity to explore different methods to mitigate the effects of human activities on the environment itself and potentially reversing existing major impacts, there should also be vigorous attempts to conserve current endangered species in new ways.

Active researching on tardigrades may uncover biological compounds that can be transferred or artificially synthesized and address the many problems that organisms face with the increasingly threatening climate change. For example, the Dsup in tardigrades will most likely become an important piece of information to allow the DNA of organisms to be

protected against mutation or DNA damage from radiation sources present. More significantly, if the molecules matrix released during anhydrobiosis is better understood, it can be artificially created and inserted into various organisms to protect intracellular components that are highly sensitive to temperature, pH level and water level so even the most fragile ecosystems can be maintained.

Furthermore, the research may open countless possibilities including understanding and developing “Cryosleep” technology that prevents humans ageing, improvements to quality of space food and canned food, genetically-engineered meat that can tolerate higher temperatures without changing in taste or creating a thin layer from biological molecules that complements daily wear or protection suits for any organisms from radiating heat to withstanding pressure in the ocean depths.

However, scientists should be aware that the act of interfering with natural selection by artificially engineering and selecting genes should always have unexpected risks, which usually concern mutations and the reduction of genetic diversity, leading to the lack of naturally-evolved characteristics in organisms that may also bring along unprecedented consequences and prove catastrophic to nature and humans.

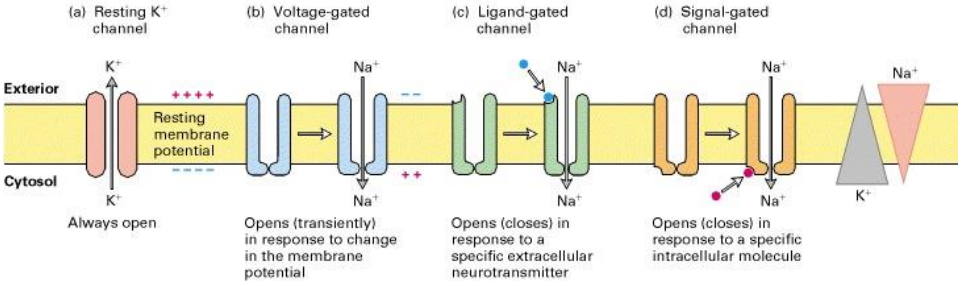
There are still many species of tardigrades that scientists believe have yet to be found, and many uncertainties that surround how they have evolved to cope with desiccation and other extreme conditions to such an extent when they appear to be simple organisms. By learning the processes involved, humans can imitate the secrets behind their survival and apply them to those in need for prospering in the rapidly changing world.

Chemistry of Neurones.

By Duncan Huntley

Neurones are one of the most important features in the human body. Neurones make conscious thought possible and are responsible for sensations such as pain, warmth and humidity. Furthermore, neurones make movement possible and help us to feel our surroundings. So how do neurones create such varied and incredible phenomenon?

Neurones are composed of three major parts: the axon, the dendrites and cell body (soma). Neurones work by induction of an action potential creating an electrochemical pulse. So how is this action potential created and then transmitted? In the plasma membrane of all cells, there is a small negative membrane potential (typically between -30mV and -70mV in animal cells).[1] However, unlike other animal cells, neurones can control their membrane potential by the opening and closing of ion-specific protein channels in the plasma membrane. There are 4 typical channels necessary for the propagation of an action potential:



A) Resting K^+ channels remain open at resting potential and close during propagation of an electric impulse. They are responsible for generating the resting potential of the membrane, called repolarisation and hyperpolarisation, in which there is a net flow of K^+ ions out of the cell following the induction of an electric impulse. This allows the membrane potential to return to its resting potential.

B) Voltage-gated channels allow for sodium ions to cross the phospholipid bilayer. Once opened, the channels stay open about 1 ms, during which time about 6000 Na+ ions pass through them. These positively charged sodium ions change the membrane potential, as it becomes positive. This is called depolarisation and subsequently causes adjacent sections of the axonal membrane to depolarise. This slight depolarisation initiates further opening of voltage-gated channels, maintaining the action potential. This means the signal is transmitted down the axon. After depolarisation occurs, the voltage-gated channels close and the membrane potential sharply decreases due to K^+ ions. The time between the closing of the channels and the next depolarisation of the same area is called the refractory period and prevents too many action potentials being induced per second and also ensures the unidirectionality of the electrical pulse down the axon.

C) Ligand-gated channels are essentially the same as voltage-gated channels, however, depolarisation due to the influx of sodium ions is initiated by an extracellular neurotransmitter binding to the channel protein and allowing for the necessary shape conformation. These channels are typically found at the dendrites allowing for the action potential to be transmitted across the synapses.

D) Signal-gated channels are again similar to voltage-gated channels, yet open in response to specific intracellular molecules.

The combination of these channels creates an action potential which travels unidirectionally down the axon. The sequence of events in which this happens is as follows:

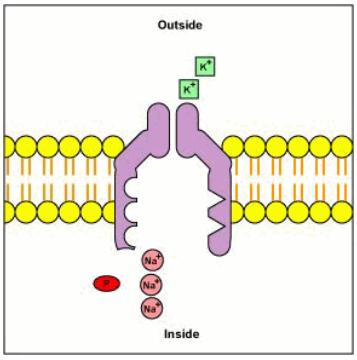
1. A stimulus induces a small depolarisation of the dendrites in the neurone.
2. This creates a very small action potential which opens the voltage-gated Na^+ channels, as they conform to the shape of the ions. This increases the membrane permeability of Na^+ ions.
3. This quickly increases the membrane potential, reaching typically a max potential of 35mV. This is called depolarisation.
4. Once the membrane potential reaches its max the channels close, due to a channel inactivating segment blocking the channel. This is due to the changing position of the positively charged a-helices within the protein. As a result of this, P_{Na+} decreases.

[1] https://www.ncbi.nlm.nih.gov/books/NBK21668/

5. When the Na^+ channels close, extra K^+ channels open, so P_{K+} increases. Therefore, K^+ ions leave the cell and quickly decrease the membrane potential.
6. The membrane potential briefly dips below the resting potential in a process named hyperpolarisation.
7. The membrane potential returns to its resting potential in a process called repolarisation. The neurone is now ready to be used again.

This occurs at each segment of the membrane as the depolarisation is spread by adjacent segments and their associated ions, meaning the action potential is maintained and travels unidirectionally. Another important factor of the transmission of an electrical impulse, as briefly mentioned before, is the refractory period of the Na^+ voltage-gated channels. When the channel is closed, it cannot reopen until the membrane potential returns to a negative number. This means that there is a suitable length of time between transmissions of action potentials so that the direction of travel is not disrupted by a difference in charge, and also prevents the impulse from being continuous; Continuous impulses can cause paralysis and seizures.[2]

The resting membrane potential of nerve cells, and other animal cells, is maintained by the Sodium-potassium pump. It simultaneously pumps 3 Na^+ ions into the cell and 2 K^+ ions out of the cell. This process, as for all of the processes mentioned above, relies on energy produced by the hydrolysis of ATP, using ATPase. However, in the sodium-potassium pump, the phosphate ion is also then used for conforming the shape of the protein to the Na^+ ion and K^+ ion to allow for the transport of these ions across the membrane. [3]



Lastly, between neurones, there are gaps called synapses. These can be both electrical and chemical; however, we will focus on chemical synapses. The following series of events occurs at the synapse:

1) An action potential reaches the terminal of the pre-synaptic synapse.
2) This opens a voltage-gated Ca^{2+} channel, and due to the steep concentration gradient, Ca^{2+} ions rapidly enter the cell.
3) The increase in the concentration of Ca^{2+} ions in the cytoplasm allows the neurotransmitter molecules to fuse with the plasma membrane, releasing the neurotransmitters into the synaptic cleft.
4) These molecules diffuse across the cleft and bind to receptors on the post-synaptic neurone.
5) This causes Ligand-gated channels to open creating an action potential, so the electrical pulse is continued.[4]
6) The neurotransmitters are then broken down by extracellular enzymes to close the gate and prevent paralysis. In the venom of the green mamba, an inhibitor of acetylcholinesterase prevents the breakdown of acetylcholine, a neurotransmitter, and causes paralysis.[5]

There are other factors that should be considered in the process of nerve conduction. For instance, Cl^- ions have a profound effect on the creation of action potential. Most animal cells contain an abundance of Cl^- ion channels and neurones are no exception. High concentrations of Cl^- ions within the cytosol increase membrane excitability and has been suggested as one of the leading theories for the causes of epilepsy.[6]

Another interesting part of nerve conduction is the use of Schwann cells to form a myelin sheath. Schwann cells produce myelin which gives the myelin sheath its insulative properties, whilst also being one of the primary areas involved in nerve cell regeneration.[7] The insulation provided by the myelin sheath increases the velocity of signal transmission and provides protection from damage. However, it also prevents the propagation of an action potential, therefore, in myelinated neurones, there is a small area called the node of Ranvier, which is unmyelinated and is where all propagation of action potentials occurs.[8]

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2 https://www.christopherreeve.org/living-with-paralysis/health/causes-of-paralysis/als
3 http://www.biologymad.com/NervousSystem/nerveimpulses.htm
4 https://www.ncbi.nlm.nih.gov/books/NBK11009/
5 https://www.sciencedirect.com/topics/pharmacology-toxicology-and-pharmaceutical-science/eastern-green-mamba
6 https://www.mpg.de/623143/pressRelease201004203
7 https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/myelin
8 https://www.ncbi.nlm.nih.gov/books/NBK21668/

So, Teeth Whiteners ruin your Enamel?

By Luke Schofield

It is no secret nowadays that the influence of social media has prompted people to become more self-critical and insecure about their appearance. But now, at the global peak of cosmetic surgeries, more people are being drawn into undergoing treatments- and this comes with its negatives, as the increasing market is leading to more off-book cosmetic brands and shops providing cheaper alternatives to the masses. This article is aimed at making you more aware of this problem, specifically in the area of cosmetic dentistry, so you or anyone you know is less likely to be affected.

More and more people are seeking aesthetic treatment. The teeth-whitening market has risen by 29% since 2016, now totalling $3.5 billion worldwide, showing that cosmetic dental work is rapidly turning from an expensive luxury into an everyday essential. A huge 45 million Americans (Mintel)- 14% of the population have had professional teeth whitening, compared to only 3% in the UK. Dr James Nickman, president of the American Academy of Paediatric Dentistry said the concern arose from teenagers growing up to find their new permanent teeth were not as naturally white as their predeceasing 'baby' teeth. The increasing influence of social media has also led people to prioritise their dental aesthetics, with the general public craving that 'pearly white' that is so commonly seen in celebrity magazines, or on TV.

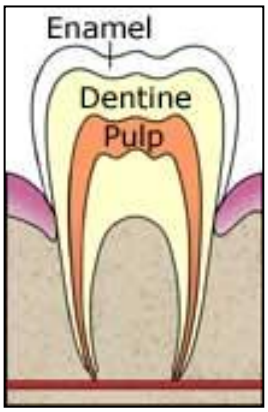
In America, whitening kits, strips, or lights are all viewed as cosmetic products rather than drugs, and therefore can avoid testing by the FDA before going on sale. These products can simply be bought over the counter. Whereas in the UK, the laws are very different. Only a licensed dentist can provide whitening treatment with between 0.1% and 6% Hydrogen Peroxide, the most commonly used bleaching and oxidising agent, due to fears that the gels can lead to increased enamel thinning or even burn the gums. In American clinics, the most common concentration of Hydrogen Peroxide is 20% to 40%, an enormous increase. Supermarket whitening kits can range from 3.5% to 15%.

In late 2016 a trend emerged online where the use of 'activated charcoal' as an active ingredient in toothpastes was shown to whiten teeth. It is a form of carbon processed to have small, low-volume pores that increase the surface area for absorption or for surfaces in chemical reactions. The pores make the charcoal absorbent, allowing it to trap substances which may harm or discolour your teeth. You might find activated charcoal for teeth whitening in several forms. In some cases, it is sold as a powder that you apply to the teeth with a damp toothbrush. Certain types of toothpaste also contain it. When applied to the teeth, activated charcoal supposedly traps and lifts away stains for a whitening effect. In fact, further research by Colgate has shown that the charcoal's abrasiveness is its key to cleaning the teeth. Since the enamel layer may be eroded largely over time, this will not only make them more texture or temperature sensitive, possibly leading to poorer brushing out of discomfort, but also will reduce the teeth's whiteness, as the worn enamel will expose the more yellow dentin layer underneath, from which most of the tooth is composed.

Another major risk in using these products was that they did not contain as many Fluoride ions. In some cases, charcoal teeth whitening may increase the risk of tooth decay as people tend to use it instead of brushing their teeth or flossing. Crest's charcoal toothpaste contained bentonite clay as an absorbent, which was later banned after the USDA found it to contain lead. This further proves that more and more people are jeopardising their oral health to get better-looking teeth.

Many people hear about the dangers of various teeth-whitening methods and then try veneers instead. Veneers are very thin, white, nail-shaped layers of composite or porcelain material that are semi-permanently attached on the teeth, typically for a week. Whilst they aim to protect the teeth from erosion and acids, whilst maintaining a healthy colour and hygiene, the reality is that in many cases incorrect fitting or cleaning of the veneers means that plague builds up behind them if they are not removed, if they are not regularly cleaned or replaced. This eventually leads to an even greater risk

of caries on the anterior side of the teeth. This damage can spread to the gingiva (gums), or more likely into the inner dentin which could lead to the tooth dying, in the most severe cases.



Enamel is a very hard, porous combination of minerals and salts, the majority being Calcium Phosphate. H_2O_2 applied to the tooth easily and quickly diffuses through the enamel to reach the dentin. Most studies into enamel and dentin in the lab show bleaching systems are safe however, a few studies focusing on the effect on surface structure of the teeth and their chemistry have shown degradation of the tooth's surface associated with the whitening process, like shallow depressions and increased porosity, certainly resulting in the tooth being less resistant to changes in its environment, be it temperature or pH. It indirectly causes decalcification of the enamel, in the same way that plague bacteria's lactic acid does. Studies have also shown that high concentrations of H_2O_2 cause minor inflammation of the upper layers of the pulp, where it meets the dentin, and swelling of the gingiva. Peroxide whitening is not a good choice if:

- You have recently had a plastic-based composite to restore damage in your teeth.
- If you have had high-resin cement added to your teeth as part of your orthodontic treatment, as peroxide could make it slightly soluble.
- Dental amalgams may react with the product of teeth whitening in the dentin after it's oxidation, which could cause localised spotting and colour changes under the surface of the tooth. For example, Silver Amalgam may in some cases leach Ag+ ions, which contribute to tooth decay, darkening the tooth.

Dental whitening strips contain carbamide peroxide as their active ingredient. It dissociates into H_2O_2 at roughly a 30% rate, meaning the dentin is not exposed to as much of it. The problem arose when a lower concentration of peroxide was found to be more damaging to the collagen-rich apical dentin section, in the intertubular section (as collagen is not found in the peritubular dentin), resulting in it becoming fragmented in that layer, and the collagen-mass of the tooth diminishing. A positive aspect is that this research has provided a base for what could be a new protein-suppressant drug. Despite these widely publicised risks, about 40.5 million people used teeth whitening products in America in 2018. A common situation is when the mouthguard containing the bleaching gel does not fit properly and some of it leaks causing painful burns to the mouth, lips, gums and tongue.

If you would still like whitening, tell your GDC-certified dentist beforehand, as they will offer you the correct advice on how may impact your teeth specifically. Most cases don't suggest that it is a harmful process, but this is only if it is supervised by a professional and you are given the right amount. You may even be able to get treatment on the NHS, if you have had a failed root canal operation or a nerve death, darkening your tooth. If you are a smoker and use a smoker's toothpaste, whitening is usually not a healthy choice, as your enamel is already at a high risk or thinning. Just remember that cleaning will always be more important than appearance, but if having better-looking teeth helps to motivate you into flossing and brushing regularly, then take care in your approach.

Chemistry and Venom.

By Ali-Abbas Nabi 12BW

Currently, one in every six deaths in the world are due to cancer, making it the second largest cause of death on the planet. In 2017 alone, it is estimated that roughly 9.6 million people died due to various forms of cancer. Furthermore, current statistics suggest that in the next few years, as many as one in every two people will be diagnosed with some form of cancer during their lifetime. This figure is undoubtedly shocking and therefore has led to a recent surge in the research and development of new drugs and treatments for cancer. Some of these treatments have been found in the most unlikely of places, one being in the sting of one of the most poisonous scorpions in the world, which left me intrigued into finding out the chemistry behind the treatment, why it works and how it can be used.

Leiurus quinquestriatus, better known as the Deathstalker scorpion, is a species of scorpion found in North Africa and spread across the Middle East. The deathstalker scorpion is considered to be one of the most dangerous species of scorpions in the world, its venom being a deadly mixture of neurotoxins with a low lethal dose. Whilst the sting of this species is extremely painful, its dose is not enough to kill a healthy adult; however, it is much more dangerous for the young, elderly or infirm. Any bite or sting runs the risk of anaphylaxis, a serious allergic reaction which can cause swelling of the throat and lungs, shortness of breath, vomiting, low blood pressure and even death. However, the venom injected by the scorpion also has other properties. A component of the venom, the peptide chlorotoxin, shows the potential to treat human brain tumours. Furthermore, recent research has shown that it may also be used in aiding the regulation of insulin, which could help treat diabetes.

Ion transport across the cell membrane plays a crucial role in the functioning of tumour cells. These ions are transported via specific ion channels – for example, potassium or sodium or chloride channels – and enable the tumour cells to carry out particular processes, such as cell cycle progression and cell volume regulation. All these functions are critical for tumour cell survival.

In 2015, the first clinical trials using the chlorotoxin were carried out. A fluorescent molecule was attached to the brain tumour. This acted as a marker and helped to highlight cancerous cells to the surgeons in real time during the operation. This proved to be vital in brain surgery as not only did it allow cancerous cells to be identified and removed but also allowed healthy cells, playing key roles in the functioning of the brain, to be identified and retained. Clusters of cancerous cells as small as 200 in number could be identified by the chlorotoxin in contrast with the standard MRI scan with a lower limit of 500,000, thereby earning itself the name ‘tumour paint’.

There are numerous different compounds within the deathstalker’s venom which can be adapted for cancer therapy. The extent to which these numerous compounds can interact with the ion channels depends entirely on the properties of the individual peptides. Chlorotoxin is a small 36-amino acid peptide. Initially, it was used as a tool in pharmacology to aid in the identification of chloride channels. However, when studying glioma-specific chloride currents, it was discovered that in addition to these properties, the chlorotoxin possesses the ability to be attracted towards cancer cells including melanoma (cancerous cells in the skin), glioma (cancerous cells in the brain and spinal cord) and neuroblastoma (cancerous cells in nerve tissue) to name a few. In this project, however, I will be focusing on gliomas.

Gliomas are a rarely curable invasive brain tumour which arise from healthy glial cells – the cells that surround neurons, providing support and insulation. Gliomas account for 80% of malignant brain tumours. Cancerous cells spread rapidly across areas of the brain and spine as a result of a cancer in another area of the body. Traditional treatments include surgical excision, radiotherapy or chemotherapy; however, in recent years these forms of treatment are proving to be less and less effective, having limited effects on gliomas. Targeted cancer therapy has become a promising approach for the future of cancer treatment; however, the identification of tumour-specific regions remains difficult.

Chlorotoxin, or CTX, has a compact structure which is upheld by four disulphide bridges, connecting the eight cysteine groups present in the sequence. The amino acid chains adopt a specific arrangement pattern of the cysteine groups, in the form C_1-C_4. C_2-C_6, C_3-C_7 and finally C_5-C_8. This forms a structure whereby three small antiparallel Beta pleated sheets are arranged

closely to an Alpha helix. Due to its compact structure, CTX can pass through the BBB (the blood-brain barrier), a highly selective semipermeable border which separates the circulating blood from the brain and the extracellular fluid in the CNS (the central nervous system). This means that the CTX has unique properties as it can deeply diffuse into the tumour whist other targeting agents that the body produces, such as antibodies, cannot.

The first step in glioma treatment is for a majority of the tumour mass to be surgically removed. This is crucial as glioma cells have a great tendency to quickly spread and invade healthy brain tissue. However, removing the entirety of the tumour is extremely difficult. Cancerous cells surrounding the tumour often remain and therefore this allows the formation of a new tumour mass, provoking the relapse of the patient. This is where the venom of the Leiurus quinquestriatus, more specifically the chemical properties of the CTX, proves to be invaluable. The small neurotoxin peptide selectively binds to the glioma cells.

There are numerous chemical modifications which the chlorotoxin can undergo, giving it different chemical properties and abilities. For example, one variation of the CTX covalently binds to a fluorescent indicator, which allows surgeons to directly visualise cancer cells in real time during the tumour removal surgery. While CTX has the ability to specifically bind to glioma cells and any other related tumour cells, it does not have the ability to be detected if a marker is absent, hence the need for the fluorescent indicator. Furthermore, this indicator, known as Cy5.5, proves to be even more useful and effective as not only does it produce an image of any cancerous cells remaining in real time, but also emits photons in the near infra-red-spectrum (IR). These photons are poorly absorbed by water and haemoglobin, which means this method can be used for intraoperative imaging, providing a real time image during the operation. In addition to this, tests have been carried out which show that after two weeks of exposure to the CTX-Cy5.5 compound in mice, there were no apparent signs of toxicity as the compound is removed via the urine.
This indicates that the binding of CTX on its cell surface receptor has no toxic or unwanted physiological consequences.

To conclude, although in its early stages the use of scorpion venom when approaching the treatment of brain cancer is proving to be much more effective and efficient than any other treatment currently available. Usage of the venom is now evolving to maximise its long-term effects on the patient and eradicate any chance that they develop the same type of cancer again in the future. Currently, the combination of surgical procedures, with the venom aiding the removal of the tumour, is in its early stages for cancer therapy; however, it can be expected that with further research and trials this treatment will become much more widely used in the future.

Bibliography

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4417956/ - US National Library of Medicine
https://www.frontiersin.org/articles/10.3389/fphar.2019.00250/full -Frontiers in Pharmacology
https://www.sciencedirect.com/topics/neuroscience/chlorotoxin - Science Direct
https://www.spandidos-publications.com/10.3892/ol.2014.2835# - Spandidos Publications
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6162746/ -US National Library of Medicine

Why did the Millennium Bridge Wobble?

By Toko Avaliani

The Millennium Bridge was opened in June 2000 but closed two days later. The bridge was meant to be the flagship for British engineering sciences going into the 21st century but had an essential design flaw.

The Millennium Bridge is essentially a suspension bridge, much like Tower bridge in London and the Golden Gate in San Francisco. However, the Millennium Bridge intended to be different, because the designer wanted pedestrians to have an unrestricted view of the Thames.

The problem arose from the natural lateral force that humans exert when they walk. Although most of the force that humans exert whilst walking is vertical, a small component of force is also lateral. Therefore, the initiation of wobble on the Millennium Bridge was caused by the natural walking movement of humans. However, the initial oscillation of the bridge was not large. Engineers have estimated it to be possible 10mm. It was the bridge's resonance which caused the bridge to oscillate with increased amplitude.

Objects which are disturbed and able to vibrate freely do so at a specific rate. This is known as natural/resonant frequency. The phenomenon causing the Millennium Bridge to vibrate with such a large amplitude is called resonance. Objects vibrate with the greatest amplitude when they are subjected to vibrations at a similar frequency to their natural/resonant frequency. Therefore, a relatively weak vibration in one object can cause a strong vibration in another.

Resonance was observed on the Millennium Bridge. The force of the pedestrians caused the bridge to vibrate at a natural/resonant frequency.

A phenomenon called "Synchronous lateral excitation" began. The vibrations of the bridge made it more comfortable for pedestrians to walk in synchronisation/in-phase with vibrations. This increases the total lateral force of the pedestrians on the bridge and caused an increase in the amplitude of vibrations in the bridge. Therefore, this reinforced the resonant vibration of the bridge. This is a result of crowd dynamics and acts as a "positive feedback" to the initial vibration of the bridge.

It was later discovered that there was a critical number of pedestrians that could set the bridge into initial vibration. On the Millennium Bridge this critical value was just 160 pedestrians. After these critical 160 people set the bridge into vibration, then resonance and the positive feedback of synchronous lateral excitation would send the bridge into vibration with greater amplitude.

Engineers closed the bridge in order to find a solution to the issue. There were two options. Either increase the tension in the cables to increase the natural frequency of the bridge. Or fit the bridge with dampers to limit the bridge's response to external forces.

There were two main dampers used on the Millennium Bridge. Viscous dampers and Tuned mass dampers. Dampening refers to the process of controlling unwanted motion.

In Viscous dampers, the magnitude of vibrations is reduced by dissipating kinetic energy as heat energy through hydraulic fluid. The upper mount of the dampers connects to the sprung weight (i.e. the bridge), the upper mount also connects to a piston which sits in a tube of hydraulic fluid. Thus, when a force is exerted on the bridge, the energy of the bridge is transferred to the shock absorber through the piston rod and into the piston. This energy is dissipated through the hydraulic fluid in the damper and reduces the vibration of the bridge.

In a Tuned Mass Damper there is a mass, a spring and a damping device (Viscous damper) to dispel the energy caused by the mass itself. The Objective of a TMD is to act as a "Counteragent" and absorb the kinetic energy developed from the force of pedestrians. When the structure begins to sway, the mass within the Tuned Mass Damper is set into motion. The mass counteracts the force causing the structure to vibrate and means that the structure will stabilise faster. A Tuned Mass Damper is optimised by operating at a frequency that is very similar to the natural/resonant frequency of the structure.

These dampening systems helped to reduce the amplitude of vibrations on the Millennium Bridge by dissipating the energy which pedestrian traffic transferred to the bridge.

What went wrong with the Boeing 737 MAX 8?

By Varun Patel

As one of Boeing's newest airliners, the Boeing 737 Max 8 first flew commercially in 2017. It was a huge success with airlines as it has the capacity of a short haul plane but with the range of long-haul airlines. This allows airlines to fly more niche routes such as Norwegian Airline's route from Edinburgh to New York. However, within the space of 5 months, 2 fatal 737 crashes resulted in the deaths of 346 people. Consequently, the aircraft were grounded in March of 2019.

Lion Air flight 610 took off on October 21st, 2018. Soon after, the abnormalities began to emerge. There were critical faults in the sensors and controls. The plane could not maintain a stable altitude and erratically dropped. The aircraft's computer system had forced the plane's nose down and the pilots were playing a tug of war. The aircraft seesawed up and down more than 24 times before plunging down 5,000ft at 450mph into the Java Sea. All of the 189 passengers on board were killed.

The second crash was Ethiopian Airlines' Flight 302. On March 10th, 2019, the second Boeing 737 Max 8 came crashing down in an avoidable accident. The plane began moving uncontrollably shortly after take-off. The plane's computer sends it into a dive and immediately, the pilots recognise that the situation is similar to that of the Lion Air flight. However, a series of human mistakes led to the plane diving to the ground at nearly 700mph. All 157 people aboard were killed instantly.

These events had a chilling similarity and their resemblance was no coincidence. The Boeing 737 has been around since 1968 and is the highest selling commercial jetliner in history. The newest variants of the plane formed the 737 MAX series which had the goal of efficiency in mind. The 14% increase in fuel efficiency comes partly from the larger engines. However, to accommodate the engines with sufficient ground clearance, they were pushed upwards and forwards relative to the wing. This new position of the wing caused the extra lift to be caused and therefore deemed the aircraft non-compliant with the US Federal Aviation Regulations This is where the Manoeuvring Characteristics Augmentation System (MCAS) was introduced. Without the MCAS, once the nose is raised above 14 degrees, the nose will keep rising until the aircraft stalls. Unfortunately, designers missed a crucial point in which a single point of error such as erroneous data from sensors will cause the pilots to lose all control over their plane.

The major faults in the case of the Lion Air and Ethiopian crashes were the readings from the Angle of Attack sensors. The sensors detected a high angle of attack which caused the computers to think that the plane was stalling. A stall is when the lift coefficient is reduced, and the plane begins to fall. When recovering from a stall, the nose is pointed down to recover laminar flow over the wings. With the 737 MAX being more prone to stalling, the MCAS was designed to aid pilots by automatically carrying out a stall recovery procedure.

This issue raises many questions, both philosophical and technological. Although autopilot is used in every commercial flight, to what extent should it be allowed to control the plane? Currently, the autopilot controls the plane during cruise and sometimes landing; however, the main purpose is for navigation. Personally, I believe that the limit was reached when auto-land was introduced and therefore allowing features such as the MCAS to control the plane during an emergency scenario have crossed the line. They render the pilots' skills and training useless and clearly pose a threat when pilots struggle to override the computers.

On the other hand, there are technological issues raised such as the failure to detect the potential risks and hazards of the MCAS system. The new system clearly had flaws and it had never been introduced in a plane before. Furthermore, there was not sufficient pilot training for the new 737 max 8, as it was deemed to be similar enough to the previous variants of the 737. Therefore, 737 pilots were not well informed on the new MCAS system and did not have sufficient knowledge to override the computer.

Clearly, the aviation industry has a lot to learn from the fatal crashes of the Boeing 737 Max planes and many changes have to be made before the planes can resume normal operations. It is rare that 2 similar plane crashes occur in a short space of time and these events will definitely make commercial aviation safer than ever. With the information gathered from these accidents, new safety features can be introduced and hopefully the Boeing 737 Max returns to the skies soon.

The argument for encryption.

By Man Hong Chan

Cryptography is the science of secret-keeping. Used for thousands of years, it is no surprise that it has followed us to the modern-day. Technology is ubiquitous, and so is encryption. Although you might not realise it, practically everybody has benefitted from it: If you've ever created a password for a website, it is likely that your password is hashed, and you have benefitted from encryption. The same is true for social media: messaging services like WhatsApp use encryption. Encryption allows your personal data to remain private, by obfuscating data. This means that even if a hacker managed to take your information, they would not be able to glean anything useful from it.

Encryption is closely intertwined with cybersecurity, which is a growing sector in the UK: from 2016 to 2021, 1.9 billion pounds will be invested into cybersecurity. In 2011, the average per incident cost to a company of a data breach was around $5.5 million - and that number has probably only increased. Technology is literally a part of our lives - over 3 million people would not be here if pacemakers did not exist. Vehicles enable modern society to function: many people need them to commute. Malicious hackers could be able to send commands to these crucial devices: taking control from a driver, or potentially harming somebody, which is why cybersecurity is more important than ever.

But some people want to reverse the strides we have taken in cybersecurity. Almost equal to cryptography's age is cryptanalysis - the reversing and breaking of encryption. However, cryptanalysis has fallen well behind cryptography (or maybe cryptography has far overtaken cryptanalysis). Using 256-bit AES, it could take 1.75 vigintillion years for a computer to decipher something that is encrypted. To put that into perspective, the sun will begin to die in 5 billion years. Basically, it would take a while to crack. Because it is so unfeasible to break encryption, the UK government, amongst others intend to force companies to build backdoors into their products. This would enable intelligence services to see all of the private and personal data on these products. As proposed, this is effectively a ban on encryption, because the whole point of it is that only the sender and recipient have access to the data.

The rationale behind this is that it will remove "safe spaces" that unscrupulous people use online. However, it will also vastly weaken a key security measure used by a wide range of companies, because that backdoor that can be exploited by cybercriminals. Proponents of the backdoor would say that technology companies could just create a backdoor that can only be accessed by people with good intentions. However, that is literally impossible, because anything the government can do, others can - and it is impossible to be sure of the government's good intentions in the first place. For every criminal that would be caught by this, at least tens of thousands of people have their privacy and security breached.

I find it hilarious that the government of America - a country that allows semi-automatic rifles to be bought and sold by the everyman fears an encryption program that costs literally £0, more than guns. In conclusion, I think that encryption should be illegal because if you have nothing to hide you have nothing to fear and the government wants only the best for you.

Computing Gravity.

By Mikolaj Lenczewski, 12SW

Introduction:

Gravity is a force felt by any and all particles in the universe. Particles interact with one another and exert forces on each other, with the force exerted being given by Isaac Newton's "Law of Universal Gravitation".

We explore two methods of computing the gravitational attraction between particles in a given set, both a brute-force, naïve approach and a more optimised, albeit less accurate, optimised approach. We provide pseudocode for both the algorithm used and any relevant data structures used with the algorithms.

Common Data Structures

The only common data structure is that of the body. It simply holds a position, and a force. It has a method to add to the internal force, and a method to update the internal position with a given time interval.

```
class body
    private force
    private position
    private mass

    public procedure new(mass, position)
        this.mass = mass
        this.position = position
    end

    public function get_pos()
        return position
    end

    public function get_mass()
        return mass
    end

    public procedure add_force(force_vector)
        force += force_vector
    end

    public procedure reset_force()
        force = (0, 0, 0)
    end

    public procedure update(delta_time)
        position += delta_time * (delta_time * force / mass)
    end
end

function get_force_between(a, b)
    delta_position = b.get_pos() - a.get_pos()

    distance = delta_position.get_magnitude()

    numerator = gravitational_constant * a.get_mass() * b.get_mass()
    denominator = distance * distance

    return numerator / denominator
end
```

The Naïve Model:

The gravitational force experienced by a particle can be given by the following formula. It is non-relativistic, meaning that it doesn't accurately model the force experienced by particles that travel very fast or that have a high mass or energy, but is sufficiently accurate for most common applications:

$$F = \frac{Gm_1m_2}{r^2}$$

Where G is the gravitational constant ($6.67 \times 10^{-11} m^3 \cdot kg^{-1} \cdot s^{-2}$), m_1 and m_2 are the masses in kilograms of the two particles under consideration, and r is the distance between the centres of masses of the two particles.

This equation allows us to calculate the gravitational force experienced between two particles. Since force is a vector, and the equation only takes into account 2 particles, we can find the sum vector for the gravitational force experienced by summing up the force vectors between a given particle (i) and n other particles (where the other particle is j). The equation that gives the resultant thus becomes:

$$F = \sum_{\substack{i=1 \\ j=1 \\ i \neq j}}^{n} \frac{Gm_im_j}{r_{ij}^2}$$

Where m_i and m_j are the masses of particle i and j respectively and r_{ij}^2 is the distance between the centres of mass of the two bodies. The only condition that we impose upon the two bodies is that they cannot be the same, as that would mean a distance value of 0 m between the two bodies. This causes a divide by zero error, so must be avoided.

Pseudocode is a form of representing computation in an abstract way, that isn't platform dependent. Representing the equation in pseudocode, we arrive at the following code:

```
for i = 0 to n
    force = (0, 0, 0)
    for j = 0 to n
        a = bodies[i], b = bodies[j]

        if a is not b
            force = force + get_force_between(a, b)
        end if
    end for
end for
```

Here we spot the major downside of this naïve implementation. It uses a nested loop and so leads to quadratic time complexity; its big-O time complexity is of the order $O(n^2)$. We observe that as our collection of bodies grows linearly, our force calculation time grows quadratically. This means impractical calculation times for any non-trivial body collection. Another method is required.

The Efficient Model:

One of the major problems with our naïve method is its requirement for a nested loop. This is required to model gravity accurately, as gravity is experienced as the sum vector of all gravitation attraction force vectors. We note however that as the force of attraction is inversely proportional to the square of the distance between the two particles under consideration, the force experienced decreases quadratically as the distance increases. This means that a large amount of small bodies at a large distance away from a given body can be approximated as a single, larger body at the same distance. This approximation is valid for any number of particles if the distance away from the particle under consideration is large enough.

This method is called the Barnes-Hut method and uses a tree structure to represent space as either a tree of quadrants (for 2D space) or a tree of octants (for 3D space). Bodies are stored within the nodes of the tree and when computing the force vector for a single body, the tree structure is traversed; nodes that are within a limit, θ, are computed individually but any other nodes are grouped together.

The use of a tree structure changes the big-O complexity from $O(n^2)$ to $O(n \log_2 n)$. We can observe that this method is better in all cases than the naïve method, with the calculation time growing much slower as the number of bodies in the collection grows. This method allows for much larger and non-trivial collections to be simulated. Of note is the fact that as the mass grouping variable (θ) tends to 0, the big-O complexity tends back towards $O(n^2)$. In fact, when θ becomes 0 the algorithm degrades back into a brute-force, naïve approach.

Conclusion:

We conclude that the brute force approach for computing gravitational attraction, whilst simple to perform and accurate, has a very poor time complexity. The execution time increases quadratically as the number of bodies under consideration grows. The efficient approach is more difficult to perform and gives very slightly less accurate results but has a much better time complexity. Its execution time increases logarithmically with respect to the number of bodies under consideration.

A history of revolution. How uprisings have shaped our world.

By Calin Aneculaesei

Our world has been shaped by revolutions, uprisings and struggles. These have ranged in size, ideology and purpose but all have a final goal of instating an ideological goal into their countries' high command and, for some, to spread this change worldwide. This spread of revolutionary thought has come in two big waves in the past 350 years.

The French revolution of 1789 is the first example of a people rising up en masse to force a change in their country's government. This was sparked after the inexperienced King Louis XVI took the throne from his father King Louis XV after he contracted what they presumed was smallpox. Inheriting a kingdom in economic ruin, King Louis' inexperience didn't do him any favours. His position was further worsened through his intervention in the American War of Independence, which threw his country further into financial ruin. This, combined with bad harvests due to harsh winters during the years of 1787-1788 resulting in the rise in the price of bread by 88% as well as a rise in taxes to compensate for the spending on the American War of Independence, created great disdain from the peasant population which made up 98% of the country. This would force the country into a nosedive of political demonstrations, which resulted in the initial diminishment of the king's role in ruling the country and his replacement by a parliament. Due to fear of anti-revolutionary action, the King was later fully removed and killed in a wave of killings which extended to all members of society known as the September Massacre.

This shaped the rest of the 18th and 19th century as France became the focus of multiple wars after this. It was also the first instance of a proper democracy in Europe, which made many other monarchs on the continent afraid of the now apparent fragility of their position. This, as well as the American Constitution, would serve as a base for most future democracies and would spark many future revolutions, shaping what we call democracy today.

The fate of Russia in the 20th century follows quite closely what happened in France in the 18th century. Once again, a country left in ruin due to their involvement in a war was dissatisfied with their incompetent ruler and wanted change. This again started with his forced abdication and introduction of a provisional government, but unlike France a coup removed the democratic leadership and forced the country into a civil war after an ungraceful exit from World War One. After a bloody civil war, the communists would emerge victorious, leading to a split between the east and west of the world, which would culminate in rise of the Eastern Bloc and the Cold War.

The rise of communism shaped western foreign policy throughout most of the 20th and 21st century. Fighting between the two main ideologies, communism and democracy, would be a staple of most of the late 1900s, with a heavy amount of resources being poured by both sides into outgunning the other. Because of this, M.A.D., also known as Mutually Assured Destruction, would become a new concept cemented into our media. The fear of nuclear conflict would impact all facets of life and would become the talking point of many conferences between the two sides. We can certainly say that without this ideological conflict our world would look drastically different. From the resources wasted in the arms race to the lives lost in meaningless proxy wars, a world without the fight for world domination between the two sides could have been more united and much more well off.

Just from these two examples, we can see that events with an initially small scale greatly impacted our world through their international influence and ideas that they have spread. Smaller examples have had the same impact – even as recently as the conflict in Sudan, where the general populace is slowly rising up against their tyrannical government. This has pulled many nations together to help and has changed the minds of many in terms of how we think about Africa. Overall, we can conclude that conflicts, big and small, have shaped our world and made us and our nations who they are today.

China claims that the Hong Kong extradition bill protesters have "trampled" the rule of law by invading parliament – but was such an act inevitable?

By Ayush Sanghavi

Since gaining momentum in late April 2019, the protests in Hong Kong against the proposed extradition bill have allegedly attracted two million members amid fears that the bill would reduce much of the autonomy Hong Kong residents enjoy, and instead subject them to the unscrupulous Chinese Communist Party-controlled courts. The Chinese government has (from a distance) long called for harsh measures to be taken against the protesters, and, when the protestors sieged the central chamber of Hong Kong's parliament on 1st July, accused them of "trampling on the rule of law". This article will holistically look at the course of events in Hong Kong so far, and from this analyse to what extent it can be argued that such non-peaceful acts by protestors were inevitable in the current socio-political climate in Hong Kong.

The saga began with a controversial murder in early 2018: 19-year-old Hong Kong resident Chan Tong-kai allegedly killed his pregnant girlfriend Poon Hiu-wing while on holiday in Taiwan, and despite admitting to the murder, couldn't be charged – Hong Kong had no formal extradition agreement with Taiwan, and thus Poon couldn't be transferred back there to face justice. Aiming to close the "legal loophole" in February 2019, the Hong Kong government proposed changes to fugitive laws that would allow case-by-case transfers of fugitives by the Hong Kong Chief Executive (their equivalent to a Prime Minister) to any jurisdiction with which Hong Kong lacks a formal extradition agreement. These proposed changes materialised into the proffered Fugitive Offenders and Mutual Legal Assistance in Criminal Matters Legislation (Amendment) Bill 2019, commonly known as the Hong Kong extradition bill.

Concerns came thick and fast. Pro-democracy lawmakers questioned why the government didn't propose an extradition treaty with Taiwan only, especially since the case of Poon Hiu-wing's murder was one so often cited by Chief Executive Carrie Lam in her relentless pressing of the extradition bill. The paramount fear, however, was that a bill allowing extradition to 'any jurisdiction with which Hong Kong lacks a formal extradition agreement' would open up the potential for Hong Kong residents to be extradited to mainland China, where there exists a significantly different legal system, the courts are controlled by the dictatorship of the Communist Party, the record on human rights is notoriously poor and residents enjoy notably less rights than their neighbours in Hong Kong. Since the Chief Executive of Hong Kong is also elected by a panel of 1,200 mostly pro-Beijing politicians, the people also wondered if ulterior political motives from Beijing were at play. Promised a high degree of autonomy over their affairs after being returned from the control of Great Britain to that of China in 1997, the Hong Kong residents felt a degree of apprehension that was not only well-grounded, but was also recognised, amongst many others, by the US, the UK and the EU – and so began historically large protests.

The widespread opposition to the proposed bill, ranging from silent protests by lawyers to larger marches contributed to by residents from all walks of life, started in their thousands and grew to as many as two million protestors as claimed by organisers in mid-June. If this number was true, it would constitute a staggering approximate 25% of the population of Hong Kong. Mrs Lam was forced to halt the bill and publicly apologise but did not offer to withdraw it. While the protests were overwhelmingly peaceful with small pockets of violent resistance (inspiring clashes between protestors and police that injured dozens), it seems that such futile concessions may have sparked the impatience, and thus the resulting anger, that saw branches of protestors march on police headquarters on 21st June and then forcibly enter the Hong Kong parliament on 1st July in an hours-long siege, vandalising the Legislative Council and then having to be removed by tear gas-wielding police. It was here that the Chinese government accused protestors of "trampling on the rule of law".

Defined by the Oxford English Dictionary as *"the authority and influence of law in society, especially when viewed as a constraint on individual and institutional behaviour"*, the rule of law could, to an extent, be argued to have been broken by the protestors; they did indeed, in their invasion of the ultimate law making institution in Hong Kong, either directly or indirectly aim to undermine the authority and influence of law in their society – the choice of parliament as a target was clearly symbolic for those who want democracy. However, when such legal "constraint[s]" are so forcibly imposed and often untrustworthy, it can be argued to a large extent that such actions were inevitable, especially when the current socio-political climate in Hong Kong is considered.

Since the residents of Hong Kong are legally allowed to protest but have no opportunity to democratically elect their leadership figures (and thus their Chief Executive), protests in Hong Kong are seen as a way of forcing legislative change to protect the core values of the people. For an issue which aroused action in so many of the residents of Hong Kong – becoming the largest protests the city has ever seen – protestors appearing to 'break' the rule of law were no doubt to

an extent inevitable in an area where laws are often forced upon the people; in theory, laws are intended to represent the best interests of the people – and when such teachings are ignored by dictating governments, social discontent is bound to erupt. Furthermore, these protests represent a larger pro-Democracy movement that has been a visual reminder of popular discontent in Hong Kong for years; such marches are common on a variety of issues, with the Umbrella Movement, the key political movement in the 2014 democracy protests, playing a large role in these. The extradition bill perhaps gave the people an opportunity to protest at what seems like the climax so far of democracy issues in Hong Kong.

In addition, the hostile Chinese reaction to the protests – and even to just the idea of them – has also arguably made such excessive acts in the extradition bill protests inevitable. Whilst some Hong Kong protests have succeeded in forcing a Chinese government to back down in the past, such as with the forced withdrawal of national security bill Article 23 after mass protests of 500,000 people in 2003, Xi Jinping, China's president since 2013, has made it clear that he will not tolerate any activity aiming to destabilise the authority of the Communist Party government. Naturally, such a stubborn response has only made the Hong Kong residents more determined to challenge this undemocratic rule of law in unconventional ways, despite the thinking that the recent violence could be a catalyst for Beijing to push for tighter control over Hong Kong. Moreover, protests themselves aren't formally legal in mainland China, with many protestors and petitioners arrested each year. This Chinese governmental influence has arguably led to the Hong Kong police classing the extradition bill protestors as 'rioters' – a fundamentally inaccurate accusation which soon became a key goal of the protestors to remove. Thus, this also to a sizeable extent made actions which "trample" the rule of law in Hong Kong inevitable – in an area where the lines are blurred regarding the action, if any, the people can legally take to challenge unpopular government decisions, such unorthodox methods of searching for change are sought by desperate people.

Therefore, it seems that it can be argued to a sizeable extent that the alleged "trampling on the rule of law" by the Hong Kong extradition bill by protestors was inevitable. The current socio-political climate in the city allows undemocratic laws to be forced upon the people, with a stubborn defence of these laws exerted by the all-powerful Communist Party of China, meaning that those who feel that peaceful protests are not effective are forced to take more unconventional approaches to challenging the government. The pro-democracy protests in Hong Kong have been gaining ground for a number of years now, and regarding the current situation, it is unlikely that they will stop any time soon.

Sources:

ABC Radio National, *BBC News*, *Bingham Centre*, *Government Information Services*, *The Guardian*, *Hong Kong Free Press*, *Los Angeles Times*, *The New York Times*, *Oxford English Dictionary*, *South China Morning Post*, *United States Census Bureau*, *Weltbank*.

The decline of the United Kingdom's criminal justice system.

By Milo O'Farrell

At the heart of any just and free democratic society is an efficient and trustworthy criminal justice system. Our society is built around trust in one another; trust to behave responsibly and in a manner that will not harm each other. Without a well-functioning criminal justice system to safeguard us against those who would break these laws and betray that trust, our society could not function. Unfortunately, the criminal justice system of the United Kingdom is in crisis. Continual budget cuts from subsequent governments have left our criminal justice system at breaking point. As crime in the UK increases and the police force too faces budget cuts, our criminal justice system is struggling to cope, and a failure could be catastrophic.

The figures are incriminating and terrifying. It is clear that our criminal justice system cannot cope; it is, without a doubt, failing. Slowly and, if nothing changes, inevitably grinding to a horrifying halt. In 2018 only 8.2% of the 5 million recorded crimes were prosecuted in court and in 2018 in 42% of cases for violence and 35% of cases for rape the victim did not support action against the perpetrator. In 35% of cases where someone has been raped the victim did not support legal action against the rapist. Trust in our criminal justice system is rapidly falling; only 55% of those who have been a victim in, or a witness to, a crime would be prepared to go to court again. This means if you were to be assaulted and a person who witnessed it had been to court before there is only a 50% chance they testify in court against your assailant. This lack of faith stems from the inefficiencies of our criminal justice system. In 2018 30% of ineffective trials in the magistrates' courts were due to poor court administration, e.g. barristers lacking paperwork about their case or evidence being in the wrong place, and prosecution witnesses being absent and the defence not being ready made up another 15% each. The reason for this inefficiency is simple, budget cuts. In the royal commission in 1993, it was said that "No one disputes that at its inception the Criminal Prosecution Service was seriously under resourced" and since then the CPS, the service that compiles evidence, creates the case, and makes the decision to prosecute, has faced nothing but budget cuts. In 2010 its budget was cut by a whole quarter. During this decade the justice ministry is having its budget reduced by 40% and the police service has lost 20,000 officers since 2010. Every aspect of the criminal justice system has been facing budget cuts and personnel losses. Our criminal justice system, that is so vital to our society, has been ignored and suffered greatly under austerity. It is understaffed and underfunded and naturally, this has led to massive workloads and mistakes. However, criminal justice is an area where we cannot afford mistakes. Criminal justice decides whether an innocent man will go to jail for years of his life for a crime he did not commit. Our criminal justice system has such high stakes, for both individuals and society, that we cannot afford for it to be anything less than perfect.

If a well-functioning criminal justice system truly is so vital and important to our society then the question begs to be asked; why has it suffered so greatly? Why has it suffered these budgetary constraints? Unfortunately the answer is mostly because unlike the NHS, for example, which is easy to see in the hospitals and GPs it runs and easy to appreciate; since everyone knows a grandma or relative who has been given a hip replacement or cancer treatment by the NHS, free of charge. Our criminal justice system is generally seen as esoteric and strange, divorced from the daily life of many. Courtrooms are rarely seen by the general public and with their legal jargon and horsehair wigs and traditional gowns, they are very inaccessible to the public. Moreover, everyone can imagine going to an NHS run hospital at some point in their lives; whether it is for treatment, the birth of their child, to support their parents or even just for a check-up. The same cannot be said for courtrooms. Most people cannot imagine being a victim of a violent crime or a mugging despite the fact that 5 million crimes were committed in 2018 in England and wales. Nearly everyone will at some point in their life be a victim or witness to a crime or be close to someone who is. The government has slashed the budget of our criminal justice system due to this unawareness of it. Like schools or the NHS, the criminal justice system is absolutely key to our society yet its obscurity and 'alienness' allows the government to cut its budget to make room for other projects. In order to fix the issues within our criminal justice system, it desperately needs more funding and attention from future governments. However, the criminal justice system itself also needs to work on making itself more accessible to the public. Currently, a person's time as a victim or witness is strange and scary; they have no idea what is happening nor why. If our criminal justice system is more open and accessible to the public then the problem of a lack of faith in it and the desire to re-enter it can also be solved alongside putting it into the public eye and preventing governments from cutting its budgets.

A solution that may seem attractive given the costs of running an effective criminal justice system and the ever-present issue of balancing the government budget is the privatisation of the criminal justice system; a person who has a crime committed against them would hire a barrister themselves who would gather the evidence and take the perpetrator to court. It would massively cut costs for the government and, as the argument goes, make costs lower for consumers and increase the quality of services offered due to increased competition. However, there are a few issues with the privatisation of the criminal justice system; firstly, and perhaps most importantly many of the victims of crimes are often living on lower incomes. When compared to households above £50,000 a year, households under £10,000 a year are considerably more likely to be attacked by someone they know and far more likely to be attacked by a stranger, three times as likely to suffer rape or attempted rape, and six times as likely to be a victim of domestic violence. These lower income households are disproportionately victims of crime and are much more likely to require legal representation, either as a victim or being prosecuted, and under a private system, they are also disproportionately likely to be unable to afford representation. Under a private system, we may end up having despicable crimes such as rape or domestic abuse, crimes that target the most vulnerable with the least resources, not prosecuted due to a lack of funds. Furthermore, there have been experiments with privatising parts of the system such as the outsourcing of interpreters to the firm Capita, and these experiments have not ended well. For example, in 2015 a war crimes case against a Nepali officer collapsed due to a poor quality of interpreting and in a single adoption case, it failed to provide an interpreter on 7 different occasions. Our criminal justice system is so vital to our society that the risk of poor quality private companies such as Capita that cut corners in the name of profit or crimes not being prosecuted due to a lack of funds are the reasons that it is under the control of the government in the first place and revoking that could have devastating impacts for our society.

Our criminal justice system is the bedrock of our society. It ensures that the laws that we all live our lives by are enforced and those who would break them and betray the trust of us all are punished fairly and without undue harshness. Our criminal justice system is arguably more important than even the NHS and without it, our society would be vastly different. In order to safeguard it and to safeguard the quality of life, we all enjoy we must ensure that it remains well funded and impartial. Nearly everyone will have some experience of the criminal justice system at some point, whether you were a victim of a crime or your mother, father, or even wife or husband was, and it is absolutely imperative that the budget cuts it has endured are reversed in order to keep our society just, free and fair.

Feminist International Relations: How Gender Affects Politics.

By Alexander Hoekema

The world of politics and international relations has long been dominated by men. Even in the 21st century, misogyny within politics is a massive issue, with men still being the main beneficiaries from the decisions made in high politics. But as society has progressed and women have become more included within international relations, feminist scholars are now looking at the world of politics though a gendered lens, creating an entirely new field within international relations: feminist international relations.

Feminist International Relations studies how international politics affects men and women differently, how international relations is influenced by gender and at how key concepts within international relations are themselves gendered.

Arguably the main cause of sexism within politics is gender essentialism, the idea that there are two genders, male and female and that each gender has different physical and social traits that are innately native to that gender. It plays into the deeply held belief that men and women are inherently different and hold true to either being feminine or masculine, with women being viewed as caring and nurturing and men being viewed as aggressive and strong.

Gender essentialism is extremely prevalent in politics, creating a perception that women are incapable of certain jobs and that women will take care of 'women's issues', such as education and healthcare, whilst men will take care of 'men's issues' such as the military, national security, and the economy.

Not only does this create sexism within politics but it genders politics itself: the Columbia Journalism Review did a study where they asked 269 university students to determine the gender of a politician featured in a news story that did not include any gender identifiers.

Nearly 80% of respondents assumed that the candidate they read about was male – a strong suggestion that political professions are still assumed to be male, rather than female, occupations.

In addition, women in politics who are viewed as caring and full of emotions, end up being viewed as not competent. When the image is reversed by women who reject the traditional gender roles assigned to them, they are seen as lacking emotions, creating an unappealing image of them.

Feminists within IR also examine how conceptions of masculinity have shaped foreign policy, security and armament. Men are often seen as the sole actors in war whereas women are often seen as passive in conflict. As asserted by Swati Parashar in 'Gender Matters in Global Politics: A Feminist Introduction to International Relations', women are only ever documented as "grieving widows and mothers, selfless nurses and anti-war activists". In reality, women have actively participated in war since the 9th century BC and this process of erasing women from war is a tool used to discredit women as agents in the international arena, leading to women not being taken seriously in national security and defence.

However, it is important to recognise that although women play various roles in conflict, it must also be emphasised that war affects men and women differently, with mass rape during wartime being another focal point for feminist scholars. These scholars seek to explain why wartime sexual violence is so prevalent; one explanation is that rape can be used as a weapon or as a reward for soldiers during the war, whilst another justification sees sexual violence as an inevitable consequence when social restraints are removed.

One of the most common stances taken by international relations feminists is feminist anti-militarism, a stance within Feminist International Relations that opposes weapons of mass destruction and holds gender accountable in part for the promotion of militarism. It argues that gender has become embedded in relations of power as strength is seen as a masculinised identity, while emotion and empathy are seen as indicators of weakness and become associated with femininity. In this way, the military strength of a state becomes associated with its degree of masculinity, which feminist anti-militarists see as problematic. As disarmament could be perceived as emasculatory, states are less likely to disarm and consequently, militarism becomes normalised, downplayed, and countries are more likely to incite warfare.

Another key aspect of Feminist International Relations is how the media can be particularly detrimental to a woman's ability to attain political office. Women generally face a higher level of criticism for their actions, personalities, and physical appearances and the media often focuses on a female politician's personal life, rather than the prominent political questions of their campaign. This kind of coverage discourages voters from voting or contributing to the

campaigns of female candidates and discourages women from entering into a campaign. This places men in positions of high politics and reinforces the idea of 'women's issues' versus 'men's issues', and who is best suited for high politics due to flawed understandings of gender.

For example, in March 2017 the Daily Mail compared the legs of Theresa May and Nicola Sturgeon, a perfect example of how the media often focuses on the personal appearance of women, instead of their political careers and achievements. The media also focuses much more heavily on women's personal lives compared to men's: just seven hours after being appointed as the head of the New Zealand Labour Party, Jacinda Ardern was asked by TV host Jesse Mulligan, whether or not she planned to have children, a clear example of how married women's fitness for office can become a question of how they manage being a politician while taking care of their children, something that a male politician would rarely, if ever, be asked about.

Another reason for the difficulties for women attaining political office is women's socioeconomic status, which creates difficulties in funding a campaign. While women are more educated than ever before, the average woman's socioeconomic powers still do not match the average man's, which leads to a lesser ability to finance a political campaign but impacting women's participation in politics from the very beginning.

In conclusion, Feminist International Relations has been extremely important in challenging female near exclusion from traditional IR, which is most visible in women's marginalisation from decision-making. Feminist International Relations has helped feminists to challenge assumptions about gender that dictate what women and men should do in global politics. Outside of politics, it has also helped to combat gender essentialism, which is arguably one of the biggest causes of misogyny in society as a whole and could therefore be seen as beneficial to women in all careers, not just in politics.

Why Populism could be here to stay.

By Mark O'Keeffe

In recent years there has been a complete overhaul of the widely accepted political rules surrounding decorum, respect, and the truth. In amongst this era-defining change, a word that has been thrown around is populism. Populism is usually used in reference to a candidate removed from the establishment and who dares to criticise it, such as Nigel Farage. It is also associated with right-wing ideas. However, the true meaning is more nuanced than that. The meaning of populism, in fact, is the appealing to the people that only they represent the views of the people. Even if they don't garner 100% or even a majority, they still claim to represent the only opinion of the people. This is because, as stated by Jan-Werner Mueller in his book What is Populism, they will claim that they are being sabotaged by institutions of the elite or the people that don't vote for them aren't truly the people. This is epitomised by Hungarian leader Victor Orban who talks about creating a 'Christian Homeland'. These sorts of xenophobic attitudes are usually found in populism as the creation of a single ethnicity state is what they would refer to as representative of the people. This attitude threatens our democracy and populists have no qualms about subverting our democratic institutions and rules. Mueller also says that populists imply that they represent everyone. While some may believe that this populism is a new phenomenon, it has always existed, on the fringes of Europe with people such as Jorg Häider and Geert Wilders, but has always been present in South America, for example with the left-wing populist Hugo Chavez, the former Venezuelan leader. However, a change in recent years is that these populist attitudes have seeped into mainstream parties. For example, with Trump and the Republicans, and Boris and the Conservatives. I believe that this is a watershed moment for European politics as populism had always been on the fringes but now it is the norm. I think it has forever damaged the political climate and has irreversibly changed the social norms.

With the elections of Emmanuel Macron in France and Mark Rutte in the Netherlands, it can be wrongly interpreted that populism has come and gone. Look below the surface, however, and a different picture will be painted. In May's European Parliament elections Macron's pro-European party was beaten by Marine Le Pen's National Rally and in March's Dutch regional elections, which indirectly elect the Senate, Rutte's party was beaten by Thierry Baudet's populist Forum for Democracy party. These populist leaders are as strong as ever and arguably growing. They are now focusing on creating a conveyor belt of new populist leaders inspired by the current crop. This is exemplified by the attempted creation of a populist academy in a monastery in Italy, although the lease was revoked by Italian authorities.

In addition, advances in technology have allowed populists to achieve their aims easier. The advent of social media has allowed these leaders to communicate directly with their followers, keeping the illusion of these leaders as true representatives of the ordinary people. This is best shown with Trump's now infamous Twitter account and the Turkish leader Erdogan's live FaceTime interview amidst the attempted coup in 2016.

The rise in these populist attitudes has borne a more divisive attitude amongst society has arguably led to our worst instincts coming to the fore. The 'Us and Them' attitude has now become the norm. Both sides of the political spectrum are no longer against saying vile things if it will win votes, such as Boris Johnson's comments over Muslim women or Trump's comments over Mexicans. Political sanity is lost and an agreement to disagree is gone. Even if you disagree with someone and the words they spout you believe are wrong surely throwing milkshakes at them or sending bomb threats is an insult to peace, society, and democracy itself. Even if these populist fringe parties fade away or the supposed centre regains its political stranglehold, the damage has been done. Our parties have all succumbed to populist ideas and values and society has lost its moral compass. Compassion has gone. Populism, in name, may disappear but its values are now ingrained in our political climate. Even our so-called moderates have adopted the idea of creating a common identity that only they represent, whether it be a European identity or equality. Politics has no longer become a debate of ideas over the best way to move society forward and leave behind a better world for our future generations but a choice of identities where you are either in or out.

Moreover, our democracies are threatened. Populists, by claiming to represent the 100%, can make a case for bypassing elections as they are already the perfect representative of the people. In addition, democratic institutions, such as the judiciary, and democratic values, like the rule of law, are happily subverted and undermined, exemplified by Erdogan's Turkey. Many populist leaders have been able to establish so-called illiberal democracies, like Orban in Hungary. Even if populists can't remove an entire system of checks and balances, they can undermine and destroy parts of them such as Trump with freedom of press, exemplified by the revoking of CNN journalist Jim Acosta's White House pass. Democracy is

built on the values of trust, peace, mutual respect to agree to disagree and equality. Those populist values of representing the 100% marginalise parts of society eroding equality and can lead to the tyranny of the majority over the minority. The western world has been quick to intervene in foreign countries over the idea of democracy so maybe it is now time we assess our own democracies and realise that if we keep going, they could soon disappear.

Populism isn't a new phenomenon, but it has moved from the fringes of European politics to the mainstream. As a part of the political sphere that is removed from the centre it may fade away but make no mistake: its values, morals, and attitudes have forever contaminated our society and all our politicians now engage in the dark arts of populism. Society is forever divided. Politics is not a gentleman's game anymore. It's a war and the loser may ultimately be democracy.

Opportunity costs – What are they and why they matter.

By Ubayd Mirza

Any economics textbook would tell you that opportunity cost is the loss of other alternatives when one alternative is chosen. The concept is based on the fundamental fact that factors of production, in other words, land, labour, and capital, are scarce and versatile. We must also remember that opportunity cost does not only include monetary costs, but it also includes all real costs of making one choice over another, including the psychic profit of lost time, energy, and pleasure.

Let us analyse the example of university; If you choose to go to university you give up the opportunity to gain 3- or 4-years' worth of experience and money for a degree. For many this may be a better alternative, however, for some, the opportunity costs of going to university are too dear to neglect.

The concept of opportunity cost is becoming increasingly important in society as more and more household incomes are becoming stretched to the limits. As decision-makers, we are quick to neglect the impact this has when making choices. We often overestimate or underestimate the consequences our decisions incur. Not only are we subject to false asymmetric information, but also normative statements that prevent us from making informed and rational decisions. Subsequent consequences soon arise due to our uninformed decisions which can affect us both psychologically and monetarily. When opportunity costs are not taken into consideration while making a choice, decision making pitfalls occur. Rational people always apply the cost-benefit analysis to their decision-making process, that is that an action can only be done on the condition that the extra benefit is greater than the extra cost, but the common problem amongst many of the decision-makers is that they neglect the implicit costs. However, taking forgone opportunities into account is vital for prudent and intelligent decision making. People incur opportunity costs with every decision that is made. When you decided to read this article, you gave up all other uses of this time. You may have given up a few minutes of your favourite television program or a phone call to a friend, or you may have even forgone the opportunity to invest or earn money. All possible costs should be considered when making financial or economic decisions, not simply those that can be concretely measured in terms of money or rates of return.

It is important to take opportunity cost into account in every kind of decision making. It is not only important for the economist but also for the common rational person to take opportunity cost into account in order to increase their utility and to make better choices amongst scarce resources.

Are there inherent problems with the idea of market failure?

By Isaac Hammond

Market failures occur when there is a misallocation of goods or services in a market. There is much left to interpretation by this definition as it does not specify what the optimal allocation of goods and services is. This is a major flaw of using the idea of market failure to form economic policies as the ideal allocation of goods in a market is subjective and changes according to the different views of different politicians, making the ideal policies to correct the failure different according to different politicians, that is if they even consider there to be a market failure. The consequences of this is that the government could end up overspending when interfering with the markets, thus worsening the budget deficit unnecessarily.

Market failures can also be deliberately manipulated to service a political agenda as politicians trying to win votes may say that the ideal amount of consumption of goods in a market is much greater than the current levels and promise to spend more on subsidising this industry in order to increase the levels of consumption. This could lead to excessive levels of government expenditure as politicians try to use market failures to justify unreasonable subsidy packages that ultimately worsen the budget deficit and place a heavier burden on future growth as younger generations may have to pay for this extravagant spending through higher taxes to finance the national debt.

Another problem with the use of market failure is that it has become harder to quantify the positive and negative externalities of a good or service. For example, a construction company could teach new workers skills which benefit society as a whole and provide a positive externality; however, they could also use machinery that produces CO2 which worsens global warming, harming society as a whole and providing a negative externality. How much that company should be subsidised or taxed to compensate for the externalities they provide is what has made the idea of market failure more difficult to apply when deciding these things, especially seeing that the negative externalities of CO2 production will not be seen for many years.

Additionally, the idea of market failures becomes less effective when considering how externalities are not necessarily contained within the borders of a country. If a construction company produces lots of CO2 and worsens global warming, countries in Africa may be more severely impacted by the effects of global warming and temperature rises than those in the UK through arid conditions that may cause droughts and famines. Applying the idea of market failure to this problem would see increased taxes on the UK business producing the externality; however, this money does not go towards helping those that are more heavily affected by the externality in other countries, leaving them to deal with the burden created by the UK business. This system can easily be considered unfair, especially when considering how developed countries are the main producers of greenhouse gases but will be far less affected by it than less developed countries.

Finally, a more recent problem with using the idea of market failure is the rise of free services that make it more difficult to quantify the cost paid by a consumer in the transaction and thus more difficult to understand how large the externality of the company is. For example, if a business starts a free educational website that is deemed to be under-consumed, this would be considered a market failure and the government's usual approach would be to subsidise the business in order to decrease the price and increase the consumption of the service. In this scenario, however, a subsidy would not increase the consumption of this service as it is already free for consumers to use in the sense that they do not directly pay the firm any money to use the website. Instead the firm makes a profit by selling adverts to other businesses so any subsidies received would not have the intended effect on consumption and so would not correct the market failure. This shows how the idea of market failure is becoming less applicable to modern businesses and is not suited for its purpose of improving the allocation of resources when the price paid by consumers is not done directly to the company.

The Automation Anxiety: Is This the End?

By Dominic Martin

It's safe to say that science fiction has defined the way we think about robots. From the first use of the word "robot" in Karel Čapek's play R.U.R though to Isaac Asimov's famed novels, we all know what our mechanised friends look like. A 1950 New York Times review of Asimov's *I, Robot* called it "an exciting science thriller [which] could be fun for those whose nerves are not already made raw by the potentialities of the atomic age." As in the 50s, these nerves are still alive today. Unlike in the 50s is the reason why.

No longer do we fear the violation of Asimov's Laws by humanoid robots — that is stuff for the silver screen, not the real world. Rather, the automation anxiety arises from fear of unemployment. For some, the replacing of humans with machines is a threat to tangible to ignore.

The finding that 47% of US jobs are at risk of automation by 2034 — released by Oxford Academics Carl Benedikt Frey and Michael Osborne in 2013 — has been cited in over 4,000 articles since, and even featured on a banner at an anti-automation protest. "Doom prophets" have jumped on the bandwagon; books under the titles of *Rise of the Robots* and *Architects of Intelligence* stir this negative sentiment.

Mr Frey is, however, no bearer of bad news. He suggests his work has been misunderstood. Stressing that the 47% are only at "high risk" relative to other jobs, it's clear that half of jobs will not just disappear. A 2018 report from McKinsey&Company tackles a different angle. Looking at activity rather than occupation, it too found that 40% of work will be automated. However, rather than disappearing, these jobs are *changing*.

Economic history points to this trend. The first industrial revolution of the 19th century changed labour forever. The economic prosperity which soared Britain into the position of "workshop of the world" was not off the back of mass unemployment but saw a huge expansion in the industrial labour forces. Weavers who would spend 98% of their time doing "routine" tasks had this time replaced by mechanical looms. Productivity increased, as did wages, while working hours were reduced. In the United States, the second industrial revolution of 1870-1914 electrified countless jobs. Instead of an unemployment surge, worker hours were reduced from 70 to 40-hour weeks on average, and living standards, due to prosperity and productivity growth, soared. Even the introduction of the Automated Teller Machine (ATM) only 40 years ago did not replace bank tellers, instead changing the way they worked. In fact, the number of bank tellers increased twofold from the 1980s-2000s.

John Maynard Keynes himself predicted in his *Economic Possibilities for our Grandchildren (1930)* that automation in the future (which is now!) would increase leisure time for humans. We need not fear the machines!

On the brink of the fourth industrial revolution, routine tasks — cognitive and manual — such as spreadsheet filling, making minor trades, conducting simple surgery and giving diagnoses are most susceptible to automation. However, traders will not be fired – they will focus on more high-risk trades. Accountants will look at specific large-impact decisions and doctors will focus on high risk specialist cases. The removal of the mundane will have beneficial psychological effects too, and so worker productivity will grow further still.

It is clear that some unemployment will occur – this is natural. The economic theory proposed under the name "Engel's Pause" suggests that wages and employment will lag behind productivity growth 20 years after an industrial revolution. This is no crisis, however, it is just bumps in the road. The $15 trillion in promised GDP growth due to automation in the world economy by 2030 guarantees that governments will have the income to spend on social security systems to protect those impacted in the short term. In the long term, the labour market will reach an equilibrium as new jobs are created. Reduced production costs will drive down prices, increasing living standards for all, even in developing nations.

Governments and policy makers need not worry. While we may be facing the end of work as we know it, automation will help everyone in the long run. Necessary, however, are proficient and extensive reeducation provisions, as well as liberalised labour markets. With this guarantee, workers can move into new jobs and change their activities according to technological implementation. In this way, everyone can prosper.

Asimov may not have been right, robots won't replace humans, but he was right in that automation is here to stay. If we fear this, we risk repeating the mistakes of the British Luddites. By embracing it, however, we may be the wealthiest generation yet.

Why China will have the world's largest economy by 2030

By Josh Brosnan

The global economy. A massive economic system that brings together the economies of every country in the world. It has been growing at a moderate but steady pace since rebounding from the financial crisis of 2008, and that trend has continued in 2019.

Last year, the world's GDP grew by 2.7%. This was following on from a growth of 2.9% in 2017, which was just as impressive. But once again, by far the most influential contributor to this statistic was the economic superpower, China.

The Chinese economy is still expanding today, and I believe that within the next four years it will become the largest economy in the world.

To open my argument, I'd like to emphasise the consistency of Chinese economic growth since the reforms of 1978. It is true that growth has been slightly slower and more variable at times, but there was a clear change in consistency with the trend rate of growth when the government introduced their reforms. Not only is their growth consistent, but it is fairly impressive as well, with per capita GDP rising at levels in excess of 8% per year. In the last 15 years per capita income has nearly quadrupled, while looking back at the pre-reform period we can see that growth rates rarely topped a very modest 3%, so there is no denying that these reforms have had a thoroughly positive impact on the economy.

The reforms I'm referring to are those that occurred in 1978. After years of state control of all productive assets, the government of China embarked on a programme of economic reform, which included acts such as encouraging the formation of rural enterprises and private businesses, liberalising foreign trade and investment and investing in industrial production and the education of its workforce. By nearly all accounts, the strategy has worked spectacularly.

There is a much clearer trend rate in GDP from the start of the reform period, and aside from a minute dip in 1990 the GDP is yet to sway substantially from this trend in the whole of the reform period. This is relevant because it suggests that the economy may well continue its growth at these rates. With the Chinese economy currently growing at around 6% year on year, this would likely be sufficient to see the country possess the world's largest economy by 2030.

Moreover, it is true that China may face some economic problems in the next decade, but in the past its economy has shown that it can overcome these obstacles without too much disruption. For example, towards the beginning of China's economic development the country was the world economic and technological leader, thought to have had the most advanced technologies, the highest iron output, the highest urbanisation rate, and the largest national economy in the world from around the year 900 to the year 1200. However, beyond this period the country was introduced to some significantly more centralised political systems, including that of the Ming and Qing from 1368-1911. These dynasties stifled innovation and commercial activities but there were other obstacles as well. The Sino-Japanese War and the Opium Wars in the 1800s led to China having to concede some of its treaty ports and territories to the West and to Japan.

Although it is true that these problems did have some economic consequence, as China lost its leadership position in Western Europe, the degree of damage was kept to a minimum. Living standards and commercialisation in the Lower Yangzi region in particular were easily comparable to even the richest parts of Europe in the 18th century, and the degree of market integration was actually higher than it was in the vast majority of European countries. This provides strong evidence to suggest that China may have been unaffected by obstacles it encountered in the past. This does by no means guarantee that China will be unaffected by any problems in the future, but it is certainly a positive indicator. Also, China's economy is built on a very wide and stable base, which has contributed greatly to growth in the past, and it is very unlikely to start to decay to a point where it negatively impacts the economy within the next decade.

Although China's economic development began in the primary sector with agriculture, the foundation for almost all the growth we have seen in the last few decades is in fact the massive Chinese manufacturing industry. The secondary sector grew very quickly in China and really accelerated through the transitional and take-off stages with a large workforce willing to work for a relatively low wage. Influential, developed countries imported factors of production, and then retrieved goods that the Chinese workforce produced with these factors. The working population quickly gained enough disposable income to start buying goods and local factories suddenly started producing goods that remained in the local economy. The multiplier effect accelerated growth from here, but arguably the most important step in this development

process was the start of production of goods that were staying in China, being made in local factories that began popping up all over the place. This led to what were really the first recognised Chinese companies, which, crucially, allowed China to eventually develop its own multinationals.

The actual base of China's booming economy nowadays is this large collection of multinationals. These have developed a broad and sturdy foundation which has helped China to become as influential as it is today. Many of these corporations are centred around the primary and secondary industries, which is the case with The China National Petroleum Corporation, the Sinochem Group, and The China Petrochemical Corporation. With these companies at its base, the Chinese economy may not experience increases in its growth rate, but it is more unlikely to experience any falls.

Overall, I believe that these factors supply enough evidence for me to say in confidence that China will have the world's largest economy by 2030. In my opinion, there is little chance that the obstacles it may face in the near future will provide enough of a problem to stop the economy from progressing in the manner I believe it will.

High Speed 2 (HS2): So, what is all this fuss about HS2 and what is it?

By Bargav Rentala

Well, HS2 (High Speed 2) is a large-scale railway project. This project is designed to introduce a strong infrastructure to the UK by connecting major cities together such as London to Birmingham, Liverpool and Manchester, and all the way up into Scotland. (View map below for full destinations.)

Due to this, in the long run HS2 is expected to generate a whopping £92 billion in benefits to the UK economy. The project in itself requires the employment of 30,000 men and women as well as 2,000 apprentices, which helps people specialise skills and therefore be able to then transfer their skills into other projects as well. As well as this, the project aims to increase economic growth through tourism and supporting hundreds of thousands of jobs, thus helping Britain compete on the global stage as a strong nation.

HS2 aims to transform journey times and significantly increase rail capacity. It will free up space on the existing network for more local services and freight, taking lorries off the roads. Less traffic keeps everybody happy! On the contrary, some may argue that we could simply upgrade existing networks. However, upgrading the existing network would not deliver enough new capacity, cut journey times like HS2 or deliver the wider economic benefits of the new line. It would also cause widespread disruption to existing passengers for many years as many lines would have to be paused due to construction and work being done.

A question that may arise from this is: will this project be destroying land and countryside?

Well, HS2 promises to:

- Treat local people and businesses with the utmost respect by keeping them informed of anything they are doing.
- Minimise disruption – this means that they would apply high standards to protect people's health and quality of life by holding strict regulations on noise pollution, air pollution and traffic congestion.
- Keep workers' health and safety as a priority, making HS2 the safest ever Major UK project as in their words, 'Good health and safety is an investment, not a cost'.
- Create new public spaces. They have £45 million of funding for local communities around phase 1 and 2a to improve community facilities and town centres, helping the local economy. They are also committed to creating parks, play areas and public rights of way.
- Create a 'green corridor' alongside the centre of the country. This involves the creation of wetlands, ponds, hedgerows, heathlands, meadows and farmland along a huge portion of the 345-mile track. This involves over 7 million trees and shrubs along phase 1. Whilst leaving many rich and diverse wildlife habitats intact. An extra £7 million has been put aside for the HS2 Woodland Fund which aims to support the restoration of existing woodland sites and the creation of new woodlands. Before building tracks, tunnels and bridges, a huge amount of work will also be put into archaeological work along the route as part of an initiative called Unearth British History. This programme is the largest archaeology programme undertaken in the UK. This gives us the opportunity to reveal over 10,000 years of British history.
- Design and build the world's most sustainable high-speed railway. They have set a 50% emission reduction target on stations and rail systems.

However, it is quite understandable why HS2 is controversial. Many people's homes and local businesses are on the route of HS2. This would mean that many people will be displaced and moved to other housing or have to relocate their businesses. This can be highly detrimental as people who are moved may end up far from their work or schools and therefore make commuting a nightmare. Along with this, it may end up costing people their jobs due to not being able to make this commute. Furthermore, the locations to which businesses are moved may not appeal to the demographic of the area and therefore drive business down. This could potentially end up leading businesses to bankruptcy or businesses having to sack employees to cut costs in order to keep the company afloat. Moving the businesses may also mean that the current employees end up too far from the work-place and therefore lose their jobs.

As stated above, however, many jobs will be created through HS2 as well. For phase one, it is estimated that 30,000 job will be created. This may not help those individuals who lose their jobs. Overall, though, I believe HS2 is vital for the UK.

I can see why HS2 is controversial; however, I believe that HS2 in the long run will allow businesses to employ people from all over the country and also allow people to go to many different areas for universities too. In my case, for example, I would like to apply to Manchester, Liverpool and Birmingham universities. As someone currently living in the south, this service would be extremely useful. Although HS2 will not be complete by the time I go to university, in the long run it would benefit many people like me.

So, there it is. A brief introduction to the HS2 project.

The effects of a Global digital Currency.

By Ethan Friend

Global digital currencies, often referred to as cryptocurrencies, are virtual mediums of exchange that have been introduced into the modern world within the past few years. Despite much speculation about their safety, cryptocurrencies have the potential to completely transform the exchange of money around the world. They have the potential of doing away with fees, delays and other barriers to the flow of cash. It might give those in less developed countries access to the financial system and a means to protect hard-earned wages against inflation. This is what Facebook promised on 18th June 2019 with their introduction of a new entirely electronic currency known as Libra. This social media network aims to further integrate cryptocurrencies into the global market. As we see countries slowly moving away from fiat currencies (such as Sweden, whose demand for cash has dropped by more than 50 per cent over the past decade and more than half of all bank branches no longer handle cash), we must ask: do the negatives of a virtual currency exceed the positives or would the world be better off completely cashless? There are many effects of this exchange upcoming in the world. In this article, these points will be discussed.

A big benefit of cryptocurrency is that it allows people to have ultimate control over their money, including whom they send it to and what types of fees they do not have to pay. Cryptocurrencies could help to get rid of intermediaries in everyday transactions. This could cut costs for businesses and save consumers quite a bit of money around purchases as it would see the breaking down of geographical barriers. Digital currency transactions can take place at the same speed, regardless of where the sender and receiver are located. If in future, transactions with services and goods are to be handled by automated systems, the cryptocurrency would remove many of the intermediaries that would take their own cut.

However, this is a double-edged sword as if an economy were to go completely cashless, the removal of intermediaries taking a slice out of transactions would cause them to lose their source of income. A whole sector of jobs, including agents, brokers and wholesalers, would become virtually obsolete in an instant and with this would come along an increase in unemployment. In addition, the continuous developments in technology further remove the need for employment in workplaces, as improvements in AI make the business costs of production even cheaper than employing people. This decrease in the need for employment coupled with the ever-growing population means mass unemployment; and with an economy that removes a whole sector of intermediaries. This will spiral the problem out of control.

Nonetheless, the cryptocurrency cannot be bound by interest rates, transaction charges or exchange rates, and due to their decentralised and unregulated status, cryptocurrencies cannot be manipulated as much as fiat currencies. This means the prevention of the printing of money by governments. This is a large bonus to those in less developed countries as cryptocurrencies protect people’s hard-earned money from unpredictable inflation. This risk has caused mass poverty on many occasions – most recently in Venezuela, where hyperinflation in what was once boasted as Latin America's richest economy, boosted by the biggest oil reserves on the planet, has led to economic collapse amid accusations of corruption, mismanagement and high levels of debt under their current President Maduro. If the people’s money had been kept under a virtual medium of exchange, this devastation would have been prevented.

However, this lack of control also leads to negatives as governments are no longer able to exercise the same level of control over the country’s currency if it were to go entirely cashless. The Governmental control over central currencies is key to regulation in many ways, and without regulation economies will lack allocative efficiency, thus making cryptocurrencies potentially detrimental to the economy as it operates with much less government purview. For example, governments could no longer determine how much of a currency to print in response to external and internal pressures. If an economy which depends on government intervention (i.e. a command economy) becomes dependent entirely on cryptocurrencies, there will be eventually an unpreventable misallocation of resources, resulting ultimately in market failure.

As well as protecting people from runaway inflation, cryptocurrencies also cut down on theft and other forms of crime, as people cannot be robbed for their money as easily by criminals. Now the money is tied up electronically, people cannot

be stolen from and, to a certain extent, can keep track of where their money goes. This is a high-risk factor in less developed countries, in which people often have their money on them rather than in secure bank accounts.

Nevertheless, even though this system would provide those in the less developed areas of the world with access to the financial system and ultimately a safety net from crimes directed at them physically, the use of cryptocurrencies may cause an increase on the amount of transactions in crime and will cause a loss of government surveillance on tracking and fighting crime. Certain modes of cryptocurrencies, such as the Bitcoin, are simply untraceable and this makes the mode of transactions between criminals faster, easier, cheaper and less of a risk for them than physical exchange. Criminals cannot be found 'red-handed' with electronic currencies the same way they would have been exchanging fiat currencies physically and people may be more inclined to enter crime due to the lowering of risks associated with it. Moreover, cyber-attacks may become even more of a threat if companies, such as Facebook, do not properly safeguard their platforms, as there will be more money at stake. Scams will also become more frequent if the use of cryptocurrencies grows.

To conclude, cryptocurrencies as a medium of transactions will be beneficial for the world economy if only partially integrated. As discussed, an entirely cashless world would not be effective and could cause many issues for governments in particular. Traditional currencies will lose value without any means of recourse. Should cryptocurrencies take over entirely, new infrastructure would have to be developed to allow the world to adapt. There would inevitably be difficulties with the transition, as cash could become incompatible quite quickly, leaving some people with lost assets, and established financial institutions would most likely have to scramble to change their ways. There are many benefits for the individual, but the change stands to pose some major challenges for the global economy in its current form, and therefore maintaining fiat currencies in conjunction with digital currency would be the most effective way forward.

Marketing in Formula One: How it continues to evolve.

By Lewis Rundle

Introduction

Whilst Formula One has existed since its first World Championship event at Silverstone in 1950, its commercial side was only developed and exploited by Bernie Ecclestone from the later 1970s onwards. Ecclestone held a firm grasp over the sport for four decades before being toppled by media giant Liberty in 2016. In that time, F1 has expanded across five continents, bringing in huge sponsors and conglomerate appeal. The globalisation of Formula One continues to progress; however, teams are beginning to receive less and less money, and in 2018 Formula One Management Group's operating costs ballooned. As a case study for marketing across time, Formula One is the perfect microcosm to investigate.

In this article I will look at the role and effect of tobacco sponsorship in Formula One and the expansion of Formula One across the global market and the related consequences.

Tobacco Sponsorship

Tobacco sponsorship was, and to some extent still is, the bread-and-butter of marketing in Formula One. Initially, and remarkably, sponsorship in Formula One was banned. It was only in 1968, when Imperial Tobacco became the first ever commercial sponsor in an £85,000 pa deal, that tobacco companies started to flock to the sport. The black and gold 1972-78 Lotus, emblazoned with Imperial's JPS logos, is a sporting icon with three World Championships to its name. This showed the strength that big-name sponsors could bring to a team.

It was only in 1990, when the UK Government Report acknowledged the influence of tobacco advertising on cigarette consumption that there were moves to impose legislation. In 1997, Bernie Ecclestone gifted £1,000,000 to the Labour Party in order to have F1 be exempt from a ban on tobacco advertising. The exemption was dropped by the government in the wake of mass public outcry, but the damage was done. In 2005, EU and UK laws were properly introduced, significantly limiting tobacco sponsorship at sporting events.

Up until 2007, teams were incredibly reliant on tobacco companies for their funding. Companies would pay in excess of £50 million for the rights to title sponsorship. A brand almost synonymous with F1, and more recently Ferrari, is Marlboro, who continue to spend in excess of £100m annually on the team from Maranello. Despite not being able to directly run their logos on the cars since 2008, Phillip Morris International (PMI) have attempted to wriggle through a loophole allowing "socially responsible" branding. The launch of PMI's "Mission Winnow" in late 2018 marked the controversial return of tobacco sponsorship under the guise of activism rather than the 'untrustworthy, grubby and sleazy' giants of yesteryear. In 2019 a second of the Big Tobacco companies joined the F1 circus, wearing the same disguise. British American Tobacco (BAT), who used to run their own team (BAR) between 1999 and 2005, have re-emerged with their "A Better Tomorrow" programme. They have taken up residence with McLaren, who have struggled financially in recent times but are now on the rise. An official statement from BAT states they will have an *"on-car and off-car presence throughout the [2019 F1] season, at all times in line with applicable regulation and legislation". The deals have been scrutinised heavily, and rightly so. The Australian GP organisers prohibited the tobacco-backed logos at the season opener at Melbourne, and the sponsorships have been continuously investigated by the governing bodies of the sport. In June 2019, it was reported that PMI were considering withdrawing their "Mission Winnow" logos, showing that tobacco companies may recognise that they aren't as welcome in 21st century sporting events as they were in the past.*

So why do tobacco companies want to be so close to Formula One, despite every effort to push them away? A lot comes down to the image of Formula One: glamorous, expensive and decadent. This reflects the way that tobacco companies want their products to be viewed, and so a partnership for these reasons makes perfect sense. Another reason for tobacco and F1 to be intrinsically linked is due to the marketing aspirations of tobacco companies. F1 reaches a huge audience – 588 million viewers across the globe – and races globally across a variety of emerging markets. With this outreach, tobacco companies, armed with their hundreds of millions of dollars, look to F1 as the best way to promote their brands.

The social impact of smoking, especially its negative effects on health, is the reason that F1 has tried so hard to part ways with tobacco sponsorship in the last decade. The advertising of tobacco can have significant implications on its consumption, and with Formula One appealing to people of all ages, this can be particularly damaging. It is for these reasons that I am worried about the return of tobacco sponsorship in Formula One, even if it is only implicit.

Global Expansion of Formula One

Formula One's brand stretches far outside of its initial European roots. With 588 million viewers across 200 different countries, F1 is one of the world's most consumed spectator sports. Whilst firmly established in Europe since the 1950s, F1 has looked to embed itself in American sporting culture as well as expanding across the Middle East, Asia, and Africa. This global strategy has led to an expansion of the race calendar but with it a rise in overhead costs and consequently a fall in team profits. The gamble for global domination is a developing story for modern Formula One and could dictate the next decade of the sport.

For the first decade of Formula One's existence (1950-59), the race calendar consisted of an average of 8.4 races a season, peaking at 11 in 1958. Of those eleven races that year, eight were European, two were American (Argentina, Indy500), and just one in Africa (Morocco). Across the decade, the percentage of European races stands at 78.6%, with just 20.2% in America and 1.2% in Africa.

2019 marks the final season of this decade, allowing for a comparison between the original calendar and the modern era. Between 2010-2019, there will have been 198 races, with an average season length of 19.8 races. In 2016, 2018, and 2019, a record 21 races per season were held. 2016 saw eight races held in Europe, with 13 races spread across Russia, Asia, the Americas and the Middle East. Over the period 2010-2019, the percentage of European races is 41.4% (82), however there is a greater spread across the rest of the globe than ever in F1 history: 22.6% of races taking place in Asia (45), 16.5% in the Americas, 11.4% in the Middle East (23), 5.1% Australian (10) and 3% in Russia (6).

Whilst this is a lot of data to process, the trend is clear: Formula One is moving rapidly towards conquering a global market.

Why is this significant? Well, by exploring and expanding into new markets, Formula One becomes more commercially attractive. Formula One cars are essentially billboards clocking speeds of 350km/h. With cars being raced across the world, potential sponsors looking for new audiences in different markets can look to F1 as a delivery system. With this, lucrative deals are struck between teams and companies. The collective aim is to show off to the world.

In 2020, Formula One will return to The Netherlands, tapping into a market which has been re-energised by the talent of Red Bull driver, Max Verstappen. More significantly though, F1 will also make a leap forward in the Asian market by hosting an all-new venue in Vietnam.

It will be interesting to see whether the Vietnam gamble pays off for Formula One, or if it will fall flat like many other venues in recent years (see Sochi, Turkey, Valencia and Malaysia for just a few examples). Undeniably, Liberty Media shows no sign of stopping their global expansion and will continue to seek out opportunities to expand further.

Saturn Devouring His Son – Why it is Horrifying?

By Ben Goodier

What do you feel? Is it terror, horror, anxiety, or just disgust? Out of all the paintings Francisco Goya y Lucientes, or simply Goya, painted during his career, this image of a crazed titan slowly eating his son is one of the most haunting paintings in history. Firstly, it is important to understand the context behind this painting: Goya (1746-1828) was a Spanish painter between 1785 to 1820,[9] one of the most influential in continuing the Spanish Baroque style,[10] an art style that focused on natural realism combined with Catholicism. However, during his lifetime, Goya witnessed atrocities such as the invasion of the Napoleonic Army during the Peninsular War of 1808-1814. The violence can be viewed in his painting the Third of May 1808, showing the horrific executions of surrendering Spanish civilians by French soldiers. These atrocities, combined with an illness that left Goya deaf when he was 46,[11] are believed to have resulted in his change in art style, transforming the beauty of his early work into a twisted nightmare. In 1819, Goya purchased a house known as Quinta del Sordo or 'Villa of the Deaf Man,' for his retirement.[12] It was within the villa that Goya painted the fourteen Black Paintings.[13] Each one was painted directly onto the wall of the villa, using oil. One of these is the image shown on the left: Saturn Devouring His Son.

Why is this painting so terrifying? The image itself is startling: a crazed-looking man eating a corpse. Saturn is twisted in a half kneel. The victim's head has been bitten off and Saturn is preparing to rip off the left arm. Saturn's fists are clenched so tightly that blood oozes from around the fingers. What creates the true horror is the look Saturn gives; he is wide eyed, startled and surprised. It is just as though the viewer of the painting has stumbled across him. The painting also unsettles the viewer when considering the legend, it is based upon. Saturn is the Roman name for Cronus[14], the Greek Titan, who was told of a prophecy in which one of his sons would usurp him. So, as a result, whenever his wife Rhea would produce a son, Cronus would eat him. However, Rhea secretly hid three sons – Zeus, Poseidon and Hades. Eventually, Zeus would overthrow his father. The painting though shows Saturn, not devouring a new-born child, but consuming an adult. The thought of someone being fully aware whilst they are slowly eaten is gruesome. The cannibalistic imagery creates a deep feeling of revulsion, and this feeling makes it all the more unusual with the knowledge that the painting was in Goya's dining room. Another point to make clear is that Goya never mentioned any of the Black Paintings to anyone[15], or even wrote about them. He never intended anyone else to see these creations of his; there is no meaning behind this painting. It has no greater purpose to comment on society or the nature of humanity. This painting is about horror, uncontrolled and in its purest form. It is as if someone has simply stumbled upon this gruesome image. What consolidates this is that Goya never named this painting. The title 'Saturn Devouring His Son' was given by people who discovered the paintings after his death and linked the image to other

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9 *Saturn Devouring his Son, Goya: Analysis*, Visual-arts-cork.com, http://www.visual-arts-cork.com/paintings-analysis/saturn-devouring-his-son.htm, Accessed 24th June 2019

10 *Spanish Baroque Art*, Visual-arts-cork.com, http://www.visual-arts-cork.com/history-of-art/spanish-baroque.htm, Accessed 24th June 2019

11 Harris-Frankfort, E, 2019, *Francisco Goya*, Encyclopaedia Britannica, https://www.britannica.com/biography/Francisco-Goya, Accessed 24th June 2019

12 Ibid, Accessed 24th June 2019

13 Lubow, A, 2003, *The Secrets of the Black Paintings*, The New York Times, https://www.nytimes.com/2003/07/27/magazine/the-secret-of-the-black-paintings.html Accessed 24th June 2901

14 *Cronus Facts and Information about the Titan Cronus*, 2017, Greek Gods & Goddesses, https://greekgodsandgoddesses.net/gods/cronus/, Accessed 24th June 2019

15 *Saturn Devouring his Son*, 2019, En.wikipedia.com, https://en.wikipedia.org/wiki/Saturn_Devouring_His_Son, Accessed 24th June 2019

paintings of the time, most notably Peter Paul Rubens's painting of the same name.[16] This isn't a painting about a grand Roman myth, it is simply a monster eating the body of a man in the dark.

On the Development and Importance of Programme Music.

By Cameran Johal

Programme music can be defined as a form of instrumental music that attempts to evoke some extramusical meaning, often of a literary idea, legend, scenic description, or personal drama. Its evocative nature means that it is often seen as a precursor to the film soundtrack. The style flourished during the Romantic period in the Western Classical Tradition during the 19th Century and led to the development of the symphonic poem, a piece of orchestral music which illustrates or evokes the content of a poem, short story, novel, painting, landscape, or other source.

Programme music, by its nature, is contrary to absolute music, which is not explicitly about anything and is thus non-representational. Absolute music is a more abstract concept, often described as 'music for music's sake' and its appreciation consequently relies solely on the aesthetic value of the sound and its components in which any associations, images or narratives evoked are not an original intention of the composer.

An early example of programmatic features in instrumental music are seen in Beethoven's Symphony No. 6 'Pastoral', premiered in 1808, in which each movement is given a pictorial title such as 'Szene am Bach', 'Scene by the Brook'. However, Beethoven himself showed reluctance in writing programme music, stating that 'the whole work can be perceived without description – it is more an expression of feelings rather than a tone-painting'. The style, therefore, was later formalised by the likes of Carl Marie von Weber and Hector Berlioz who published programme notes - listening instructions that outlined a synopsis of the narrative - which were printed and distributed at performances of their works. Berlioz's Symphonie Fantastique, premiered in 1830, is indicative of the style, portraying the quasi-autobiographical dream of a young man having overdosed on opium, driven to the brink of suicide after a failed love affair. Berlioz, through his compositional technique with an expanded orchestra and a recurring theme described as an "idée fixe, an obsession, was able to depict scenes from the drama entirely through instrumental forces.

However, despite its innovative reception by some, programme music was heavily criticised following its rise in popularity. The aestheticians of the Hanslick-Riemann school of musical thought stated that the essence of programme music is 'antagonistic to the essence of musical art' as the form enabled a piece to gain a good deal of popularity without being subject to the same rigorous conditions that govern absolute music, based on technical compositional excellence. It was seen as a dilution of the purity of abstract music, no longer appealing to a deeper region of the mind, as absolute music had done.

However, since this early criticism, research has been conducted on the impact of programme notes on listeners. A study, Damon 1933, examined the effect of listening instructions and programme notes on listeners' reactions for emotional or narrative programmes. The results suggested that their presence led to a greater enjoyment of a piece. Comparatively, in the same study, the presence of intellectual programmes notes, based on musical analysis and such, meant that subjects rated the music as being better, but not necessarily more enjoyable. Research conducted by Delis, Fleer and Kerr in 1978, suggests that the mere presence of concrete titles, rather than abstract ones, increases recognition memory of pieces. This is the difference between simply labelling a piece as a Symphony or Sonata as its title and creating an evocative name such as Strauss' 'Tod und Verklärung' meaning 'Death and Transfiguration,' portraying the death of an artist.

In 1986 Annette H. Zalanowski published her research into the effects of listening instructions and cognitive style on music appreciation. This used the theory that the left hemisphere of the cerebral cortex was mathematical and logical, and the right hemisphere was holistic and creative as a basis, with individuals generally favouring one side. The listening notes were tested in four sections: no programme notes, imagery notes, concrete narrative programme notes and abstract analytical programme notes. Imagery instructions in the music led to the highest rating of enjoyment whereas the concrete programme led to the greatest understating and memory of the piece, and this was notably higher generally for those who favoured the left hemisphere.

[16] *Saturn (Rubens)*, 2019, En.wikipedia.com, https://en.wikipedia.org/wiki/Saturn_(Rubens), Accessed 24th June 2019

From this then, one may infer that the presence of listening notes makes music more enjoyable and understood because of its ability to be comprehended by the mind. This suggests why those inclined to the logical left hemisphere favour programme notes as it removes the mystery of the abstractness of absolute music.

In the 21st Century, there is a clear decline in the popularity of Classical Music which, in part at least, is caused by a lack of understanding of it. Promoting accessible programme music with well-targeted listening instructions may consequently be a way in which untrained listeners may be encouraged to enjoy the art of Classical Music.

Languages

Why should foreign language learning be compulsory to learn up until the age of 16 in the UK?

By Michael Carmody

Learning a foreign language should be compulsory until the age of 16. This is because language learning contains many benefits which the UK population is missing out on due to low participation.

Context:

Only 38% of Britons speak at least one foreign language, 18% speak two and only 6% speak three or more. This compares to the EU average which shows that 56% speak at least one foreign language, 28% speak at least two and 11% speak three or more. The large disparity in foreign language learning means that the British population as a whole is worse off. The lack of language learning could be because language learning in the UK only typically begins at the age of eleven and this venture ends at the age of fourteen. This contrasts with typical EU language learning. For example, a study conducted by El Pais found out that 89.2% of parents say their kids are studying English and 38.3% say they also take their children to private language classes.

Improvements in native language:

People opposed to foreign language learning may say that as English speakers we do not need to learn another language as 51% of the EU population can have a conversation in English. However, learning a foreign language actually improves your native language level. This is because learning a foreign language draws your focus to accurately speaking a language through learning grammar, conjugations, and sentence structure. This makes you more aware of language, and the ways it can be manipulated. These vast skills that are acquired make you a better writer and a communicator. This is why of the 45 men who have served as Presidents of the United States, at least half have displayed proficiency in speaking or writing a language other than English. Four of the earliest Presidents were multilingual, with John Quincy Adams and Thomas Jefferson demonstrating proficiency in a number of foreign languages.

Multilinguals are skilled at switching between two systems of speech, writing, and structure. According to a study from Pennsylvania State University, this “juggling” skill makes them good multitaskers, because they can easily switch between different structures. This makes them more efficient in the working world. This skill boosts your ability to negotiate meaning in other problem-solving tasks as well, all of which are useful in your general life.

Cerebral stimulation:

In addition to this, speaking a foreign language improves the functionality of your brain by challenging it to recognise, negotiate meaning, and communicate in different language systems. This skill boosts your ability to negotiate meaning in other problem-solving tasks. As a consequence of this cerebral stimulation, there are health benefits. For monolingual adults, the mean age for the first signs of dementia is 71.4. For adults who speak two or more languages, the mean age for those first signs is 75.5.

Brexit:

Even prior to Brexit, language learning was important. However, with the imminent Brexit issue, it is critical to increase the value of language learning and to be aware of the positive impacts of having a multilingual population. Foreign languages are essential for trade, business, and the economy. Alarmingly, the economic cost of the UK’s linguistic underperformance – in terms of lost trade and investment – has been estimated to be up to £48bn per year, or 3.5% of GDP.

Languages are also vital to national security and diplomacy. For example, in September 2013 when the Home Office’s language centre was opened, the foreign secretary at the time, William Hague, said: “The ability to speak, read, listen and write in a foreign language is one of the fundamental skills of our diplomats. Without it, they cannot get under the skin of a country and really understand its people.” As we enter a post-Brexit Europe, we will need a population with a plethora of different language speakers, who can use these skills to ensure a smooth transition post-EU membership.

GCSE foreign languages:

GCSE participation in languages is a very useful determinant of foreign language learning. In 2002, when foreign language learning was made compulsory to learn between years 7 and 9, around three-quarters of pupils studied a language other than English as part of these qualifications. In 2004, this requirement was struck down and by 2011, participation had declined to just 40 percent. So, in order to increase participation, foreign language learning at GCSE should be compulsory. In addition to this, one hour a week of language learning in primary school should also be essential. This should not be arduous and learning of the culture of the foreign language should be conducted. This would mean that there would be positive connotations with learning languages, making the experience more positive.

Potential negatives:

If language learning were made compulsory, inequality would exist in language learning between different schools. This would mean that the most prestigious schools would have more fluent speakers and a higher continuation of language learning and the less prestigious schools would have a lower rate of foreign language continuation. This disparity in foreign language learners would mean the most well off in the UK society would have a reduced chance of dementia and would leave school with more skills and a more prosperous future. This would contrast with the students who received a worse education, who would have a higher chance of dementia and fewer skills than those who received a more adequate education.

Conclusion:

Foreign language learning up until the age of 16 should be compulsory in the UK. This is because this learning contains many benefits. It improves the level of our native language, allows us to multi-task better, it aids diplomacy which is essential in a post-Brexit Britain and also it increases the average age of dementia victims. However, if foreign language learning were made compulsory there would be inequality, as income would be a factor regarding the level at which the foreign language is learned up to.