LENSES

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CONTENTS

CAN AI FULLY REPLICATE HUMAN EMOTIONS?

Yelena Yara

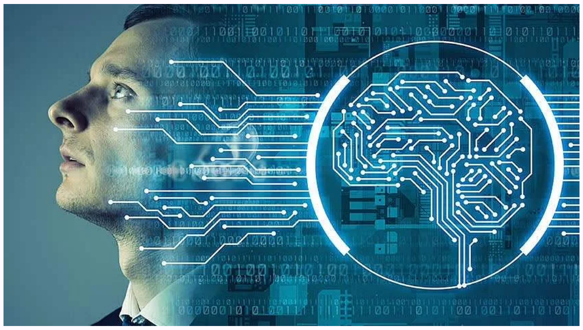
“Is AI going to take over the world?”, “Will AI steal your jobs?”, “What are the dangers of AI”, “Will the robots rise and rule over us?!”. With many speculations of let’s firstly address the main issue, AI is undoubtedly an advanced technology that has greatly influenced our society where around 7% of existing UK jobs could face a high (over 70%) probability of replacement by autonomous machines in the next 5 years, rising to around 18% after 10 years and just under 30% after 20 years. Nevertheless, AI is far from perfection as we have yet to understand our own psyche and psychology to fully implement morality or decision making into machines. Oxford dictionary defines “human” as “relating to or characteristic of humankind”, but what is a characteristic of humankind? In relation to machines the main uniqueness of our species is our emotions.

Now some say Humans on average use 10% of their brains, and the reasoning for this could be because if we did use 100% of our brains, we could not learn new skills and information as all the brain capacity would be already used. The human brain has about 100 billion neurons and each neuron is thought to be connected to about 7,000 other neurons, so every time a single neuron fires a signal, 7,000 other neurons get that information. If you multiply these three numbers, you get 200,000,000,000,000 bits of information transmitted every second inside your brain. To gain information, we need to focus our attention on what we seek to learn, and we are unfortunately not the best at multitasking therefore with limited attention produces limited input, and that information then needs to be encoded into your memory. This can be either short-term or long-term, regardless memory depends on forming new neural connections and as mentioned we have a limited number of such connections. As we age, it becomes harder for our brains to create new connections as existing connections are filled with memories and knowledge gained throughout the years. Linking to AI, it is merely unrealistic to create a machine with that amount of information, and by the time we do create a machine of that capability it will be nearly the size of Texas and even in this state it would be financially inefficient to mass produce it, due to size and cost. Additionally, if AI is replicating human intelligence to evolve itself it will inherit the same limitation associated with the human mind, except with faster processing than a human.

However, our brains are information-processing systems, yet emotions, hopes or fears are yet to be explained in depth. Emotions can be physically measured by either an increased heartbeat, extra muscle tension which could imply anger etc. Although feelings are slightly different, you can have a sensation of happiness or sadness, these are experiences that come hand in hand with emotional physical responses. Therefore, Emotion can be viewed as a rapid, automatic function that initiates appropriate actions in response to external stimuli. As an example, when a bear is heading towards you, the rising fear directs your brain to do the right things such as determining an escape route instead of things that are not useful in that situation. The main reason why the brain cannot be analysed in detail is because of the limited access to our brain, we must first get past our skull, and it becomes very difficult to do that while making sure the brain is still fully functional and alive. AI is a machine and machines do not have emotions although they can simulate emotions to an extent there is no possibility that they “feel” them. Emotions are responses to external stimuli as mentioned above, and machines do not have the necessary biology or consciousness to experience them. Keeping in mind, AI can still recognise emotions due to our physical responses that indicate human emotions.

I believe it is necessary to mention the Turing Test, developed by Alan Turing, an English mathematician and cryptanalyst, is used to test whether machines can think. Originally called the Imitation game, it is done as follows. Suppose that we have a person, a machine and an interrogator. The interrogator is in a room separated from the other person and the machine. The objective of the game is for the interrogator to determine which of the other two is the person, and which is the machine. The interrogator knows the other person and the machine by the labels 'X' and 'Y'— but, at least at the beginning of the game, does not know which of the other person and the machine is 'X'—and at the end of the game says either 'X is the person and Y is the machine' or 'X is the machine and Y is the person'. The interrogator is allowed to put questions to the person and the machine of the following kind: "Will X please tell me whether X plays chess?" Whichever of the machine and the other person is X must answer questions that are addressed to X. The objective of the machine is to try to cause the interrogator to mistakenly conclude that the machine is the other person; the objective of the other person is to try to help the interrogator to correctly identify the machine. Currently, Eugene Goostman has successfully convinced over a third of an audience of its humanity.

AI still have many limitations that affect its capacity to explain and interpret information. To start, AI systems have a limited understanding of context and nuances of human language and communication, an example being struggling to understand sarcasm, irony or figurative language such as the phrase "Better late than that is mostly composed of men will likely be biassed towards men and make less accurate predictions for women. They can also be trained on a dataset of criminal defendants that is mostly composed of people of colour and will likely be biassed towards people of colour and make less accurate predictions for white defendants. Another limitation that has been evident nowadays is the lack of creativity. AI systems are based on algorithms and mathematical models which recognise patterns however they cannot create new ideas or concepts. This limits the potential applications of AI and makes it difficult to rely on AI for original thinking such as art, music and literature which can link to an influence of emotion which AI also lacks but is once again still able to capture.



To conclude, AI can simulate emotions and recognise them but cannot feel them. Human emotions are directly linked to our conscious human minds however AI is based on logic and reasoning causing it most likely never be able to implement or experience the full range of human emotions. To answer the main questions of will AI ever have emotions, it remains an uncertainty as it could be possible that machines could someday be advanced enough to experience emotions however with AI still in its infancy there is still much to learn about its potential and there is a relatively low possibility for this to happen soon.

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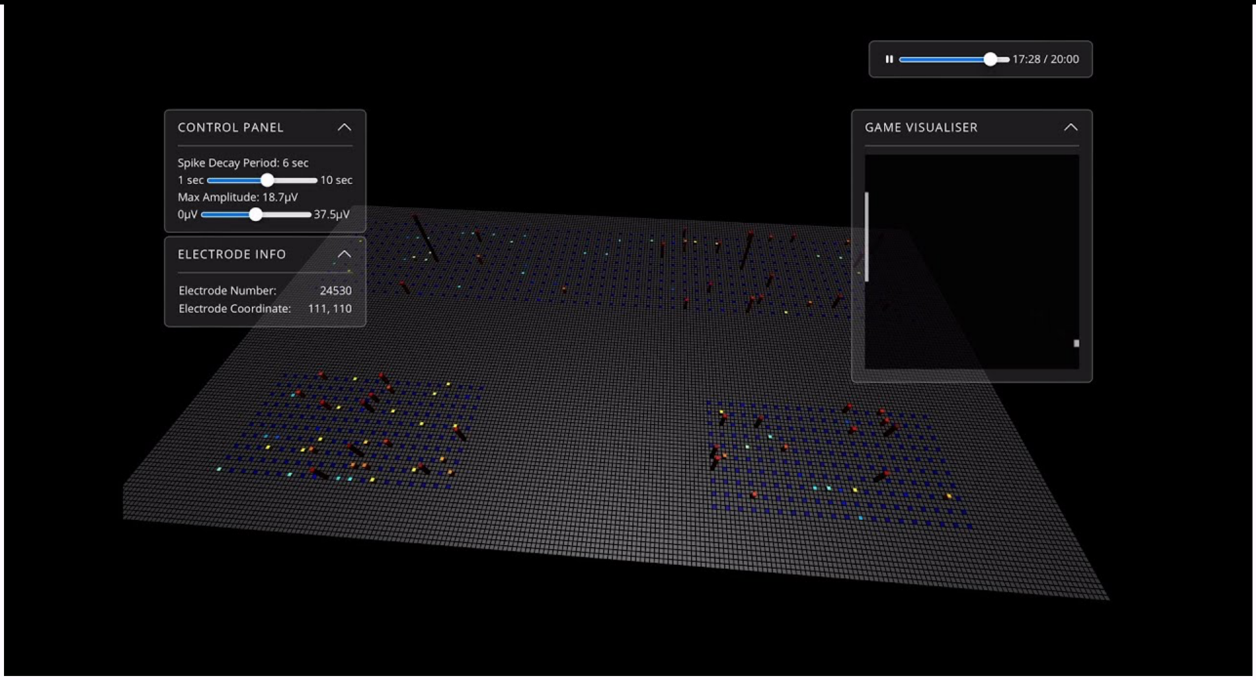
CAN THIS DISH OF DISEMBODIED BRAIN CELLS GAME BETTER THAN YOU?

Shireen Simgy and Melissa Andrews



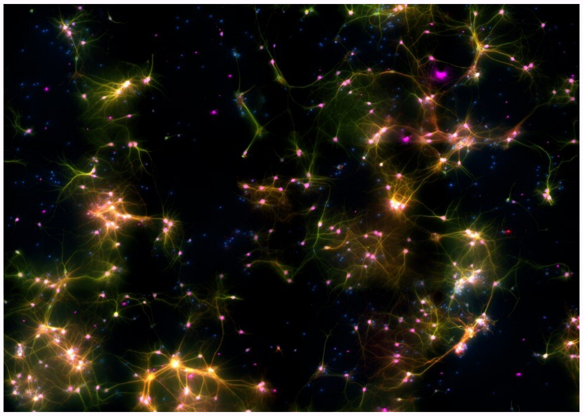
In October of 2022, an experiment set on understanding how the brain learns was launched at Cortical Labs in Melbourne, Australia and UCL Queen Square Institute of Neurology. Scientists have been able to teach living brain cells to play an arcade game - Pong- through the creation of a system called ‘Dishbrain’.

For context, Pong is a typical arcade game from the 1970s, involving a video screen on which a black rectangle defines the table, and a white cursor represents each player's paddle, which can be moved up or down to intercept a white ball. For the sake of the experiment, a more simplified version of the game was used, but the overarching concept remained unchanged.

The experiment involved taking stem cells and differentiating them into 800,000 embryonic mice and human brain cells. These brain cells were placed on top of microelectrode arrays, which are a group of small electrodes that can simultaneously record and stimulate electrical activity, without disrupting them.

Micro electrode arrays (also known as MEA) allows scientists to take note of patterns of neural activity, and allow them to learn more on how information is processed and transmitted. While additionally, investigating the mechanisms underlying various cognitive processes.

MEA are used frequently in the field of electrochemistry due to the unique electrochemical properties that they display, such as their high sensitivity to small changes in electric potential. This property was critical in order to detect the activity of individual neurons and to send feedback to the brain cells, to detail which side the ball was on, via the electrodes. The group of cells acted as the paddle that hit the ball, while the distance from the paddle was shown by the frequency of signals.



Initially, the cells were seemingly unbothered by the signals coming from the computer, not understanding or knowing what signals to send the other direction. They also had no reason to play the game. In an effort to coax the cells into cooperating, scientists tried to motivate the cells using electrical stimulation: a short burst of electrical activity-if they got it right, and when they got it wrong, a chaotic stream of white noise. Soon enough, Dishbrain began to learn to electrically generate patterns that would move the paddle in front of the ball, to continue the rally. The experiment suggested it learnt to hit the ball more when provided feedback on how well it was playing.

The use of (MEA) has existed for a long time, in order to investigate many electrically active cells, such as heart cells, retina, muscle etc. However, this experiment was the first time in which the brain cells had been investigated to process information from external environments and respond to it in real time.
By extracting data from several attempts, Kagan, one of the lead scientists working on the investigation, was able to conclude three things: one, that human brain cells seemed to achieve a slightly higher level of play than mouse brain cells, two, the level of play was unexpectedly sophisticated, considering that each network contained fewer cells than the brain of a cockroach, and three, the cells dissipated less energy as the game went on, and soon learned to play in five minutes.

Even more fascinating though, is when the results of the isolated cells were compared with those of an AI computer, as when AI would generally take around 90 minutes to learn what to do in this situation, the mini-brains seemed to learn in just 5. Kagan summarises this discovery in a simple analogy; "You might have never been to someone else's house, but with a bit of rummaging and searching you can probably make a decent cup of tea as long as I've got the ingredients," but even a very powerful computer would struggle to carry out that task in an unfamiliar environment. As amusing as the entire situation is, the achievement is part of an effort to understand how the brain learns, and how to make computers more intelligent.

While seeming silly, these disembodied, isolated brain cells, dubbed Dishbrain, could be seen as a huge step in the development of more intelligent and sophisticated computers and may even be used to study drugs and therapies for damaged brain cells in the future

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THE HIDDEN EPIDEMIC: UNRAVELLING THE SCIENCE BEHIND DRUGS AND THE SHADOWS OF SUBSTANCE ABUSE

Adjoa Owusu-Afriyie

We all know what a drug is, but do we know how they work and the detrimental effects they can cause? Like keys to forbidden doors, drugs possess the power to unlock altered states of consciousness, tempting us with their promises of euphoria and escape. Yet, something that seems so captivating comes with a price. In this compelling article, we will embark on a journey of discovery, peeling back the layers of this mysterious puzzle, as we unravel the science behind drugs and confront the haunting shadows of drug abuse.

Unveiling the Mechanisms of Drug Interaction:

This intricate dance between drugs and the human body consists of 4 stages resulting in the euphoric effects felt from within: Absorption, Distribution, Metabolism and Excretion. The journey begins with absorption which is the way the drug enters the body. This can happen in multiple different ways including oral administration, iv injection, snorting and many more. Once in the bloodstream, the drug is ready to embark on its journey throughout the body. Distribution.

During the distribution stage of drug action, an intricate dance unfolds as drugs travel throughout the body, reaching their intended targets. Once drugs enter the bloodstream, they become part of a dynamic circulatory system that transports them to various organs, tissues, and cells. Blood flow plays a crucial role in drug distribution, as organs with higher blood supplies receive a greater concentration of the drug, facilitating its delivery and potential therapeutic effects. This intricate journey allows drugs to interact with specific target sites, where they can exert their pharmacological actions.

Several factors influence the distribution of drugs within the body. Drug solubility is a key determinant, as lipophilic drugs that dissolve easily in fats and oils can cross cell membranes and distribute widely into tissues rich in lipids. On the other hand, hydrophilic drugs, which dissolve in water, may have more limited distribution as they struggle to pass through cell membranes. Protein binding in the bloodstream also affects drug distribution, as some drugs bind to proteins like albumin. Bound drugs remain in the bloodstream, reducing their availability for distribution to target tissues. Understanding the complex interplay of factors that impact drug distribution provides valuable insights for healthcare professionals in optimising drug therapies, ensuring appropriate dosing, and maximising therapeutic efficacy.

After the drug has been distrusted, the next phase is metabolism. Metabolism, often occurring primarily in the liver, involves enzymatic reactions that convert drugs into metabolites. Note: While the liver is the primary site for drug metabolism, other organs such as the kidneys, GI tract, and lungs may also perform metabolic functions. These metabolites can be either inactive or active, and they play a crucial role in determining the drug's duration of action, potential side effects, and elimination from the body. Enzymes involved in drug metabolism, such as cytochrome P450 enzymes, catalyse various reactions that facilitate drug (protein) breakdown and facilitate the formation of metabolites.

These metabolites are usually less active chemically than the original drug molecule but may in some cases be equally as powerful or even more so.

Several factors can influence drug metabolism. Genetic variations in enzymes involved in drug metabolism can lead to individual differences in how drugs are processed by the body. Some individuals may have variations that result in slower or faster metabolism, affecting the drug's effectiveness and potential toxicity. Other factors, such as age, gender, and the presence of other drugs, can also impact drug metabolism. The rate of drug metabolism can be influenced by drug-drug interactions, where one drug may inhibit or induce the activity of enzymes responsible for metabolising another drug. Understanding the intricacies of drug metabolism is essential for healthcare professionals in optimising drug therapies, ensuring appropriate dosing, and minimising the risk of adverse reactions or drug interactions.

The process of enzymatic breakdown can make it easier for the drug to be excreted, which is the final phase. The last phase of a drug within the body is excretion. This is the process by which drugs and their metabolites exit the body, primarily via urine or faeces. Drugs may also be excreted in sweat, saliva, breast milk, or exhaled air.

How Addiction Occurs:

Historically, it used to be thought that addiction resulted from a lack of willpower and a moral failing. But we now know that addiction is a physiological disease. It changes the brain structure that can alter the way it works and processes information. To understand how that happens we start by thinking about reward and the brain's natural reward system. The reward pathway's primary function is to reinforce sets of behaviours. Evolutionarily it began to indicate to us that actions that help us survive are good and we should keep doing them. This is mediated through a chemical called dopamine. Following appropriate behaviour, the reward pathway releases a small burst of dopamine. That burst of dopamine is a satisfying jolt encouraging you to repeat the same action in the future. Addictive drugs all cause dopamine to flood the reward pathway 10x higher than a natural reward would which creates intense feelings of euphoria and reinforces the drug-taking behaviour. Over chronic use nothing else natural is quite as rewarding. As substance use increases the circuits adapt and reduce their sensitivity to dopamine.

Over time, repeated drug use leads to a phenomenon known as neuroadaptation(tolerance). The brain adjusts to the excessive dopamine stimulation by reducing the number of dopamine receptors or by decreasing dopamine production. As a result, individuals develop tolerance, needing higher doses of the drug to achieve the same pleasurable effects. With continued drug use, the brain becomes rewired, and the reward system becomes dysregulated. The individual's motivation and decision-making processes become increasingly focused on obtaining and using the drug, often at the expense of other aspects of their life. The brain's reward pathway becomes hypersensitive to drug-related cues, leading to intense cravings and compulsive drug-seeking behaviours. These changes in the brain contribute to the cycle of addiction, making it difficult for individuals to stop using drugs despite negative consequences. This biological basis helps to explain why addiction really is a brain disease and not a matter of will power. The stigma that accompanies addiction only makes seeking treatment more difficult.

Treatment Against Substance Abuse:

Treatment against drug abuse is quite complex and requires a comprehensive and personalised approach. The goal is not just to address the physical aspects of addiction but also to address the underlying psychological, social, and behavioural factors that contribute to substance misuse. One common treatment approach is detoxification, which involves the safe and monitored withdrawal from the drug, often accompanied by medications to alleviate withdrawal symptoms and minimise the risk of complications. Detoxification helps individuals clear their bodies of the substance and prepare for further treatment.

Beyond detoxification, therapy plays a crucial role in addressing the psychological aspects of addiction. Cognitive-behavioural therapy (CBT) is a widely used approach that helps individuals identify and modify negative thought patterns and behaviours associated with drug abuse. It aims to enhance coping skills, develop strategies for managing cravings and triggers, and promote healthier decision-making. A typical session of CBT will normally involve you working with your therapist to fully understand your problems and decide the next tops to help overcome them. This can be done through “homework” which consists of you setting a goal for yourself each week e.g., to only take a small amount of a certain drug. Other forms of therapy, such as motivational interviewing and contingency management, can also be effective in fostering motivation, building resilience, and reinforcing positive behaviours. Support groups and peer support networks, such as 12-step programs like Narcotics Anonymous, offer individuals a sense of community, understanding, and accountability, further aiding in the recovery process. Overall, a comprehensive treatment plan that combines detoxification, therapy, and ongoing support can empower individuals to break free from the clutches of addiction and embark on a path towards long-term recovery and well-being.

Illuminating the Impact of Drugs on Society and Paving the Path to Responsible Use

In our quest to understand the impact of drugs on society, we must confront the profound consequences that reverberate through every aspect of our lives. From strained relationships to shattered dreams, drug abuse casts a long, dark shadow over individuals, families, and communities. The ripple effects extend beyond the personal realm, permeating social structures and imposing significant burdens on healthcare systems, law enforcement, and the economy. However, amidst this sombre landscape, glimmers of hope emerge as we recognize the transformative power of responsible drug usage. By embracing a paradigm shift that prioritises education, harm reduction strategies, and compassionate support networks, we can empower individuals to make informed decisions, minimise risks, and promote responsible drug use within our society.

The path to responsible drug usage lies in creating a culture of knowledge, empathy, and personal discipline. Education plays a vital role in tackling myths, addressing misconceptions, and equipping individuals with the necessary tools to make informed choices. By promoting evidence-based information about the potential risks and benefits of drugs, we can empower individuals to navigate the complexities of drug use responsibly. Additionally, harm reduction strategies offer practical approaches that prioritise safety and minimise harm. These include measures such as needle exchange programs, drug testing kits, and overdose prevention initiatives. By shifting our focus from disciplinary measures to compassionate and pragmatic solutions, we can embrace a new example that recognizes the innate human desire to explore altered states of consciousness while minimising the associated risks. Not only this, but education in schools in assemblies, for example, can provide people with the knowledge of the risks of drugs so the result of addiction never has to occur in the first place. With structured education and a strong support system we have the power to redefine our relationship with drugs, paving the way for responsible usage and a healthier, more enlightened society.

In conclusion, "The Hidden Epidemic: Unravelling the Science behind Drugs and the Shadows of Substance Abuse" highlights the profound impact of drugs on individuals and society. By understanding the intricate mechanisms of drug interaction and the complexities of addiction, we can work towards effective prevention, early intervention, and compassionate treatment strategies. Together, we can unveil the hidden truths, destigmatise substance abuse, and strive for a society that embraces responsible drug usage and supports those affected by addiction.

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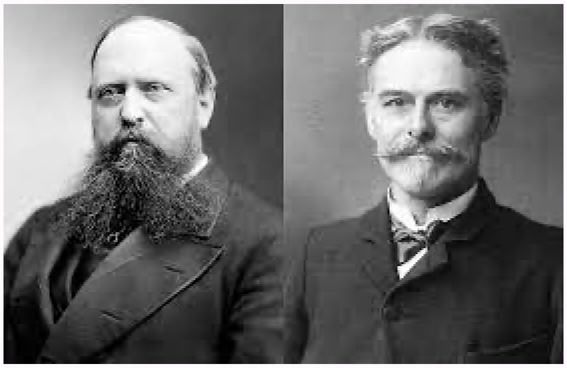
GREAT LIZARDS AND GREATER WOMEN: HOW MISOGYNY AFFECTS HOW WE VIEW DINOSAURS

Leona Zerezghi

If a person was asked to describe a dinosaur with one word, the semantic field of the words offered would be one of violence, danger and terror. Dinosaurs, after all, are "terrible lizards" as their Greek name tells us. However, this label has been mistranslated throughout the ages, making the name "great lizard" much more accurate when discussing the prehistoric creatures. Feminist paleontologists of the last 20 years have argued this mistranslation could have been caused by the rich white male paleontologists of the 19th century - also known as Edward Cope and Othniel Marsh - consumed by their "Bone Wars". While their infamous feud made undeniable advances in the paleontological field, it also meant that the narrative surrounding paleontology and dinosaurs became dominated by men - and women, such as Mary Anning, became entirely overshadowed. The "Bone Wars" also poisoned the idea of dinosaurs with the men's own toxic masculinity creating an image of violent reptiles, judged in worth by their size and embroiled in a conflict of men. This paper will determine to answer the question of how misogyny affects how we view these colossal creatures.



Othniel Marsh and Edward Cope first started the “Bone Wars” in 1877; the two men were obsessed with being able to find and describe more dinosaurs than the other to add to their own private collections. Their feud was suffocating and their mutual hatred was widely and publicly known within both the paleontogical and non-paleontological spheres. When the two began the quarrel, there were only 9 named species of dinosaurs - by their deaths, they had discovered over 130 dinosaurs between them, including the *triceratops*, *diplodocus* and *stegosaurus*. The two warring paleontologists therefore deserve the acclaim they receive for their work - despite some fame coming from their bitter rivalry. However, one individual that was not (until more recently) appreciated for the work she did for paleontological advancement was Mary Anning, a poor woman from Lyme Regis.

Anning was an incredible paleontologist, nicknamed the “princess of paleontology” (albeit an admittedly quite sexist name), and is credited with being the first to find a complete *plesiosaurus* and *pterodactyl*, as well as the first to discover an *icthyosaur* at only 12 years old in 1811. Anning was alive and working more than 60 years before the Bone Wars’ official start and yet she only receives a fraction of the fame that Cope and Marsh have granted to them. Although Mary Anning has been recognised for her work in more recent times, her findings at the time had to be sold to rich men who took the credit for it. For this reason, it could be argued that the initial lack of recognition for Mary Anning was due to class issues rather than gender issues. However, it could equally be argued, in response, that although Anning’s lack of privilege fueled the issue, the issue itself was mainly caused by men taking advantage of a woman and claiming her genius for their own. Anning’s work not being accredited to her acted as a clear example of women being excluded from, and shut out of, paleontological, geological, and archaeological fields despite being just as good as (and in some cases better than) their male counterparts.

The dominance of men in the paleontological field, therefore, can be used as an explanation as to why we, as a society today, view dinosaurs as inherently vicious and aggressive creatures. The men who collected dinosaur fossils in the Great Dinosaur Rush in the 1800s did so in order to be able to name them and be credited with discovering them, only to then put them in museums or their own private exhibitions. Little of the research done at this point was focused on attempting to decipher how dinosaurs really lived and how they died as the men were more concerned about finding new dinosaurs, the bigger, the better. Since such little time was devoted to actively attempting to understand dinosaurs, a lot of the narrative surrounding these incredible fossils created an image of dinosaurs as deadly and violent. While some violence was inevitable (as all animals have a degree of aggression inherently ingrained into them), the degree of which dinosaurs are viewed as savage creatures is massively overstated. Due to the fossils of *Broomistega* and *Thrinaxadon* that have been discovered, we have evidence that dinosaurs were able to co-exist harmoniously.

The fossils, affectionately known as "The Triassic Cuddle" are both two different species of animals. While the two were roughly the same size, *Broomistega* was an amphibian whereas the *Thrinaxadon* was similar to a reptile. The *Thrinaxadon* is presumed to have burrowed into a hole (either to hide from a predator or to have a resting place) where it was soon after joined by the *Broomistega*, who curiously had broken ribs. The broken ribs of the latter animal would have inhibited its ability to breathe and to move and since it was an amphibian, being stranded in the sun would have been extremely detrimental for it and so it needed to seek shelter, which was provided for it by the *Thrinaxadon's* burrow. Both of the animals were believed to be carnivorous and so the fact that the *Thrinaxadon* did not eat the injured *Broomistega* even though it would have been very easy for it to and so the fossils show that prehistoric creatures had the capacity for co-habitation and sympathy and may not have been as vicious as they are presumed to be today. The discovery forms a question as to whether dinosaurs were truly aggressive or if this is a narrative that has simply been imposed onto them; did dinosaurs kill for sport or did they kill for survival?

Paleontology, as a whole, is a study that is constantly reaching new conclusions about historic and prehistoric creatures. We can never be completely certain about how animals before us lived because we were not alive then but, as new evidence is unearthed, we can try to learn and develop judgements about the animals that came before us. Less than 50 years ago, dinosaurs were assumed to be reptiles but now scientists believe they most likely had feathers rather than scales, making their predecession to birds more understandable. That is why dinosaurs may not be as irrational and vicious as they are made out to be, with movies such as *Jurassic Park* (1993). Furthermore, the paleontological field, since its inception, is an industry that has profited off of women's work and suppressed female excellence which feeds into the narrative that has been and is currently spread about these ancient animals. In more recent times, we have seen Mary Anning receive the credit she is due for her work, with movies about her, such as *Ammonite* (2020) and *Mary Anning and the Dinosaur Hunters* (2019), helping to allow her discoveries to be reclaimed as her own. As well as this, as we have moved into the 21st century, there have been more women going into paleontological study, which is catalysing a departure from the field being male-dominated.There is still a long way to go in terms of change and research but as more study is put into the paleontological field, it is possible for us to witness the extinction of the misogynistic ideas with which we view the extinct great lizards.

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EDITOR'S NOTE

Dear Readers,

It is with great pleasure to present to you the second edition of St. Michael's Sixth Form Academic Journal Lenses.

Once again, we have featured a range of subjects that will be of great interest to you, covering a broad range of topics. This edition features; technology in particular the advancements of AI, biology and the use of stem cells, drugs and their growing impact on society and the chemical mechanisms and impact on human anatomy as well as palaeontology and how we view dinosaurs has been impacted by misogyny.

We would like to express our appreciation to the talented writers who have contributed their exceptional work to this second edition. Without the passionate writers who have shared their insights and research findings, this journal would not be possible.

As editors, we are immensely grateful for the support and enthusiasm we received for the launch of the first edition and we extend our gratitude to all those who have read the journal and joined us on this intellectual journey. Your engagement and interest in the ideas presented in this journal are what make our efforts worthwhile. We hope that the articles in the second edition will stimulate your intellectual curiosity.

Once again, thank you to our readers and writers as well as Madame Gray for your unwavering support and help for the smooth launch of this journal. We hope that this second edition will captivate your intellect and spark your imagination, inspiring you to delve deeper into the world of knowledge.

Happy reading,
The Editors. (Reenal Dias, Cordelia Leff, Shireen Simgy and Erilda Zeneli).