



Waynflete Presentations, 3rd February Round One - 7.00pm

1. Tahmid Azam: Brain-computer interfaces for the disabled

Speech, language, and communication needs (SLCN) act as a barrier to the social and emotional development of children. Brain-computer interfaces (BCIs) can form a non-muscular channel that, like other augmentative and alternative communication systems such as keyboards or touchscreens, could work to lessen the effects of SLCN. In this project, I train a long short-term memory recurrent neural network to classify motor imageries from a dataset of electroencephalographic recordings to demonstrate the effectiveness of machine learning effectiveness in BCIs.

2. Hans Bo: Climate Justice: Guilt and Duty

In recent years, the issue of redistributive and corrective justice has risen to the forefront of international discourse as a matter of necessity. Building on the already significant work done for individual theories, this essay aims to provide a unified and internally consistent overview of the three predominant theories of justice: Polluter Pays, Beneficiary Pays and Ability to Pay. In combination with considerations of intergenerational continuity of responsibility and non-ideal theory, it offers a holistic proposal for a "least bad" solution for a uniquely difficult, but pressing, challenge.

3. Peter Crossley: A chemical micropropulsion system for satellites

In this study, I propose an improved propulsion system for the emerging field of high-performance small satellites. This enables more ambitious missions, such as lunar landings, which would otherwise be restricted to much larger spacecraft. I was faced with the challenge of miniaturising complex components such as injector plates and cooling systems, along with the adverse scaling effects for the boundary layer.

4. Joshua James -Lee: Reinforcement learning in F1

Investigating how Reinforcement Learning and the emerging paradigm of Adversarial Reinforcement Learning can aid Formula One Racing, including racing line optimisation and testing the effects of vehicle modifications upon the racing style of a driver. The talk will explore the design and implementation of the project, with details on the algorithms and code written for the project.

5. Dexter Twycross: Beyond Elections-choosing democratic representatives.

In response to the challenges facing democracy, many are calling for experimentation with alternative systems. Citizens' Assemblies are one suggestion, randomly selecting members of the public to deliberate on policy. By applying a range of disciplines, including philosophy, psychology, and political science, I sought to evaluate them in my project. I established a critique of electoral party politics throughout and examined a case study from British Columbia to reach my conclusion.

6. Luqi Wang: The behaviour of $\gamma\delta$ T lymphocytes in coeliac disease

People born with certain genes are susceptible to coeliac disease, in which eating food containing gluten causes immune cells to attack the intestinal lining. To investigate how and why destructive T cells are found in the gut of coeliac sufferers, Oxford University researchers are studying the expression of gut- and skin-homing chemokine receptors on T cells in the blood, particularly the non-V δ 2 type of $\gamma\delta$ T cell. The talk outlines how this study relates to coeliac disease and the methodology used. It then presents an independent analysis of part of the experimental data and discusses the significance of the findings.

7. Isabella Winnifrith: Fallen women in 19th century literature

I consider the female protagonists of 'Madame Bovary', 'Anna Karenina', 'Effi Briest' and 'The Awakening'. They are four examples of fallen women who commit adultery and suicide. Their personal situations and the cultural contexts in which these texts were written vary greatly. Despite these differences, I will argue that one thing which unites the heroines is their defiance of 19th century gender expectations.

Waynflete Presentations, 3rd February - Round Two – 7.30pm

1. Charlie Griffith: Is extra-terrestrial mining feasible?

With a population of 8 billion and rising as well as depleting resources on Earth, it is becoming increasingly necessary to look to the skies to supply our needs. In this talk, I compare the different sources of off-planet materials and how we can access them before concluding with an end-vision for the state of extra-terrestrial mining by the end of the 21st century.

2. Maria Teresa Maddison: Justification of matricide in Aeschylus' Oresteia

Concerned with blood revenge, justice, and family conflict, the Oresteia by Aeschylus (first performed in 458 BC in Athens) is a cornerstone of Western drama, and follows Clytemnestra's killing of her husband Agamemnon, and their son Orestes' subsequent murder of his mother. In my research, I explore Clytemnestra's subversion of the norms of femininity, evaluate the reasons why Orestes is legally acquitted of his crime and consider whether the mitigating factors presented in his defence are significant enough that they justify matricide.

3. Nick Petrov: Can self driving cars be trusted?

I researched technologies already implemented in the everyday car as well as pieces of technology in development and trials. With this research, I came across autopilots and built a practical car to see the benefits it brings first-hand. I discovered the current issues of implementing these autopilots into society and discussed whether or not they can be trusted.

4. Parisa Rajappan: Does money "buy" happiness?

This is an age-old question which many have considered, and is particularly relevant in the study of economics, specifically behavioural economics. Through exploring the international, psychological and practical relationship between money and happiness, is it possible to conclude that money could "buy" happiness?

5. Rose Ru: Infant gut microbiota and future behaviour

Gut microbiota refers to all the micro-organisms residing in our gut; its relationship to health have long been established. Recent studies on both mice and humans have shown links between gut microbiota composition and host behaviour. Given that the infant gut microbiota develops simultaneously as an infant's other various systems, like brain neural, nervous and immune system, it is interesting to ask whether infant's gut microbiota composition have any long-term impact on their behavioural development. This work examines the evidence as well as the potential mechanisms behind this.

6. Caspar Semler-West: American identity and the Vietnam war

My project seeks to offer answers to some of the fundamental questions about the Vietnam war: why did the US get involved, why did it stay involved and why was the anti-war movement ultimately ineffective? My project begins by using primary sources to assert that the US decision to invade was deeply irrational, as such I propose that popular cultural and political narratives served as a driving force.

7. Thomas Simpson: Spontaneity in improvisation

When watching improvisers, we often wonder how they are able to generate material so spontaneously. I consider musical and conversational improvisation in parallel, by proposing that each takes the form of a dialogue. The influence of patterns in this dialogue and the paradoxical role of flow are examined to construct an explanation of how spontaneity is possible in improvisation.

8. Zane Soonawalla: Treatment of cognitive dissonance in depression

This study explores the association between depression and cognitive dissonance, the mental discomfort from contradictory beliefs and actions. It analyses various ways to increase and reduce cognitive dissonance, and their connection with depression, focusing on confirmation bias as a means to reducing dissonance. Evaluating the links between depression and methods to reduce cognitive dissonance, may show that helping depressed individuals deal with their cognitive dissonance will provide sustained benefits.

Waynflete Presentations, 3rd February - Round Three - 8.00pm

1. William Brown: Aqueducts in antiquity: physics and literature

The aqueducts were a marvel of the ancient world, an integral part of any expanding empire. However, what were the features of these aqueducts which allowed for their efficiency? How much engineering understanding had the Romans and other people of ancient civilisations obtained? Which of these ideas have we kept today and why? In this paper, in order to answer these questions, I draw comparisons between the structures of Roman aqueducts and more modern pieces of infrastructure, with opinions provided by contemporary Roman historians and engineers. It is evident that the methods and structures they chose to transport their water served them well, in maintaining a desirable flow state, and water quality, and overcoming uneven terrain.

2. Hana Heffer: Gender income inequality in Japan

Despite high levels of economic development and human capital, Japan has the third highest gender pay gap in the OECD. Emerging from a complex and self-inflicting cycle of economy and culture, such high levels of inequality continue to suppress female liberation and progress for the country as a whole.

3. Jack Lipman: DIY Fluorescence Spectroscopy of Quantum Dots

In this project, I analysed a range of luminescent materials using a homemade spectrometer. Fluorescent graphene quantum dots were given particular focus due to their unique optical properties which mimic those of individual atoms and can be described using a simple quantum mechanical particle-in-a-box model. Observed resonances were used to derive an estimate for both the effective mass of charge carriers within these nanocrystals, as well as their diameter on an atomic scale.

4. Sophia Moreno How resilient is Hungary's democracy?

In this project, I explore the factors that have led to the degradation of Hungary's democracy and the ways in which opposition parties and the EU have attempted to minimise the damage. Through this discussion, I conclude that Hungarian democracy is a good example of structural flaws in a modern democracy, which allow governments to manipulate the law and institutions of a country in order to remain in power indefinitely - a threat that is very real in Hungary. Such structural problems are not only issues for

developing countries, but as the Hungarian example shows, lie at the heart of fully-developed representative electoral systems.

5. Yiyi Xia: Is silicon-based life possible?

Of all the proposed exotic biochemistries life could use, silicon is by far the most popular. In this project, I aim to evaluate the biochemical possibility of silicon-based life. I first discuss the fundamental chemical requirements for life, and examine silicon chemistry and how it compares to carbon. Then, I explore the feasibility of silicon biochemistry in planetary solvents such as water, sulfuric acid, and cryosolvents such as liquid methane.

6. Shilang Yang: Electroconvulsive therapy vs antidepressants for depression

My project compares two very different treatments which aim to tackle depression: commonly prescribed SSRI antidepressants and electroconvulsive therapy (ECT). ECT is a somewhat stigmatised treatment that uses electric current to induce therapeutic seizures. The aim of my project is to evaluate whether ECT can be more effective at treating depression than SSRIs and if ECT should be used as a frontline therapy.