

The Scholar

20 NEW
ACADEMIC
ESSAYS
FROM THE
YOUNG
SCHOLARS
AT THE
BRILLIANT
CLUB



Vol. 1 No. 1
December 2014
thebrilliantclub.org

The **Brilliant** Club

Contents IN THIS ISSUE



5

NEWS

All the latest news from The Brilliant Club, including our Inaugural Conference.

6

GUEST ARTICLES

Jessica Giles, law lecturer at one of our partner universities, The Open University, tells us more about The Arguing Club, whilst Ruth Squire of King's College, London explains how to go about visiting a university.

8

STEM ARTICLES

Our first Science, Technology, Engineering and Maths (STEM) articles include reports of two new animal species, the science of drug addiction, research into brain activity using infrared spectroscopy and an introduction to computer-based drug design.

27

ARTS & HUMANITIES ARTICLES

This issue's articles focus on such diverse topics as terrorism, poverty, the concept of "fairness" and wildlife conservation in war zones.

51

SOCIAL SCIENCES ARTICLES

The Social Sciences articles from our Key Stage 5 pupils include discussions of eating disorders, behavioural nudges and the UK fast food market.

Editorial

WELCOME TO THE SCHOLAR

It is our great pleasure to introduce the first ever edition of *The Scholar* – the journal of The Brilliant Club. This publication will showcase the very best work from pupils taking part in the Scholars Programme across the UK, and we hope will be a fitting way to celebrate the fantastic work that the pupils we work with strive so hard to produce. It is designed to be a resource for pupils, teachers, parents and PhD tutors alike – as a tool for teaching and learning, and a place where you can seek inspiration to help you push just that little bit further in your understanding of a question or topic.

From my first day working at The Brilliant Club, I felt very strongly that the assignments that the pupils on the Scholars Programme were producing deserved to be celebrated beyond the Graduation Trip, and beyond any individual school. To illustrate just why I felt this way, let me tell you a brief story. Last autumn I was fortunate enough to tutor a group of Year 7 and 8 pupils from a school in South Birmingham. The group was hard-working, challenging and clever in equal measure and I was extremely proud that at the end of the programme every single pupil submitted a final assignment. I am not a generous marker (or so I'm told!) but still awarded every pupil at least a 2.ii, with most getting a 2.i and three pupils being awarded a 1st. To put this in context, this meant that most of the group were producing work of a good or excellent standard *at GCSE level*, fully three or four years before they would normally be expected

to do so. One of the assignments stood out in particular – you can read it on page 9 – as being particularly outstanding for the age group, incorporating all the elements I was looking for as well as some that hadn't even crossed my mind.

Some months later I was doing a talk about pupil attainment at a local university and decided to use this pupil's work as an exemplar. I read a short extract from the body of the assignment and then asked the audience to guess how old the pupil was who had written it. The average age guessed was 17. One member of the audience even thought I had read out an undergraduate's work to trick them! It is for this reason – work of this calibre and originality – that we believe it is so important to celebrate and publicise the work of the pupils on the Scholars Programme. By showing others what is possible we can reset the boundaries of what we think we are capable of and provide inspiration, food for thought and a jumping-off point for countless discussions and debates in the process.

We hope that you will join us in celebrating the work included here, both by publicising it widely and also by encouraging your peers, pupils or children to aim to become a published author and show the world the limitless potential they have to offer.



Dr Tom Wilks
Editor

Introduction

WHAT IS THE BRILLIANT CLUB?

The Brilliant Club is an award winning charity that exists to widen access to top universities for pupils from non-selective state schools. We aim to do this by recruiting, training and placing doctoral and postdoctoral researchers in non-selective state schools and sixth form colleges to deliver programmes of university-style tutorials to small groups of pupils. Through our programmes, pupils develop the knowledge, skills and ambition that help them to secure places at top universities.

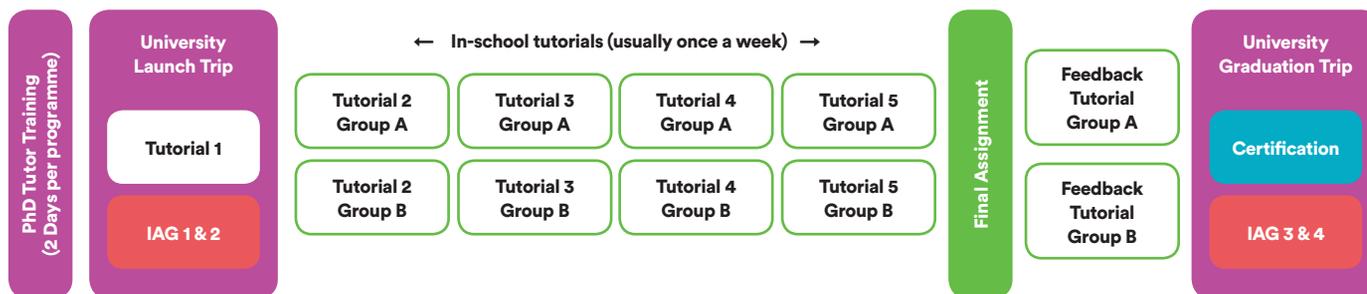
The Brilliant Club is building a national movement to mobilise doctoral and postdoctoral researchers to engage with schools serving low HE participation communities. We are currently working with over 200 schools and colleges across the country, placing over 250 PhD tutors to work with more than 5,000 pupils. Our PhD tutors are placed in schools to deliver the Scholars Programme to pupils from Year 5 through to Year 12. As the diagram below shows, the programme consists of a series of tutorials, trips and assignments.

The programme represents an authentic university-style challenge for the young people that we work with. Key Stage 2 and 3 pupils are asked to produce 1000- and 1,500-word assignment respectively, which is often the longest piece of work that they have tackled so far in their time at school.

By the time pupils reach Key Stage 5, they are asked to complete a 2,500-word assignment, which is at the same level as a piece of university coursework. Pupils receive marks at the key stage above their current level, and are marked in the style of university grades, gaining a 1st, 2:1, 2:2 or 3rd. We are delighted to be able to showcase our pupils' work and celebrate their achievements in an academic manner and we feel that a journal of academic articles by young scholars is not only the ideal format, but also a natural fit given the charity's work. Publishing original work is an important part of academia and it is enthusing for us to introduce our pupils not only to the world of research but also to the next stages of circulation and response from the academic community.

In creating The Scholar, we have brought together what we feel are the most exciting and compelling of the hundreds of assignments submitted as part of the 2014 Scholars Programme. We hope that all pupils who completed the programme are proud of their achievements but, given the number and quality of assignments submitted, we think that the pupils whose work is included here can be especially pleased. As well as highlighting the achievements of pupils, we would also like say thank you to the PhD tutors, teachers and parents who supported them throughout the programme.

Phd Tutor placement



- The Brilliant Club**
- Oversee placement with school
 - Work with school to support PhD tutor

- PhD Tutor**
- Deliver tutorials in school
 - Mark weekly assignments
 - Keep TBC and school up to date with placement

- = PhD Tutor Training
- = Academic Strand
- = Access Information, Advice and Guidance Strand

News

GOOD TO KNOW

Free University Access Scheme of Work

Working with the University of Sussex and the University of Warwick, The Brilliant Club have developed a University Access Scheme of Work, which offers a fully-resourced series of lessons that provide pupils with an introduction to a number of the key factors they ought to consider when applying to university. Each lesson is modest in its aims; acting as a stepping stone that allows pupils to go away and find out more about the key factors, rather than a comprehensive and definitive guide to applying to university. All the resources are free to download from our website at www.thebrilliantclub.org/schools/university-access-sow/.

The Brilliant Club holds Inaugural Access Conference

On 24th July 2014, and in partnership with King's College London, The Brilliant Club held its first conference on widening access to Higher Education, focused on addressing the question: 'How can universities and schools help pupils from low-HE participation backgrounds secure places and succeed at highly-selective universities?'. A huge range of speakers from universities, schools and third sector organisations contributed to a series of panel debates, presentations and workshops, with keynote talks by Lord Sutherland and Prof. Les Ebdon (Director of the Office for Fair Access). Please email hello@thebrilliantclub.org if you would like to receive a copy of the conference proceedings.

New Initial Teacher Training Programme launched

In partnership with George Abbot SCITT, Lampton School, King's College London and Challenge Partners, we were excited to launch Researchers in Schools (RIS) this September. The RIS programme is a salaried, two-year teacher training programme designed exclusively for researchers who have completed, or are finishing, their doctorate. As well as achieving QTS status, trainees complete a unique professional development programme, including opportunities to conduct and disseminate research. Having launched our first cohort of researchers who will be teaching this year, we are currently accepting applications from candidates to begin training in September 2015. To apply, go to www.researchersinschools.org/researchers/apply/

Guest Article

HOW TO VISIT A UNIVERSITY

Ruth Squire, Widening Participation Officer, Academic Schools and Partnerships, King's College London

As part of The Brilliant Club's Scholars Programme, students visit two highly selective universities. Here, Ruth Squire of King's College London give her thoughts on how to make the most of a visit.

Visiting a university, even with friends or family, can be a daunting experience. From the size of the lecture halls and libraries to the hundreds and even thousands of other students that you might see whilst you are there, everything can feel bigger and more important. University spaces can be unlike anywhere else. After all, how many other spaces contain a classroom, a library, a shop, a medical centre and a bar all in one building? Universities can also be startlingly different. At King's College London, where I work, you can leave the campus and be in the buzz of Covent Garden in minutes whereas a campus university such as Warwick puts you within strolling distance of lakes and wildlife.

Visiting a university doesn't have to be intimidating, which is why we and other universities provide lots of opportunities for people to visit. Last year over 2,500 young people visited King's through activities hosted by the Widening Participation Department and thousands of other potential students, their families and their teachers will have also visited our campuses through open days, taster days and summer schools. Visiting a university, and ideally lots of universities, is a really helpful part of figuring out what university life might be able to offer. However, not everyone is given the same opportunities to visit universities through their school, which is why programmes like The Brilliant Club and our own K+ sixth form programme, which bring students to universities and aspects of university life to schools, are a great way to make sure that students have a chance to explore what university offers. Whilst visiting a university is a great start, it's not always easy knowing how to make the most of it when you get there. Having worked alongside pupils from years 6-13 whilst they visit our campuses I can offer a few practical tips for students and teachers on how to make the most of any university trip:

FOR STUDENTS:

- Visit all the universities that you intend to apply to. You'll be spending 3+ years of your life there and, even if they might look similar in their prospectus, universities have a very different atmosphere.
- Keep a note of your thoughts on the universities that you visit – what did you like and dislike? Taking time to record these will help you later when making your choices and can provide inspiration for personal statements.
- Try something different – a taster session in a new subject or even visiting a university you hadn't considered. Lots of students on our K+ programme tell us that having a chance to try something new helped inspire them to pursue new interests.
- Don't just do open days – universities offer lots of other ways to experience studying with them, including student-led tours, taster courses and summer schools.
- Plan some questions to ask when you get there – getting together with friends to work out some questions in advance can be helpful.

- Try to ask questions that have more than a 'yes' or 'no' answer. For example, asking 'Do you have a swimming club?' will get you a simple yes or no but if you ask 'I really like swimming. Are there any clubs or societies at the university that might suit me?' might help you to find out about the gym facilities, related societies and how you can set up your own society at university.

FOR TEACHERS, ADVISORS AND ANYONE SUPPORTING A POTENTIAL UNIVERSITY STUDENT:

- If you want to arrange a trip for students to visit a university be clear about what you feel your students need but also be prepared to be flexible in how the university could meet that need. We receive many requests from schools and colleges. Without information about what you are looking for in a visit we can struggle to match you up with the right opportunity. High demand for some activities also means that we can't accommodate everyone but if you can be flexible, such as having a student ambassador visit your school instead of students visiting us, then we might be able to offer a really good alternative.
- Encourage your students to reflect on their university visits by asking them what they thought was good and not so good about the university or the courses they experienced. Questions that get the students thinking about themselves at university can be particularly helpful e.g. Do you think that you would want to go to a university like that? How would you cope with having hour long lectures?
- Take your students to different universities so that they can make comparisons. If a visit with the school isn't feasible then encourage older students to attend open days together. Putting a list of local university open days on the wall can be a good way to start.
- Talk about your own university. Teachers are a key source of information about universities for students who don't have experience of higher education in their family. Normalising conversations about university can help reduce some of the intimidation that students feel about university spaces. Do also be aware of your own bias towards certain universities or courses as students can take these very seriously. What you might consider an amusing university rivalry can put some students off applying.
- Teachers can have university visits too. Universities now offer lots of activities just for teachers so you can update your knowledge of universities, network with colleagues and learn about opportunities for your students. King's offers subject specific conferences and twilight sessions on topics including university admissions and informed qualification choices.

Introducing students to our university, at visits with The Brilliant Club, K+ or our summer schools, is one of the most enjoyable parts of my job. Over the course of a day, whatever the age of the students visiting, they start to relax into the university and can start seeing themselves as university students. Part of this comes from understanding the practical aspects of university life, like taking notes in lectures or travelling from home. What we sometimes take for granted as part of student life can appear incredibly complex to students without access to key information. Confusion over the practicalities of study and their place at university means that students find making important choices about their future even more challenging. University can offer students the opportunity to dream, to develop and to explore but that doesn't have to start in Fresher's Week. By visiting a university when still at school students can start to imagine new possibilities at any age, making them even better prepared for the big choices that lie ahead.

Guest Article

THE ARGUING CLUB

Jessica Giles, Law lecturer, The Open University

TAKING A LOOK AT ANOTHER INTERESTING ACADEMIC INTERVENTION DELIVERED BY RESEARCHERS AT ONE OF OUR PARTNER UNIVERSITIES - JESSICA GILES INTRODUCES THE ARGUING CLUB

It is a Friday in February 2014 and I am about to meet The Arguing Club for the first time – a group of six year 5 pupils from St Andrew’s Church of England School in Enfield who I will be working with every fortnight for the next two terms. If all goes well, I will be helping them to navigate the complex world of jurisprudence, introducing them to advocacy (and getting them to do it), and, ultimately, encouraging them to think beyond their existing world view and consider new intellectual horizons. We meet in a café after school and in this first session it is not entirely clear whether it is the interesting discussion or the plate of blueberry muffins that is holding the group’s attention – I am relieved that my agenda for this first tutorial is relatively flexible. Within the space of a few sessions, however, the Club are demonstrating debating and reasoning skills far beyond those normally employed by children their age.

I am a law lecturer with the Open University and carry out research in the field of law and religion, focusing in particular on the synthesis of law and theology. The challenge for me in working with The Arguing Club was to translate this experience into helping my pupils develop the skills required to discuss some of the big questions we face as a society. How do we know that something is right or wrong, just or unjust? What do we mean by “justice” and “fairness”? And, perhaps even more importantly, how do we create justice and act justly? In considering these questions we would touch on the concept of civil disobedience, and consider whether religious texts should be written into the law of the land. We started with “how do we know something is right or wrong?”. It took a while for the group to overcome the temptation to answer “because we know”. Once they did, however, their answers became more sophisticated. They came up with answers such as, “because your conscience tells you”, “we can look to religious texts” and “because we can base our decisions on a utilitarian idea of right and wrong”. In this way the sessions were about enabling the group to think and ask questions, and as we progressed through the meetings, it became clear that the biggest and only real hurdle for the group was to understand how to think philosophically and theologically. This was much more an issue of skills development than of what the pupils already knew. Once they understood that they were required to think beyond the obvious or automatic answers they might give with one question, they understood it in respect of them all.

Another important skill I helped The Arguing Club to develop was that of advocacy, enabling the pupils to appreciate and argue from more than one point of view. Having covered some heavy topics such as children in bonded labor and the conflict in Syria in earlier sessions, we chose a slightly lighter topic for their first stab at advocacy: whether it was appropriate to have chocolate for breakfast every morning. The pupils drew up lists of deontological and consequentialist arguments for and against the proposal and then argued in teams on one side or the other. They were encouraged to anticipate the other side’s arguments and counter them in advance, and were given the opportunity to respond when their ideas were questioned by the opposing side. The pupils were

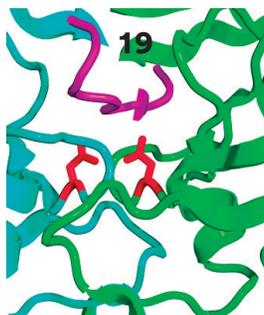
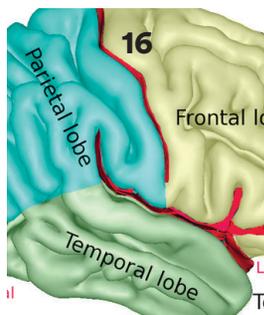
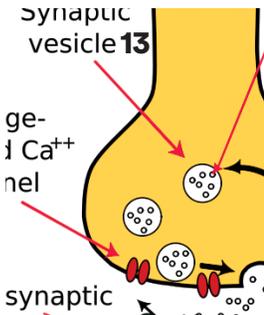
exceptionally mature in their approach to the discussions they took part in, and the presentations they were asked to prepare. They thought carefully and broadly about subjects and concepts and took the sessions seriously. One thing I was particularly impressed with was the respect they showed for each other’s points of view – they quickly learnt to tone down instinctive angry responses to others who did not agree with their ideas. This is a particularly important skill for advocates and academics alike, and of course generally for citizens of a democratic state. Indeed, in my area of law and religion, tolerance without agreement is vital to the operation of article 9 of the European Convention of Human Rights (the right to manifest religion in the public square).

When The Arguing Club was set up we had no entry requirements – those children who wanted to come were allowed to join. This had the unintended but very positive outcome that different members tended to bring different strengths to the group. One pupil – the youngest in a family of four – was particularly good at tenaciously arguing a point. Another, a member of the school debating team, was very good at providing supporting reasons for a proposition. One member was particularly thoughtful and measured in responding to questions, and one excelled when the group was filmed in order to create a podcast at the end of the year. What became evident was that the group provided a forum in which the children could share their skills and discover new ones, and excel. Being successful at something they enjoyed was a boost to their confidence and to their experience of learning. The group managed to put their learning into practice after a discussion on the concept of justice/fairness. Their whole class at school had recently had their access to the AstroTurf play area taken away, because the boys had been refusing to let the girls join in with their games. The pupils proposed that this was unfair, particularly on the girls. After using their newly-developed thinking skills to explore the reasons why this might be a proper use of the term ‘unfair’, and concluding that it was, they decided to write a letter to their teacher, which they then took into school and asked everyone in the class to sign. The letter apologised for the misbehaviour, explained how the taking away of the play area until the end of term was unfair and made a promise of future good behaviour if the play area were returned. Sure enough, the teachers were swayed by the pupils’ reasoned (and reasonable) approach, and the play area was reopened to the class. This practical exercise helped the pupils learn that it was possible to do something about injustice and put right a perceived wrong.

Thanks to the commitment and maturity of the children in the group, what started as an informal meeting to have some fun and learn some academic and legal skills along the way turned into a project which saw 9 and 10 year olds develop skills and discuss topics which some adults have difficulty with. I regularly found myself marvelling at the children’s development and was sometimes able to approach the sessions and open up questions in much the same way as I might in an undergraduate tutorial – something I never expected would happen when we first met over those blueberry muffins back in January. The pupils are now going into year 6 and I am excited to see how they will approach their next big challenge: transferring their newly developed skills for verbal reasoning onto paper.

IN THIS ISSUE

STEM Articles



9

THE MEXICAN WHITE JAY: AN ACCOUNT OF A NOVEL BIRD SPECIES

The first account of a new bird species discovered on the island of Neomesopotamia.

A. Horton and T.R. Wilks

11

THE CLAW: A NEW ADDITION TO THE FELIDAE

Introducing the newest member of the cat family.

A. Kara and C. Kelly

13

HOW DOES HEROIN CAUSE DRUG ADDICTION?

An extensive and interesting introduction to this important question.

E. Siva and K. Pillidge

16

THE PHYSICS OF MIND- READING: ILLUMINATING THE BRAIN'S ACTIVITY

Functional near-infrared spectroscopy (fNIRS) is used to evaluate functional activation in response to different stimuli.

V. Chris and G. Bale

19

COULD COMPUTER-DESIGNED DRUGS TARGET DEADLY DISEASES?

An extensive introduction to the use of computers in combating some of the world's biggest killers, including HIV.

M. Ajmal and M. Chikvaidze

23

EXPLORING PREFRONTAL ACTIVATION IN ADULTS WHEN FACED WITH A WORKING MEMORY TEST

Working memory is a process that has been shown in many studies to induce prefrontal activation in specific regions of the brain

R. Clemeno and B. Morris

THE MEXICAN WHITE JAY: AN ACCOUNT OF A NOVEL BIRD SPECIES

A. Horton, T.R. Wilks

Abstract

In this paper we will describe a new species: the Mexican white jay. The Mexican white jay is an intelligent bird species, found in the south-eastern rainforests of Mexico, with main features including an astounding ability to memorise and replicate whole strands of human conversation to frighten off potential predators (large snakes and mammals) and the ability to change the pigmentation in the skin to suit its background. Unlike chameleons, this change is voluntary and does not reflect the mood of the bird itself. The bird's noted habitats include the inside of hollow trees and nests at the top of the canopy. The Mexican white jay is clearly characterised as a bird, with it being a feathered, two legged, warm blooded, egg laying vertebrate. The Mexican white jay feeds on a mixture of fruits, fish and small mammals, most commonly the Mexican shrew.

DESCRIPTION

The Mexican white jay (Fig. 1) is small in stature, with the young and females at around 20-30 cm in height and some of the largest males reaching 40 cm. They have short, sleek, translucent feathers made of a hardwearing material called β -keratin to protect from rain and most of the deadly plants in the rainforests. When in need of camouflage, the Mexican white jay will simply adjust the pigments in its skin, with the colour showing through the translucent feathers. Beneath the transparent outer feathers are two cell layers that contain red and yellow pigments, or chromatophores. Below the chromatophores are cell layers that reflect blue and white light. Even deeper down is a layer of brown melanin (which gives human skin its various shades).

Levels of external light and heat, and internal chemical reactions cause these cells to expand or contract. Dissimilar to chameleons, this change is completely voluntary, not reflecting the bird's emotions but a will to survive and therefore camouflage.¹ Being some of the weaker animals in the rainforest, the Mexican white jays' incredible camouflage skills are a recognisable asset to survival as many of their predators mainly rely on sight. Scientists are unsure of the Mexican white jay's true skin colour, but many of these fascinating birds are a deep black colour when born, with a thin white stripe of white along the wing of the females.

Not unlike humans, this deep black is supposedly to protect against the harmful rays of UV of the sun.² The Mexican white jay has a long, enlarged beak, roughly 8 cm in length, used to penetrate the rough bark of trees to make a home in their shells or to feast upon the many grubs and small critters of the Mexican rainforests. They also have large, claw-like feet, with two 'fingers' facing forward and two facing backwards to help grip onto the many branches of the great Mexican forests. The males contain two extra 'fingers' on the right hand, both with 5 joints, allowing for the delicate composition of nests. These birds have fascinating eyes with incredible vision, with their stunning eyes accounting for more than a quarter of their head's mass. The Mexican white jay's eyes are incredibly complex,

allowing for colour, depth, shape and even infrared light to be perceived, which is essential to the Mexican white jay as it mainly hunts at night. This compensates for the Mexican white jay's limited (and in some cases almost inexistent) sense of smell.

HABITAT

The Mexican white jay is an incredibly adaptive species and has been found to reside in many different locations. Inside the bases of the plentiful hollow trees is a favourite home, with the sharp and specially adapted beak of this extraordinary creature used to break in and form the entrance. Another favourite is to construct a nest made up of a base of twigs and branches, followed by a bedding of moss and leaves (Fig. 2). These hideaways are all expertly woven, this being a chance for the males (made using their extra fingers) to make an impression on the surrounding females. Some of these incredible birds have even been found to lurk in some of the caves of Guila Naquitz, using the ledges as a residence for their nests.

DIET

The Mexican white jay is a distinctively carnivorous bird, with its main food supplement being small rodents, mammals and critters, although the Mexican white jay occasionally feeds on fruits. The food intake of the average male Mexican white jay is roughly 20 % of its body mass per day (BMPD), with the females ingesting more than 33 % BMPD. The females, despite being much smaller than the males, consume much larger prey than the males, in much higher quantities. Scientists believe that this is due to the fact that the females have a much higher metabolism than the somewhat dormant males. Whilst the active females are busy hunting prey and collecting food for their waiting chicks, the males spend their time weaving nests and attracting other female attention, meaning that the food consumption in the females must be a lot higher. The Mexican white jay has a distinct hunting pattern. Always in large groups, roughly 10-12 in a flight of birds, the fastest birds will lead, with the slow, injured or inexperienced taking up the rear.



Fig. 1. The Mexican White Jay photographed during a courtship display.

This not only saves time and energy, the slowest birds can also be helped with the aerodynamics, with the strongest flyers facing the worst of the wind whilst also creating an ‘up-lift’ for those behind. First, the slowest birds, in a group of around three or four, will go in for the kill, alarming the animal so it automatically runs straight into the death trap of faster birds waiting on the other side of the hunting ground. I use the term ‘slowest birds’ very loosely here. Even the most decrepit Mexican white jay could easily outpace the proudest of Indian spine tailed swift or pedigree falcon in a dive (top speed 320 kph).³



Fig. 2. Photograph of the nest of the Mexican White Jay showing the distinctive blue-speckled eggs.



Fig. 3. The Red-winged Blackbird, thought to be a close relative of the Mexican White Jay.

MATING BEHAVIOUR

The female Mexican white jay is extremely maternal, often nurturing not just two or three chicks of her own, but sharing the parenting role with other Mexican white jays. These birds create a kind of rota with the female parents. Whilst the males weave nests and fight for the top position and right to mate, the females look after their young and go hunting. Being extremely sociable animals, they enjoy the experience of working hard together and sharing the rewards. These birds have an extensive childhood, often up to 8 years. This is almost a quarter of the bird’s entire life span but allows for the undeniable intelligence of this species to develop, through hunting, mating and the creation of nests. The average Mexican white jay will take around 20 to 25 days to hatch, with the mother or another female bird in the rota, watching and keeping the eggs warm all throughout this period (Fig. 2).

This is a surprisingly short period for a bird of this height and size, but living in the rainforests, with danger of death at every corner, it is a distinct advantage to only have the pressure of keeping eggs alive for a shorter period.

EVOLUTIONARY HISTORY

It is thought that the Mexican white jay was originally a red winged black bird (Fig. 3), but when a large group of these birds migrated from the north of America to the rainforests of Mexico, their dark feathers were a distinct disadvantage in the colourful tropical climate. Changes in the genetic composition in a selected few birds allowed them to change the pigments in their skin, allowing them to survive much longer than those that didn’t possess this useful genetic mutation. These birds could easily disguise themselves, therefore allowing an elementary access to prey, whilst avoiding predators. This occurred over successive generations, as a result of natural selection acting on the genetic variation among individuals, and resulted in the development of a new species: the Mexican white jay. These fascinating creatures also developed their vocal chords to such an extent that they could memorise and effectively replicate short stands of human conversation, hence alarming nearby predators for example, humans, large mammals and birds. Another adaption is the change in the birds’ social preferences. Blackbirds are quite solitary animals, and whilst living in the cities of North America, they had no need to work together, but in the perilous rainforests of Mexico, with everyone taking a share in the feeding, protection and wellbeing of the entire group of birds, they clearly survive much longer as a species by working in groups.

References

1. The naked scientists (no date) *How and why do chameleons change colour*, available at: <http://www.thenakedscientists.com/HTML/questions/question/2634/> (accessed 23rd December 2013).
2. Human origins (no date) *Human skin colour variation*, available at: <http://humanorigins.si.edu/evidence/genetics/skin-color/modern-human-diversity-skin-color> (accessed 23rd December 2013).
3. Earth sky (no date) *What are the world’s fastest birds*, available at: <http://earthsky.org/earth/fastest-bird> (accessed 22nd December 2013).

About the authors

A. Horton is a Year 8 pupil at Bournville School in south Birmingham. Dr. Tom Wilks completed his PhD at the University of Warwick in polymer chemistry and delivered a course on evolution. The final assignment was to write a report on the discovery of a new animal species – this article was selected because of its extremely detailed and creative approach, as well as its academic approach to the subject.

THE CLAW: A NEW ADDITION TO THE FELIDAE

A. Kara, C. Kelly

Abstract

My name is Charles Darwin Junior and I am an explorer. I have recently returned from Neomesopotamia where I have discovered a new organism which I have named the 'Claw' (*Clawsometh*). In this report I will describe the environment of Neomesopotamia, the selective pressures in the environment, the Claw's adaptations, and its evolutionary history. I have classified the Claw as an addition to the *Felidae* (cat) family, because it shares common traits with this group such as a flexible spine, round head, pointed ears, five toes on its front feet and four on its back feet, and retractable claws.¹

Claws also have thick white fur which they lose to reveal white skin, emerald green eyes, and ears which expand and contract depending on the weather. They weigh between 30–60 kg, are 1.2 m to 1.5 m long and have a tail that is 90 cm long which is very similar to the snow leopard.² Claws have two huge curved canines which are around 25 cm long and hang out of their mouth; their teeth are strong unlike the sabre tooth tiger which had weak canines.³ They also have big jaws and razor sharp teeth, wide padded paws for grip, and a lot of blubber in their tail which is stored or burnt off depending on the season.

Neomesopotamia is a substantial sized island in Antarctica located just off of the Ross ice shelf, which is found in the Ross Sea inside the Antarctic circle (see Fig. 1). It is very icy and covered in a thick layer of snow. Unlike Antarctica, Neomesopotamia is not considered a desert since it snows regularly.⁴ Antarctica has two conspicuous seasons – a short summer and a very long winter – which is the same as the newly discovered island of Neomesopotamia.⁵ The island has an average elevation of 1152 m, which is almost eight times the average elevation of the United Kingdom (at 152 m).⁶ Neomesopotamia has very strong winds which have been recorded to reach 178 kph. Any living organism should have good grip to be able to survive in such harsh conditions. Neomesopotamia is immensely cold, especially during the winter where the average temperature is around 7°C . The lowest recorded temperature is around 12°C . The organisms living on the island should be able retain heat to keep warm during the entire winter.

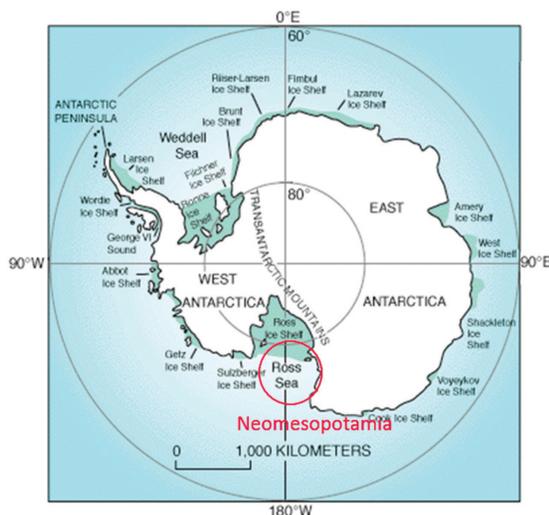


Fig. 1. Map showing the location of Neomesopotamia.

However throughout the summer the weather changes entirely. The highest recorded temperature in

Neomesopotamia has been identified to be around 14°C , while the average temperature during the summer season is 7°C . The Claws are fully adapted to their surroundings since they can lose their fur and blubber which keeps it warm during the winter. Since Neomesopotamia is famous for having warm waters during the course of the summer, Claws live in these lakes until the summer has ended.

ENVIRONMENT AND ADAPTATIONS

I will now describe the selective pressures in Neomesopotamia's environment and the ways that the Claws have adapted to each specific one over time to become more suited to their habitat. A selective pressure forces an organism to adapt to a certain feature of its environment in order to survive. An adaptation is any feature of an organism that makes it well suited to living in its surroundings. Organisms need to be highly adapted to their surroundings to be able to survive and reproduce. The best suited to their surroundings will pass on their genes to the next generation, which is which is called natural selection. As I have described, Neomesopotamia is cold and icy. The Claws have adapted to living on the island because they have thick fur to keep warm in the intensely frigid weather conditions. This feature of their bodies allows them to survive by avoiding freezing to death, which is important because they need to survive in order to pass on genes and save their species from extinction. Another selective pressure is the need to catch prey. The Claws have sharp teeth which aids them when attacking their prey. They are also able to swim which lets them search for fish, which are its main food source, over large distances. The Claws are cats but some aspects of them classify them as semi-aquatic animals because they are able to breathe underwater as well as being able to live on land just like the platypus and the duck.

One main feature which makes the Claw different from all other cats is that they are able to make their back feet webbed which helps them to swim.



Fig. 2. Food chain of the Claw.

The unique adaptation of having webbed feet occurs as Claws enter the water. It takes around one day after it enters the water, by this time they would have already shed their fur. The Claw do not usually take long swims in the water – not even to catch prey. Their webbed feet are only used during the summer season when fishes from the Ross Sea and the Antarctic migrate to the lakes of Neomesopotamia. As a result Claws live underwater throughout the entire summer. Claws are highly developed and do not only feed on fish, they also eat penguins when it is winter. Claws are not the top predators in their food chain (see Fig. 2) as they are hunted by hippopotamus seals which are very fierce.⁷ The adaptations that allow them to avoid being eaten by the seals are their white fur and skin, and their speed. White fur allows them to camouflage in with the ice and snow in Neomesopotamia, helping them to hide from their predators.

The Claw are also very fast which could help them to escape when they are under attack by leopard seals, and they also have a thick layer of fat under their skin to keep them warm. They lose and gain this blubber as the seasons change: in the summer they get rid of it and in the winter they store huge amounts of it through hibernation so they can keep warm. When they are not under water, which is most of the time, Claws use their large wide paws to walk in the snow without slipping or falling over, because their wide paws spread their weight over the ground. The Claws also have gills which they gain during the summer and when they live under water for a few months their nostrils and ears close enabling them to not get cold water into their bodies.

The Claws are greatly adapted to their habitat but are still at risk of becoming extinct. One reason they are at risk of extinction is if the fishes from around Neomesopotamia stop migrating to it. This will not make them go extinct straight away because they also feed on penguins but over time this could lead to their extinction. Another reason they are at risk of extinction is if global warming continues or increases. According to NASA global warming will continue to increase, this will result in a huge increase in the Earth's temperature. Even though Claws are able to breathe underwater and survive there during the summer, they can't last under water for more than one third of a year since they will start regaining their fur and blubber. This would leave them helpless and stranded under the water since it would be almost impossible for them to swim with lots of weight and without webbed feet.

I believe that the Claw started off its evolution as a panther that reached Neomesopotamia, presumably by going through New Zealand. The Panther could have had a mutation in its DNA enabling it to survive in the cold and underwater, making it a contender for survival through natural selection. Some evidence showing the Claw is related to panthers is the fossil record from

Neomesopotamia that I have studied. I found clues leading to the migration of the panther and how it has adapted over time. Another animal the Claw could have been related to is the sabre toothed tiger, since it has similar teeth and appearance. The fact of having sabre teeth could have originated from the sabre tooth tiger because it was one of the only cats that had these type of teeth and was the most likely creature the Claw had adapted from. The sabre toothed tiger also lived in similar weather conditions which is another piece of evidence linking to its relation to the Claw.

CONCLUSION

To conclude the Claw is a semi-aquatic cat which I have discovered in the stunning land of Neomesopotamia which is located in Antarctica. My journey to Neomesopotamia was very fascinating and exciting. I hope you have enjoyed reading about my findings.

References

1. eHow (no date) *Characteristics of Felidae*, available at: http://www.ehow.com/list_6921984_characteristics-felidae.html#ixzz2oxxMYolx (accessed December 2013).
2. National Geographic (no date) *Snow Leopards, Snow Leopard Pictures, Snow Leopard Facts*, available at: <http://animals.nationalgeographic.com/animals/mammals/snow-leopard.html> (accessed December 2013).
3. Digital Journal (4 January 2012) *Sabre-toothed tigers had weak canine teeth, study shows*, available at: <http://digitaljournal.com/article/317308> (accessed December 2013).
4. NASA (no date) *What Is Antarctica?*, available at: http://www.nasa.gov/audience/forstudents/5-8/features/what-is-antarctica-58.html#_USV2MfRdXvA (accessed December 2013).
5. National Geographic (no date) *National Geographic SeaLab: Antarctica-The Place*, available at: <http://www.nationalgeographic.co.uk/sealab/antarctica/place.html> (accessed December 2013).
6. Australian Antarctic Division (30 January 2003), *Environment*, available at: <http://www.antarctica.gov.au/about-antarctica/environment> (accessed December 2013).
7. NASA (11 March 2014) *Long-Term Warming Likely to Be Significant Despite Recent Slowdown*, available at: <http://www.nasa.gov/press/2014/march/long-term-warming-likely-to-be-significant-despite-recent-slowdown/#.Uzk5j6L6Qig> (accessed December 2013).

About the authors

A. Kara is a Year 8 pupil at Lister Community School in east London. Claire Kelly is studying for her PhD at the University of Cambridge, where her research focuses on social psychology, specifically the barriers and enablers to providing hospital services for adults with intellectual disabilities. The final assignment was to write a report on the discovery of a new animal species – this article was selected because of its extremely detailed and creative approach, as well as its extensive use of thorough independent research.

HOW DOES HEROIN CAUSE DRUG ADDICTION?

E. Siva, K. Pillidge

Abstract

The topic of this essay is the drug diacetylmorphine, commonly known as heroin, which has many other street names such as smack and horse. This essay will discuss how this drug causes addiction, and will cover the concept of addiction, following background information on heroin, a brief explanation on dopamine and the nervous system and subsequently how heroin specifically increases dopamine, finally exploring the different treatments for addiction and various opinions of them.

ADDICTION

Recently, research on substances has improved immensely, increasing the understanding of the biological and genetic causes of addiction which in turn has helped accept addiction as a biological brain disorder that is long lasting and worsening with time. Understanding how substances interact with various cells and chemicals in the brain can be mapped out using a neural pathway. Addiction can be defined as the sustained recurrence of a behaviour regardless of the negative consequences and is referred to as a chronic, relapsing disorder. The common symptoms of addiction, specifically substance dependence, include the inability to stop using due to withdrawal symptoms and/ or the reassurance of the drug's effects, denial, the built up drug tolerance also known as desensitization which means the user has to intake larger quantities to feel the same 'high' as before and lastly the obsession with the substance so that the abuser's life revolves around it. The impact the addiction has on people's lives is severe and transforms their life entirely and some believe that a full recovery from an addiction is impossible. The types of addiction people have can vary and include drug abuse, gambling, food, exercise and computer addiction.

HEROIN

Heroin is considered an opiate analgesic which produces euphoria and pleasurable feelings as well as pain relief and sedation. There are other opioid drugs such as Morphine, Vicodin, Percodan and Fentanyl and Oxycodone. Opioid drugs are both used recreationally and medically. Heroin is synthesized from morphine which is extracted from an opium poppy. Heroin was created when the addiction to opium was widely known and an attempt to eliminate the addictiveness of morphine was made by German pharmacists. They tampered with the morphine structure and invented a derived form – heroin – which was supposedly a less harmful and less addictive substitution to morphine. However it was in actual fact 2/3 times stronger than morphine as it was an already- metabolised form of morphine so had an easier and more direct route to the brain.

Heroin is an illegal class A drug however an estimated number of 9.2 million take heroin in the world out of the estimated 13.5 million who take opioids. Users can take heroin in several ways, it can be injected directly into the veins or muscles via hypodermic syringe, intranasal consumption of a powdered

form, inhalation in rolled joints and oral consumption. Users sharing the needles can pass on viruses and can become infected with HIV. The different ways a drug can enter the body affect the intensity of its effect and the concentration of the drug in the brain during the time after the administration of the drug.

THE NERVOUS SYSTEM AND DOPAMINE

Neurones

There are two types of cells in the nervous system: neurones (nerve cells) and glia (glia cells). A neurone is a cell that has specialised features to relay messages around the body and to the brain. It has 4 defined regions: the cell body, dendrites, axons and the presynaptic or axon terminal (Fig. 1). There are 3 types of neurones: sensory neurone, motor neurone and relay neurone, each with a slightly different function.

Neurotransmission

Neurones communicate with others by neurotransmitters. Each neurotransmitter fits on its receptor on the surface of the neighbouring neurone. Some chemicals can interfere with the signalling by acting on the neurotransmitters. The process where neurones pass impulses to each other is called neurotransmission. They do this both chemically and electrically. The area between the two neurones is called a synapse where the communication occurs. Fig. 2 shows the neurotransmission process: firstly the synthesis of the neurotransmitter which can take place in the cell body, in the axon or the axon terminal. In the axon terminals the neurotransmitters are stored in vesicles. Then when action potentials arrive at the axon terminals, the voltage-gated Ca^{2+} channels open and Ca^{2+} (calcium) enters the axon terminal signalling the vesicles to move to the membrane causing the presynaptic neurone to release the neurotransmitters which is a chemical transmitter substance, this release happens by exocytosis. This transmitter diffuses across the presynaptic cleft, activates and binds to its specific receptors (which are proteins) on the surface of the postsynaptic neurone. Then the receptor causes the ionic channels on the membrane to either open (excitation) or close (inhibition). Whether excitation or inhibition follows depends on what chemical served as the neurotransmitter. If excitation happens the channels open causing depolarisation to occur then the initiation of another action potential starts. The neurotransmitter then either disposes and breaks down enzymatically or is taken back to the

terminal from where it was initially released, via the DAT (re-uptake protein transporter/pump) and is recycled.

Dopamine

Dopamine is one of three neurotransmitters known as monoamines, the other two are serotonin and noradrenaline. Dopamine specifically is involved with reward and movement and regulates the feeling of pleasure (euphoria and satisfaction). Dopamine synthesis begins as an amino acid molecule called L-tyrosine and is converted by tyrosine hydroxylase into L-DOPA which is then converted to Dopamine by DOPA decarboxylase. They are stored in vesicles and once released it binds to dopamine specific receptors called D1 and D5. This is 8 dopamine pathways in the brain, but the four main ones are:

- mesolimbic pathway
- mesocortical pathway
- nigrostriatal pathway
- tuberoinfundibular pathway

The mesolimbic pathway transmits dopamine via the nucleus accumbens to the VTA (the limbic system). The limbic reward system is a brain circuit crucial to the neurological reinforcement system. Any abuse of substance has an effect on the limbic reward system. It can also affect the nucleus accumbens by increasing the release of dopamine. High levels of free dopamine in the brain enhance mood and body movement. However too much results in nervousness, irritability, aggressiveness and paranoia. Additionally too little can create tremors and paralysis of Parkinson's disease. Dopamine is thought to help the reinforcement of and motivation for the repetitive actions, suggesting that the limbic reward system and levels of free dopamine have a close connection in providing the abuse and addiction to all substances. However not all drugs increase dopamine levels in the same way, some are direct and some are indirect, some block and some increase dopamine.

EFFECT OF HEROIN AND ITS ADDICTION

The body naturally produces its own opiate substances as a neurotransmitter, they are called endogenous opioids, and an example is an endorphin. However when heroin is taken, it releases 2-10 times the amount of dopamine that natural rewards do on their own, as well as more quickly and reliably.

A substance entering the blood stream get transported to different organs and systems including the brain. If it enters the liver it may be metabolised or if it enters the kidney it can be excreted. To enter the brain the molecule must pass through a chemical protection system which consists of the blood brain barrier. These blood barriers have tight cell wall junctions keeping larger electrically charged molecules from entering the brain. However small neutral molecules such as heroin can pass through the blood brain barrier and enter the brain. Once heroin reaches the brain it is converted to morphine by enzymes. Then morphine (heroin) binds to the opiate receptors which activates them to increase dopamine by feeding forward to activate the dopamine neurones which send a signal to the dopamine terminals to release more dopamine. Heroin indirectly increases dopamine when it excites the dopamine-containing neurones in the VTA (ventral tegmental area) so that they produce more action potential. An increase in the action potential increases the amount of dopamine released into the synapse. GABA normally reduces the activity of neurons by allowing chloride ions to enter the postsynaptic

neurons, meaning that it normally inhibits dopamine release, however the opiate receptor activation decrease GABA so the dopamine release is now increased. These opiate receptors are concentrated in areas within the reward pathway including areas such as the VTA and nucleus accumbens.

The overstimulation of the brain's pleasure system, which rewards our natural behaviour, produces euphoric effects wanted by people who abuse drugs and this teaches them to repeat the behaviour as people tend to repeat activities that provide the sense of pleasure and reward. As well as that, heroin is more powerful than the body's own endorphins because it provides control to the user over how much of the substance hits the brain. Therefore when this pleasure circuit is activated the brain remembers it and teaches the user to repeat it without thinking, and this becomes drug abuse.

Dependence and tolerance are both conditions that lead to addiction. Dependence occurs when the body adapts on not making the natural products itself and becomes dependent to the drug producing the dopamine to ensure comfort and relaxation. Tolerance is when the body adapts to the drug so it has less of an impact on the brain's reward centre, this is also known as desensitization. The brain adapts by producing less dopamine or reducing the dopamine receptors, meaning that the body requires more of the drug to stimulate at the same high as before. This is how addiction forms.

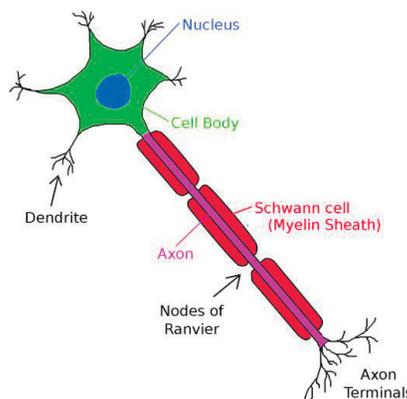


Fig. 1. Structure of a neurone, with key features indicated.

RESEARCH AND THE FUTURE

In conclusion, I do believe that addiction is a brain disorder and not just the lack of willpower. The most important method in dealing with substance abuse is to understand that each user is unique in why they take drugs, why they become addicted, what the drug does and how the drug affects the user. The root cause for substance use and dependence has 72 risk factors acknowledged, including poverty, social dysfunction, deprived education and poor upbringing. These risk factors and other genetic and environmental factors contribute to the user's initial choice to start using the substance. The continued use occurs due to the user liking the substance's effects which usually transforms a person's mood, perception and emotional state.

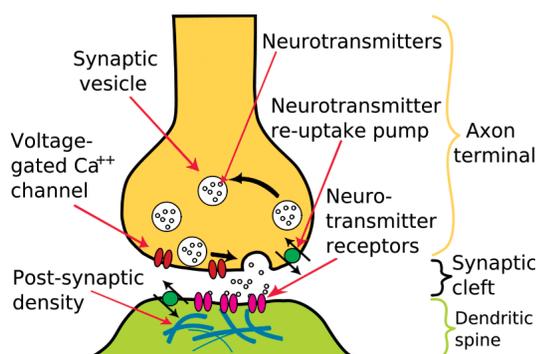


Fig. 2. Illustration of the neurotransmission process.

Treatments have to address the brain changes that occur due to drug abuse. When heroin addicts first quit ('cold turkey'), they experience severe withdrawal symptoms called including pain, diarrhoea, nausea and vomiting. To help the addicts in this detoxification period, medication in the short term can be used to help the cravings and treat the physical symptoms. However medication is also needed in the long term as part of an ongoing treatment process to help the addicts to stop using completely. The medication developed for this use uses the same receptors as heroin but is much safer and unlikely to produce harmful side effects like addiction. There are three types of medication:

- Agonists: these activate the opioid receptors. *E.g. Methadone which is taken orally, diminishes the 'high' that the heroin addict experience but prevents the withdrawal symptoms. It is given out to patients on a daily basis by only certified programs.*
- Partial agonists: also activate opioid receptors however produce a weaker response. *E.g. Buprenorphine which stops the craving for heroin like the agonists but without the 'high'. It is also approved to be prescribed so doesn't require the daily trips like methadone does, making it accessible to the users.*
- Antagonists: these block the receptor that opioids act on. *E.g. Naltrexone, which isn't addicting nor sedating and only needs to be taken once a month.*

If heroin produces different effects on the CNS how come some are more likely to become addicted than others? Couldn't anyone become addicted to the drug since it is a chronic, relapsing brain disorder? Some people believe that everyone potentially could develop a heroin dependency, some are just more likely to or have a more severe addiction as they may be unable to synthesise endorphins and consequently their body wouldn't be able to make it on their own very well.

Bibliography

- Livestrong (no date) *High Levels of Dopamine in the Brain*, available at: <http://www.livestrong.com/article/287021-high-levels-of-dopamine-in-the-brain/> (Accessed 23 April 2014).
- Wikipedia (no date) *Dopaminergic pathways*, available at: http://en.wikipedia.org/wiki/Dopaminergic_pathways (Accessed 23 April 2014).
- Wikipedia (no date) *Mesolimbic pathway*, available at: http://en.wikipedia.org/wiki/Mesolimbic_pathway (Accessed 23 April 2014).
- Wikipedia (no date) *Dopamine*, available at: <http://en.wikipedia.org/wiki/Dopamine> (Accessed 23 April 2014).
- Slate.com (no date) *What is dopamine? Love, lust, sex, addiction, gambling, motivation, reward*, available at: http://www.slate.com/articles/health_and_science/science/2013/07/what_is_dopamine_love_lust_sex_addiction_gambling_motivation_reward.html (Accessed 23 April 2014).
- BBC - GCSE Bitesize (no date) *Neurons*, available at: http://www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/human/thenervousssystemrev2.shtm (Accessed 23 April 2014).
- University of West England (no date) *Synapses and Neurotransmission -*

Introduction, available at: <http://learntech.uwe.ac.uk/synapsesNeuro/Default.aspx?ageid=1907> (Accessed 23 April 2014).

- Scientopia.org (no date) *Back to Basics 1: Neurotransmission! | Neurotic Physiology*, available at: <http://scientopia.org/blogs/scicurious/2010/08/23/back-to-basics-1-neurotransmission/> (Accessed 23 April 2014).
- Wikipedia (no date) *Agonist*, available at: <http://en.wikipedia.org/wiki/Agonist> (Accessed 23 April 2014).
- Scholastic.com (no date) *Drug Facts: Heroin*, available at: <http://headsip.scholastic.com/articles/drug-facts-heroin> (Accessed 23 April 2014).
- Drug Policy Alliance (no date) *Heroin Facts and Effects*, available at: <http://www.drugpolicy.org/drug-facts/heroin-facts> (Accessed 23 April 2014).
- BBC (no date) *Advice - Heroin*, available at: http://www.bbc.co.uk/radio1/advice/factfile_az/heroin (Accessed 23 April 2014).
- Wikipedia (no date) *Opioid dependence*, available at: http://en.wikipedia.org/wiki/Opioid_dependence (Accessed 23 April 2014).
- Wikipedia (no date) *Heroin*, available at: <http://en.wikipedia.org/wiki/Heroin> (Accessed 23 April 2014).
- About.com (no date) *What Are the Treatments for Heroin Addiction?* available at: http://alcoholism.about.com/cs/heroin/f/herion_fa09.htm (Accessed 23 April 2014).
- The Brain from Top to Bottom (no date) *How Drugs Affect Neurotransmitters*, available at: http://thebrain.mcgill.ca/flash/i/i_03/i_03_m/i_03_m_par/i_03_m_par_heroine.html (Accessed 23 April 2014).
- National Institute of Health (no date) *The Brain—Lesson 3—Drugs Change the Way Neurons Communicate*, available at: <http://science.education.nih.gov/supplements/nih2/addiction/guide/lesson3-1.htm> (Accessed 23 April 2014).
- NACASA (no date) *Opiates, The Brain's Response to Drugs*, available at: <http://www.necasaonline.org/Customer-Content/WWW/CMS/files/Opiates-The-Brains-Response-to-Drugs-060105.pdf> (Accessed 23 April 2014).
- Wikipedia (no date) *Addiction*, available at: <http://en.wikipedia.org/wiki/Addiction> (Accessed 23 April 2014).
- Helpline.org (no date) *Drug Abuse and Addiction: Signs, Symptoms, and Help for Drug Problems and Substance Abuse*, available at: http://www.helpline.org/mental/drug_substance_abuse_addiction_signs_effects_treatment.htm (Accessed 23 April 2014).
- Reach Out (no date) *Impact of Drug Use On Your Life | Facts about Drugs and Effects of Drug Abuse*, available at: <http://us.reachout.com/facts/factsheet/impact-of-drug-use-on-your-life> (Accessed 23 April 2014).

About the authors

E. Siva is a Year 9 pupil at JCoSS in north London. Katie Pillidge is studying for a PhD at University College London, where her research focuses on the behaviour of NK1 receptor knock-out mice with relation to ADHD.

PhD tutor's note

E. was part of the year 9 STEM group at JCoSS in the Spring Placements 2014, who took my "Neuroscience of Illicit Drugs" course. She was quiet throughout tutorials, but seemed to take everything in her stride. The essay she produced was a first class essay: it was well written, well-structured and well thought out. The topic of her essay was drug addiction, and in particular the drug she was nominated to research was heroin. She talks about the background of heroin use, how addiction develops and revolves around changes in dopamine, and how heroin addiction can be treated.

A significant proportion of her essay was based on material she found outside of the tutorials: for this reason I've chosen to nominate her essay over others with similar marks. She also presented graphs, statistics and her own opinions throughout, and I was impressed with the quality and the quantity of material she covered in 2000 words. I think it was a very interesting essay and a great example of the high standard of work year 9 pupils can produce.

A FUNCTIONAL NEAR-INFRARED SPECTROSCOPY STUDY OF THE PHYSICS OF MIND-READING: ILLUMINATING THE BRAIN'S ACTIVITY

V. Chris, G. Bale

Abstract

Functional near-infrared spectroscopy (fNIRS) was used to evaluate whether a stimulus triggers functional activation in different participants. The results were statistically analysed and showed that there was a link between the stimulus and functional activation ($p < 0.05$). The study indicates that different stimuli activate different regions of the brain.

Key Words functional near-infrared spectroscopy (fNIRS), stimulation, functional activation, statistical analysis.

INTRODUCTION

The brain is a major organ within the human body. It is hard to know which part of the brain does a certain function. Near-infrared spectroscopy (NIRS) is used in order to study more about the brain and to observe the activity of the brain. It enables scientists to understand more of what the brain is like and how it works. This technique is very efficient as it doesn't require the opening of the head in order to get access but uses the simple physics of light. NIRS is a way that neuroscientists can test how certain stimuli cause the brain to respond. The results of this experiment tell scientists whether or not the brain is functionally active in one region or not. The basic technology is common to all systems, but the measured signal differs depending on the location of the probe and the amount of light received. There are many possible placements of fNIRS probes, allowing the study of multiple brain regions (Jacob, 2008).

THE BRAIN AND ITS FUNCTIONAL REGIONS

The brain is divided into functional regions (Fig. 1); we know this through medical cases which suggest that certain functional regions in the brain are responsible for certain tasks. An example of these medical cases would be the incident that Phineas Gage was involved in that damaged his frontal lobe and caused him change from a respectful man to one who was unable to hold back his discourteous comments (Bale, 2014:10). From this accident we have learnt that different parts of the brain control different aspects of our nature: the frontal lobe is involved with planning, emotions and strategic thinking; the somatomotor cortex controls movement; the somatosensory cortex is related to touch; the parietal lobe is to do with learning and comprehension; the occipital lobe is involved with visual processing; the temporal lobe controls memory; the cerebellum is related to attention, language, motor control, fear and pleasure; and the spinal cord conducts information to and from the rest of the body (Bale, 2014:12).

By using a certain region of the brain, that part is said to be functionally active, meaning the neurones consume more oxygen, which is supplied by haemoglobin (a chemical in red blood cells). The need for oxygen increases, so the amount of oxygenated haemoglobin (HbO₂) in the blood going to the

functionally active area, increases. Consequently, the amount of deoxygenated haemoglobin (HHb) in the region decreases, as there is much more oxyhaemoglobin (Bale, 2014:13).

We can use this information about blood flow change to measure functional activation and understand which regions of the brain are active. Brain imaging can also be used for this reason. It is said to be important as the 'range of technologies now provide unprecedented sensitivity to visualization of brain structure and function from the level of individual molecules to the whole brain' (Asbury, 2011:1). For example, a near-infrared spectroscopy (NIRS) system uses the near-infrared section of the electromagnetic spectrum (650- 1000 nm). It is ideal to use, especially on the brain as 'near-infrared spectroscopy (NIRS) is a fast and nondestructive technique' which can be used to monitor how much infrared radiation is absorbed by the brain; the more infrared absorbed by one area of the brain, the more functionally active that region of the brain is as the localized blood volume in that area changes quickly (Reich, 2005:1110).

Another example of an imaging technique would be magnetic resonance imaging (MRI). MRI is a non-invasive technique that uses a magnetic field and radio waves to produce images of and measure the brain's activity, mostly by signals from water which helps 'to develop information on brain structures and functions' as water makes up a majority of the body's weight. By exposing water molecules to such a magnetic field, the protons produce a signal that can be read by the MRI machines (Asbury, 2011:11). However, MRI machines are very expensive and are not portable.

THE NIRS SYSTEM

The NIRS system can be used to study the brain closely, using a brain-computer interface. There are many components needed to make the complete system but when the correct equipment is used, it can bring about accurate results. For the source of light, a bulb, light LASER (light amplification by stimulated emission of radiation) or LED (light-emitting diode) can be used to be shone into the brain with optical fibres. The light is detected by optical

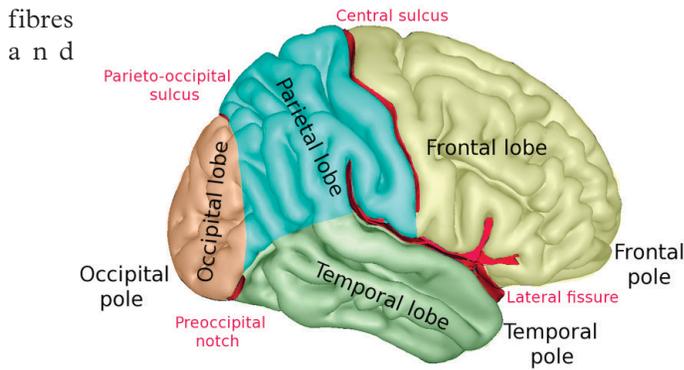


Fig. 1. The functional regions of the brain and their names.

diffraction grating or prism can be used to split the light into its wavelengths in a spectrometer. The spectrometer has a camera which detects the light coming out and compares it to how much light came in to allow us to work out how much light was absorbed by HbO₂ and HHb.

METHODS

For the experiment, data was collected using a Hitachi system with the WOT-220 Optical Topography System. With this system data was collected at 5 Hz and the source laser diodes delivered light at 705 nm and 850 nm. These are interesting wavelengths to use as they are either side of 800 nm which is where the spectra of HbO₂ and HHb cross over.

The experimental procedure had to be fairly conducted in order for the results to be accurate and reliable. This means that only one factor at a time can be changed: the participant. If the experiment was unfair, the results wouldn't be useful as factual information and the experiment would have to be repeated which uses up time, energy and is not convenient for the participant being observed. There were a number of ways in which the experiment was kept fair: all items that disrupted attention were taken away from the area of vision, the same seating position was used for all participants, the optodes/probes were placed in the same areas on the head, the same activities were done during the same amount of time, the test was repeated 8 times and a rest period was allowed. The participants were also asked to be still and silent during the 'functional paradigm' which also keeps the experiment fair and controls the experiment, as false evidence could be detected due to extra movement.

The experiment involved 8 different measurements on 3 different participants and each measurement lasted for 25 seconds, consisting of:

- 5 seconds for the rest period (baseline)
- 10 seconds of stimulation activities
- 15 seconds for the next rest period

The participant was then asked to use their working memory by looking at different shapes and to mentally manipulate them. These activities had an effect on the blood flow changes in the brain and the measurements from this activity were taken from the frontal lobe and were measuring the changes in HbO₂ and HHb. Both the pre-stimulation and post-stimulation averages of HbO₂ and HHb were found.

The measurements obtained were statistically analysed (using

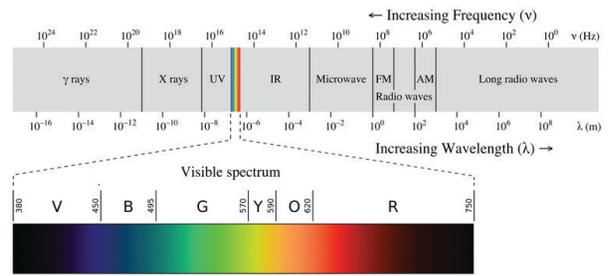


Fig. 2. The electromagnetic spectrum.

a t-test) p-values because p-values tell the real likelihood that there is a real difference; it 'is a way to check whether two averages from two different groups are reliably different from each other' (Bale, 2014:45). In order to calculate the p-values, the baseline and stimulation period were compared (if the p-value is less than 0.05 (5%), then it is recognised that there is a real difference between the groups, so functional activation has been observed). The p-values for both the HbO₂ and HHb were calculated, based on 8 different measurements. These values (which will be further discussed in the 'Discussion' section) suggested that there was a link between the stimulus and the functionality of the region, except for the second data set as it showed that no functional activation occurred, with a p-value of over 0.10 (over 10%).

RESULTS

The p-values of the experiment are shown in Fig. 3. The p-values plotted on a graph are shown in Fig. 4. There was a significant rise in HbO₂ (O₂Hb) levels due to the stimulation of functional activation.

DISCUSSION

Functional activation occurs when there is a stimulus causing the brain to respond in a certain brain region. As more energy is needed by the neurons in that certain region, there is a high demand for oxygen, so the blood supplies more HbO₂ to that area in the brain. By using NIRS, a significant rise in HbO₂ can be observed when there is a stimulus, as HHb and HbO₂ have different absorption spectra of light. For example, stimuli that involve planning, strategy and/or emotion will trigger HbO₂ levels in the frontal lobe region to increase because that is the area which is required for those activities, so the neurones need more oxygen to operate efficiently.

The first and third data set values suggested that there was a link as the results showed that there was activation as the p-values were below 0.05 (5%). This means that the chance of the groups being the same is less than 5% so it is said that there is a real difference between the groups. However, the second data set value didn't fit in the rest of the data sets and was counted as an anomaly, especially since the p-value was above 0.10 (10%), meaning that the results showed that there was no real difference between the HbO₂ and HHb levels, so no functional activation was shown. Overall, according to the 1st and 3rd data sets, there is a link between the stimulus and the functionality of the region and since the 2nd data set is an anomaly, it is not included in the final results and, therefore, does not have an impact on the final results.

The experiment was conducted fairly, so the margin for error

was narrowed. The data being statistically analysed allowed the data to be understood fully and any anomalous results were recognised quickly. The results were good as two of the data sets agree with each other, however, they are not as reliable as they could be as there are very few data sets recorded, meaning that there is not as much verification that the stimulus is linked with functional activation. If there were more data sets that could be put against each other and compared to get accurate and more reliable results, the experiment would have been more accurate and successful.

In order to better the results, improvements will have to be made: make sure that no extra light (e.g. from the sun) is getting into the detectors on the head to avoid anomalous results; confirm that the optodes are placed correctly and securely; and repeat the experiment on more participants a good number of times to authenticate the final results. It is possible that there were more parts of the brain that were functionally active, so by only studying one area of the brain there could be functional activation that was not observed. To resolve this, the other regions of the brain could be studied in addition to the frontal lobe.

It can be said that this experiment does not really show that functional activation has connections with a stimulus, because another participant may disprove the hypothesis by showing that there is no real difference in the HHb and HbO₂ levels before and after the stimulation period. This is why it is important to repeat the experiment and have more evidence recorded from more participants. The observed results may indicate that functional activation is induced by a stimulus, and the results just contained one anomalous result. On the other hand, the results may be showing that the seeming anomalous result is not anomalous but has significant meaning: the stimulus doesn't have an effect on the functionality of the brain. This could be further verified by adding more data sets. Further studies, especially those on functional activation in response to a stimulus, are warranted.

ACKNOWLEDGEMENTS

The study was supported by The Brilliant Club and Our Lady's Convent High School, with thanks to Gemma Bale from University College London.

Bibliography

- C. Asbury, *The Dana Foundation*, 2011, available at: http://innerttraditions.com www.dana.org/uploadedFiles/News_and_Publications/Special_Publications/brainimagingtechnologies.pdf
- G. Bale, *The Physics of Mind Reading: Illuminating the Brain's Activity*, Brilliant Club Publications, London, 2014.
- G. Bale, Own data collection and analysis, 2014.
- R. Bonser, *Brain Protection in Cardiac Surgery, Volume 1*, Springer, London, 2011.
- S. Fantini, *Near-infrared spectroscopy for the study of biological tissue*, 2002, available at: <http://ase.tufts.edu/ biomedical/research/fantini/researchAreas/NearInfraredSpectroscopy.pdf>
- R. Jacob, *From Brain Signals to Adaptive Interfaces: using fNIRS in HCI*, 2008, available at: <http://www.cs.tufts.edu/~jacob/papers/bcibook.pdf>
- G. Reich, *Advanced Drug Delivery Reviews*, 2005, 57, 1109- 1143.

	DATA SET 1		DATA SET 2		DATA SET 3	
	O ₂ Hb	Hb	O ₂ Hb	Hb	O ₂ Hb	Hb
P-VALUE	0.004687	0.135102	0.103573	0.394753	0.000104	0.005448

Fig. 3. The table shows the p-values of the HbO₂ and HHb of each data set.

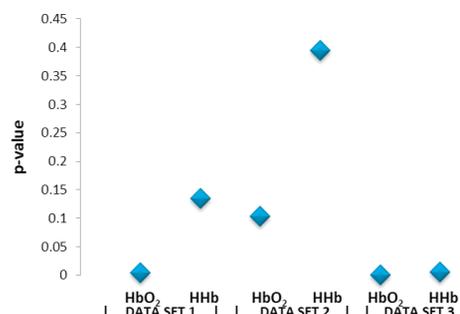


Fig. 4. The graph shows the summarised results of the statistically analysed results of the functional NIRS activation experiment.

About the authors

V. Chris is a Year 10 pupil at Our Lady's Convent High School in Hackney, east London. Gemma Bale is studying for a PhD at University College London, where her research focuses on photonic systems development in the department of electronic and electrical engineering, particularly looking at the development of optical instrumentation and methods to monitor brain oxygen metabolism and its application to neonatal birth asphyxia.

PhD tutor's note

V. is an exceptional student who put a lot of hard work into The Brilliant Club programme. Her final assignment is very impressive as she has had to write a report in the style of a scientific paper. The report covers some very challenging topics from a range of subjects – physics, biology, medicine and statistics – most of which V. had never encountered before. Nonetheless, she communicates them to the reader well, showing a very high level of understanding. I was particularly impressed with her explanation of the student's t-test which is a statistical test that I only came across late in my undergraduate degree; V. explains the test well and she also uses the results from it to interpret the experimental results. Overall it is an outstanding piece of work that shows that V. is performing at an excellent standard.

COULD COMPUTER-DESIGNED DRUGS TARGET DEADLY DISEASES?

M. Ajmal, M. Chikvaidze

Diseases like cancer pose tremendous threats to many humans, as well as animals. With regards to prevention, as well as treatment of diseases, drugs are vital and pivotal. A drug is a small molecule that interferes with the function of other molecules – proteins in most cases – by interacting with them and affecting their activity. Proteins are linear polymers that are constructed of amino acids which combine together in a condensation reaction (the name given to a chemical combination of two or more molecules, forming a bigger molecule. In this case, it's the combination of amino acids to form a protein molecule. Usually water is lost as a product). In the protein polymer, the sequences of the building blocks determine the three-dimensional structures that proteins spontaneously fold up into and the function of a protein is directly dependent on its three dimensional structure (Freeman, 2002). It is for this reason primarily why Chemists are constantly striving to ensure that ideal drugs are produced to target these diseases despite the many years of effort and sacrifice that this is always associated with. An ideal drug, what is an ideal drug? To compete with the challenges of an ideal drug, an efficient method of drug development is always demanding but here the question arises: is the conventional drug development method efficient? Is there no easier, more convenient method in which drugs could be designed more efficiently? My intention is for an exploration and critique to occur here whereby I can explore the different ways in which drugs can be designed, to ultimately conclude with the assertion that the most significant and effective method is through computational designing.

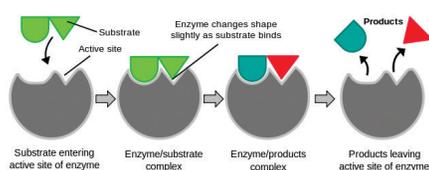


Fig. 1. Diagram showing ‘induced fit’. Initially, the shape of the enzyme and the substrate are different as shown in stage (a). As the substrate binds with the enzyme, the enzyme undergoes conformational shape change so that the shapes of the enzyme and substrate are complementary. This is known as ‘Induced fit’.

Presently, to fulfil the demands and challenges of an ideal drug production, multidisciplinary approaches are required; collectively these approaches form the basis of rational drug design. The identification of new drugs currently occurs in laboratories by testing thousands of compounds, or by fiddling with existing drugs. If the lock and key principle is implemented here (in the process of drug-protein simulation, proteins behave as a ‘lock’ – their specific three-dimensional structure only enables them to interact with substances that fit precisely; the ‘keys’) and the target molecule is considered as a key, this approach is unreasonable and illogical – it’s like taking tiny metal scraps, wire cutters and glue and then trying to design a key that’s perfectly shaped and is complementary to the lock (the protein molecule) [NIGMS, 2011]. This process of drug development is challenging, time consuming, expensive, and requires consideration of many aspects.

Glad tidings to scientists today that this process of rational drug designing can be, and has been accelerated due to the development of computational tools – tools that provide enhanced acceleration towards efficient development of drug designs! Structural based designing methods grant initial benefits – they bestow the advantage of being able to start with a computerised, 3-D, detailed model of the natural molecule; referred to as a substrate. [NIGMS, 2011] By gaining knowledge of the exact three-dimensional shape of the lock, scientists may be able to design a molecule that fits into the active site (A region on an enzyme that binds to a protein or another substance during a reaction (Wikibooks, 2014)). It is important to acknowledge that initially, the shape of the enzyme’s active site is not always corresponding to the substrate’s shape. However after the enzyme binds to the substrate, the active site undergoes conformational change, which results in a new shape of the active site that is complementary to the shape of the substrate. This is known as ‘**Induced fit**’ – see Fig. 1). This induced fit enhances catalysis (it is important to note that the enzyme is a catalyst) and puts a strain on the enzyme due to which, the activation level is lowered and the substrate is converted into products by the enzyme. This release of products restores the enzyme to its original form, which means that the reaction can be repeated continuously on the condition that the substrate is present.

Gaining knowledge about the enzyme’s active site to design a molecule computationally that fits perfectly into the active site is essential for scientists as it is more time and money efficient, as money would not have to be wasted on molecules that do not bind perfectly with the enzyme’s active site. This can be done effectively through the aid of structural based strategies. However, structural based drug designing methods have undesirable toxic side effects associated with it. Bioinformatics (the field of science in which biology, computer science and information technology merge into a single discipline (Graur, 2011)) tools on the other hand are crucial additions in the structure based drug design as they pose benefits which include time efficiency, and also provide strategies for combination therapy in addition to overcoming toxic side effects. In bioinformatics: Biologists collect molecular data – DNA & Protein sequences etc.; Computer scientists (Mathematicians, Statisticians, etc.) develop tools and software to store and analyse the data; and Bioinformaticians Study biological questions by analysing molecular data (Graur, 2011).

Furthermore, an imperative asset of bioinformatics is the study of molecular data. Studying molecular data and molecular dynamics is vital to fill in the missing gaps in our knowledge regarding the relationship between 3-D structures of biological targets and their potential inhibitors. In brief, molecular dynamics is the study of the movement of molecules and it refers to the simulation of physical movements of particles like atoms. These particles move and interact with each other and their motions are described by Newton’s equations, in

which forces between the particles and potential energy are occasionally obtained from empirical data (Biomedcentral, 2011).

Forces from interactions between bonded and non-bonded atoms contribute to molecular dynamics hence, by studying molecular dynamics, scientists are enabled to gain thorough understanding about the forces that are acting on a single particle and how much resultant force will be caused. As a result, the 3-D model of the drug molecule can be configured, so that it can travel a perfect path whereby it can fit perfectly into the receptor molecule. Doing this computationally prevents a lot of money and time being spent on actually carrying out the experiments on real molecules.

Studying molecular dynamics has become an important complement to experimental procedures in structure-function determination of targeted diseases and rational design of their inhibitors (INTECH, 2012). The fact that computers enable molecular dynamics to be studied efficiently, increases the likelihood of being able to actually target deadly diseases.

Furthermore, molecular dynamics simulations are important in identifying drug-binding pathways, however, the fact that the physical properties of a particle changes over time makes this a challenging task to complete in computer-aided drug design. One of the solutions to overcome the problems encountered by molecular dynamics is to combine electrostatic surface potential (with regards to computer-aided drug designs, electrostatic potential surfaces are valuable because they help in optimisation of electrostatic interactions between the protein and the ligand (University of Nijmegen, 2005)) analysis with molecular dynamic simulation. This enables forces to be applied to drug molecules so that the molecules could be pulled along possible pathways that were predicted based upon electrostatic surface potential (University of Nijmegen, 2005). Studying the drug-binding pathway is extremely important for investigation on non- active site mutations that possibly prevent drugs from entering binding site by rupturing the structure of binding pathway (IITECH, 2012). However, before describing these approaches, it is important to gain a conceptual understanding of how drugs work and how computers play a vital role in designing drugs.

Experimentally determining the structure of a protein is painful and time-consuming indeed! Computers alleviate this hardship. As mentioned previously, the three-dimensional structure of a protein is determined by the sequence of its building blocks. Each specific amino acid sequence produces a unique protein structure.

If the amino acid sequence of a protein target is known and the structure has to be predicted, the amino acid sequence can be fed into a computer programme through an algorithm (a set of instructions designed to perform a specific task). It is then compared to currently identified protein sequences whereby, enabling the shape of the target protein to become apparent (Attomiumculture, 1996)

Sounds amazing right? But inventing false theories is easy. Offering lip-service is even easier and lying takes no effort so here the question arises: Can computer-designed drugs actually

target deadly diseases? To solve the curiosity over this doubtful question, let's take a look at a story whose origin begins in 1989, when scientists determined the structure of HIV protease, a viral enzyme critical in HIV's life cycle (NIGMS, 2011).

HIV forms its proteins in one long piece. (Fig. 3) This is known as the 'polyprotein'. The HIV-1 protease carries the function of cutting this "polyprotein" into protein-sized pieces to form the mature virus, which can then infect a new cell. This process must occur with perfect timing, whereby enabling the immature virus to form properly before the polyprotein is broken (PDB, 2000) HIV-1 protease is an excellent target for drug therapy due to the crucial function that is carried out. The drugs bind tightly to the protease, blocking its action (PDB, 2000). Chemists hoped that through the blockage of this enzyme, the spreading of this virus could be prevented.

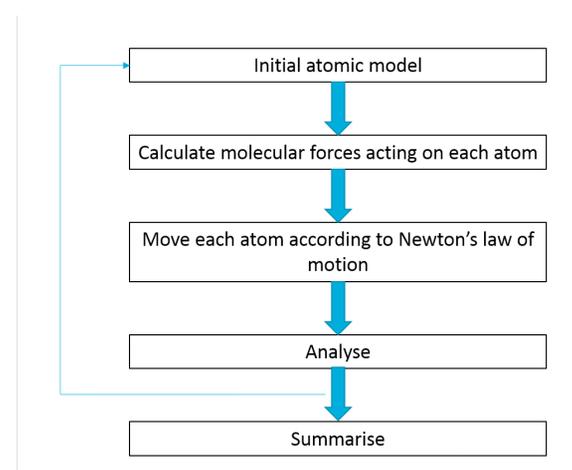


Fig. 2. A schematic showing how a molecular dynamics simulation is performed. First, a computer model of the receptor-ligand system is prepared and the forces acting on each of the atoms are calculated. The positions of the atoms are moved according to Newton's laws of motion. The results are then analysed and a summary of the results is written. The molecular dynamic simulation is then repeated several times.

With this hope in mind, researchers began their efforts in attempting to block this enzyme. With the structure of HIV protease at their fingertips, researchers were no longer working blindly. The target enzyme was now apparent from another view of apprehension – in exhilarating, color-coded detail. Chemists were able to they spin the model around, zoom in on specific atoms, analyse its chemical properties, and even strip away or alter parts of it (NIGMS, 2011).

By studying the structure of the HIV protease, key information was revealed – like a butterfly, the enzyme also comprises two equal domains with an active site located at the interface. Also, they discovered that the HIV protease has only one active site as opposed to normal such molecules, which consist of two equal sites. (PDB, 2000)

Chemists took advantage of this feature. "Conceptually, we took some of the enzyme's natural substrate, chopped these molecules in half, rotated them 180 degrees, and glued two identical halves together" as Dale Kempf, a chemist involved in the HIV protease inhibitor program says. They knew that if this single active site was plugged with a small molecule, the whole enzyme could be switched off. Pharmaceutical companies used the enzyme's shape as a guide and "... designed drug candidate molecules that had the same two-fold symmetry as HIV protease," as Kempf narrates (NIGMS, 2011).

Surprisingly, the first molecule synthesized was the perfect key to the active site – it prevented HIV protease from functioning normally (NIGMS, 2011).

Structure based drug design is a “remarkable success story,” as Kempf proclaims. In actual fact, this method of drug designing is “remarkable” as it has the potential to cut off years and millions of pounds. This method is indeed more time-efficient, as well as cost efficient as opposed to the traditional trial-and-error drug development process. “From the identification of HIV protease as a drug target in 1988 to early 1996, it took less than 8 years to have three drugs on the market”. Generally, out of every 8,000 compounds screened for medicinal purposes, only one reaches the market (NIGMS, 2011) and typically, it takes 10 to 15 years and more than \$800 million to develop a drug from scratch (Marcia Bartusiak, 1981). After taking this into consideration, it becomes apparent that a heap of a lot of time, as well as money was saved.

Additionally, other methods in which drugs can be designed are also available and vary. One method includes ligand based drug designs. In ligand based drug designs, knowledge of the biological target, as well as knowledge of other molecules that may bind to the biological target is required. Knowledge of what may bind to the target molecule is used to build a model of molecular entities that interact with the target (Wikipedia, 2013). However, this is like trial and error; it is neither the most successful method, and is neither cost nor time efficient. Also, the shapes of the protein and the target molecule continuously adjust which makes this method difficult. (Wikipedia, 2013).

Computational based strategies as opposed to ligand based drug designing have fewer disadvantages and more benefits. Another advantage of using computer chemistry is to eliminate the annoying side effects that drugs often produce when opening locks- they act like super keys and insist on opening more than one, unnecessary locks. For instance, amongst the drugs used to combat diseases, one drug used to combat diarrhoea is also present. However, this drug not only works on the intestine, but it also acts on the brain and attaches a receptor to the brain, causing undesired effects. To prevent this, scientists initially manipulate the structure of the drug first on the computer, and then in action in the laboratory to ensure that only one biological lock is unlocked, and that is the desired one (Marcia Bartusiak, 1981). In this manner, computers are used to aid in targeting deadly diseases as they ensure that only one biological lock is opened whereby; making the results more efficient.

Contrarily, computational based methods are also associated with disadvantages. Apart from the ones previously mentioned, the main other disadvantage is the cost it takes to produce drugs computationally. Although designing drugs computationally is more cost efficient in comparison to other strategies, the average cost can round up to over \$500 million (Wiley, 2009). There are several factors that contribute to enhancing the cost amongst which the fact that before drugs are released to the markets, they are expected to be of a certain standard that is approved by the government is also present (Wiley, 2009). Also, during the course of designing drugs, a lot of problems are faced by the chemist e.g. overcoming toxic side effects and

getting the drugs to be to the expected standards. In order to overcome these problems, vast amounts of money has to be spent. With the amount of money that is being spent, the pressure for the chemists to ensure that an effective drug is produced with prosperous results is further increased (Wiley, 2009).

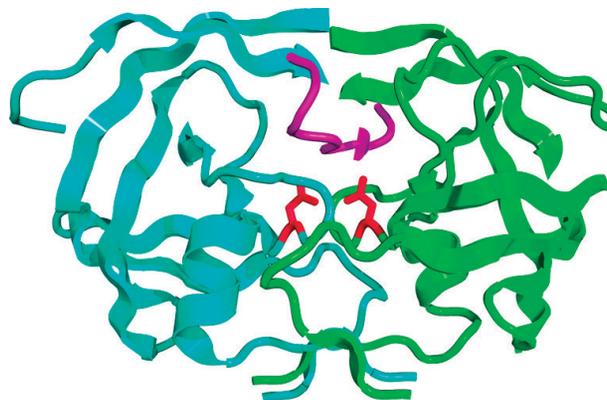


Fig. 3. Structure of HIV protease. Cyan and green: enzyme subunits. Red: active site.

In conclusion, I initially reinforce the assertion that the most efficient method of designing drugs is computationally. In my opinion, despite there being disadvantages associated with computational based methods, the disadvantages associated with the other drug designing methods are more significant. Although computational based drug designs are associated with being expensive, and produce toxic side effects, ligand based drugs do not enable molecular dynamics to be predicted whereby; making the binding of the protein and drug molecule less efficient; structure based drugs on the other hand do enable the protein and drug molecule to bind with efficiently but they're associated with toxic side effects. After considering this aspect, I proclaim with faith that the best drug designing method is computationally. The fact that they enable a three-dimensional structure of the drug and protein molecule to be apprehended whereby, scientists can experiment on the three dimensional model to see if the drug molecule designed is the ‘key’ that will fit into the ‘lock’; rather than wasting money and time on drugs that have no potential of success, is a significant factor.

I also contend that as well as being the most efficient method of targeting diseases, computer-aided drugs can in fact target deadly diseases. Perhaps on their own, computer-aided drugs may not be as efficient at targeting deadly diseases however; computational strategies can be combined with other methods (e.g. molecular dynamics or electrostatic surface potential) to enhance the efficiency of the results produced to ensure that the most prosperous results are obtained. This in turn, enables computer-aided drug designs to target deadly diseases. Take HIV as an example – HIV, a disease that was regarded as being deadly and as having no possible cure. However, scientists were able to use their existing knowledge and combine it with the knowledge gained through being able to experiment on the HIV protein from a new perspective – three dimensionally – to eventually find the drug molecule to target the HIV.

Furthermore, I initially began my essay by making a mention of a deadly disease whose mention leaves not even a child in doubt

as to what's being talked about: cancer. Cancer is commonly known to us, however, we're accustomed to associating it with no cure. Now that I've analysed above how computers can be used to target deadly diseases, well what if I said something that may seem crazy to you – perhaps in the same manner computers were utilised to cure HIV, maybe one day computer aided drugs may be designed to target cancer. Who knows?

Bibliography

- A. Paiardini, *Computer-assisted modeling for the discovery of new drugs*, 1996, available at: <http://atomiumculture.eu/node/326> (Accessed 3 April 2014).
- J.M. Berg, J.L. Tymoczko, L.S. Stryer, *Protein Structure and Function*, WH Freeman, New York, 2002.
- D. Graur, *Introduction to bioinformatics*, 2011, available at: http://www.google.co.uk/url?AA&url=http%3A%2F%2Fnsnm1.uh.edu%2Fdgra%2FBioInfo2011%2FPresentations%2FClass%25201%2F2BioinformaticsIntroduction.ppt&ei=QSNUU6j-MoTFPJCPgYgP&usq=AFQjCNEJ7BMzIoG38q86XoZGjL_K44VXFg&bv=bv.65058239,d.ZWU (Accessed 3 April 2014).
- D. Goodsell, 'Molecule of the month', HIV-1 Protease, June 2000, available at: <http://www.rcsb.org/pdb/101/motm.do?momID=6> (Accessed 7 April 2014).
- J.D. Durrant, J.A. McCammon, *Molecular dynamics simulations and drug discovery*, 2011, available at: <http://www.biomedcentral.com/1741-7007/9/71> (Accessed 4 April 2014).
- L. Le, *Incorporating Molecular Dynamics Simulations into Rational Drug Design: A Case Study on Influenza Neuraminidases*, 2012, available at: <http://www.intechopen.com/books/bioinformatics/incorporating-molecular-dynamics-simulations-into-rational-drug-design-a-case-study-on-influenza-a-n> (Accessed April 2014).
- M. Bartusiak, *The Structures of life, Designing drugs with computer*, 1981, available at: http://www.marciabartusiak.com/uploads/8/5/8/9/8589314/designing_drugs.pdf (Accessed 8 April 2014).
- NIGMS (2011) 'The Structures of life', *Structure-Based Drug Design: From the Computer to the Clinic*, available at: <http://publications.nigms.nih.gov/structlife/chapter4.html#top> (Accessed 7 April 2014). University of Nijmegen (2005), *Molecular Electron Density Surface*, available at: http://web.chem.ucsb.edu/~kalju/chem162/public/mallmol_visual_elpot.html (Accessed January 2014).
- Wikibooks (2014), *Structural Biochemistry/Enzyme/Active Site*, available at: http://en.wikibooks.org/wiki/Structural_Biochemistry/Enzyme/Active_Site (Accessed 9 April 2014).
- Wikipedia (2013) *Drug designs*, available at: http://en.wikipedia.org/wiki/Drug_design (Accessed 5 April 2014).

About the authors

M. Ajmal is a Year 10 pupil at Plashet School in Newham, east London. Dr. Mari Chikvaidze completed her PhD at Heidelberg University, where her research focused on molecular modelling of E. coli enzymes. She joins the first cohort of trainee teachers on the Researchers in Schools programme in September 2014.

PhD tutor's note

Could we employ physics, computing and mathematics to study something as intrinsically complicated as biological molecules and diseases associated with them? Scientists today are able to predict the structure and function of disease-causing molecules, design and develop drugs targeting those molecules and even minimise some of their side-effects, without having to conduct an actual experiment.

But if drugs can be made and diseases cured using mathematical modelling and computer simulations, what is the role of the experimental biologist? What is the significance of different modelling assumptions and how do they affect the calculations in a particular problem? Could chemists ever be replaced by computers? M. Ajmal, a year 10 pupil from Plashet School, has written this article in order to answer some of these big questions.

The article is an example of high quality written communication, comprising a comprehensive review covering different computational approaches used in drug design, as well as a case study of a computer-designed drug that targets HIV. Using a logical and systematic writing approach, M. has not only explained the importance of multidisciplinary thinking for making important biological discoveries, but has also fed our curiosity and imagination with the desire to learn more about tailoring drugs to diseases, using computers.

EXPLORING PREFRONTAL ACTIVATION IN ADULTS WHEN FACED WITH A WORKING MEMORY TEST

R. Clemeno, B. Morris

Abstract

Working memory is a process that has been shown in many studies to induce prefrontal activation in specific regions of the brain. In this study, hemoglobin levels in three test subjects were measured as an attempt to detect an increase in oxygenated haemoglobin, as signs of prefrontal activation. For this experiment, functional near-infrared spectroscopy was used, which is a fairly new method of brain imaging, thought to be much better than other imaging methods (e.g. PET, fMRI, etc). Statistical analysis of the results shows that there are cases of prefrontal activation but there are also those cases where there is not any activation at all.

INTRODUCTION

By definition, working memory is “the process of maintaining a limited amount of information in an active representation for a brief period of time.”^[1] Even though a large part of the brain plays a part in working memory, studies have shown that prefrontal cortex is a critical component in monkeys.^[2] It is safe to assume that this is also the case for humans.

Near to the end of the 20th century, functional near-infrared spectroscopy (fNIRS) was developed and used as a very effective non-invasive method in measuring changes in haemoglobin concentrations in the brain. This technology has been favoured over other imaging methods, primarily functional magnetic resonance imaging (fMRI), mainly because it is less constraining to the test subject.

Traditionally, fMRI has been used to map and detect cortical activation, using “the blood-oxygen-level-dependent contrast, discovered by Seiji Ogawa.”^[3] This method involves two strong magnetic fields, both of which elevate the nuclei in the brain. The first simply aligns the nuclei and the second moves them to higher magnetisation levels depending on their location. When the second (gradient) field is removed, the nuclei go back to their original states while emitting energy that can be measured with a coil to recreate their positions, creating a static image of the brain, which also shows changes in brain activity. The image is produced because deoxygenated haemoglobin is more magnetic than oxygenated haemoglobin, which is diamagnetic.^[3]

The method looked at in this article, fNIRS, involves the use of two different wavelengths of infrared light. fNIRS is favoured over fMRI because it is much less constraining for the patient, opening up numerous applications for this technology. This meant that fNIRS could be used to check for cortical activation in physical activities (e.g. balancing a ball on a card) (refer to Atsumori, H. et al, 2010). fNIRS typically uses a headset that has an arrangement of channels alternating between optic sources and detectors. This means that when light is emitted from the sources, the brain absorbs some while the rest is emitted, and the path taken by the light takes on a banana shape. Any areas that are covered by this

banana shape are measured regarding their haemoglobin levels. Increasing the distance between the source and detector increases the coverage of the scan, whereas decreasing the distance improves the spatial resolution. In the Hitachi WOT-100 system that was used, the distance was set to 30 mm.

This method utilises the optical window, which is the range of wavelengths (650-900 nm), which are wavelengths of light that “can propagate relatively deeply in biological tissue”, mainly due to the fact that it is only “weakly absorbed by water, haemoglobin, collagen and proteins.”^[4]

Even though other substances have significantly higher absorption coefficients than oxygenated (O_2Hb) and deoxygenated haemoglobin (Hb), they are present at such low concentrations that it can be said that haemoglobin are the main absorbers of light in the optical window. However, at most points, O_2Hb and Hb have different absorption coefficients; O_2Hb absorbs more infrared light whereas Hb absorbs more of red light.^[5] At 800 nm, the two types of haemoglobin have the same absorption coefficient.

These absorption spectra were also extremely important in determining which two wavelengths of light would be used for this technology. Two wavelengths have to be used, as two concentrations are to be calculated, one for O_2Hb and the other for Hb. One of the wavelengths is usually above 800 nm, and the other below, so it is easier to distinguish between the two types of haemoglobin. Various mathematical optimisation methods are then used to determine which two wavelengths are best used. In this experiment, the pair of wavelengths used was 705 nm and 830 nm.

METHOD

For this experiment, a wearable optical topography system (WOT-100) was used, mainly because it is wearable, light, with a headset that weighs only 650 g and which does not restrain the subject’s movement. The headset has a 2×8 alternating arrangement of optic sources and detectors, with a 30 mm gap between each. This system sends information from the headsets to the WOT controller wirelessly.

The experimental paradigm that was used is based on a

working memory test, and comprises eight separate stimulation periods on three different participants. Each of the stimulation periods lasted 25 seconds, made up of:

- 5 second rest period (pre stimulation)
- 10 second stimulation (stimulation)
- 15 second rest period (post stimulation)

During the pre-stimulation period, the subject is simply faced with a blank screen. At the start of the post-stimulation, they are presented with a shape made with two white squares for three seconds. Then the shape disappears for seven seconds, during which the subject is to mentally rotate it to two positions. A new shape appears for one second and the subject is to decide whether the mentally rotated shape matches with the new shape (refer to Fig. 1).

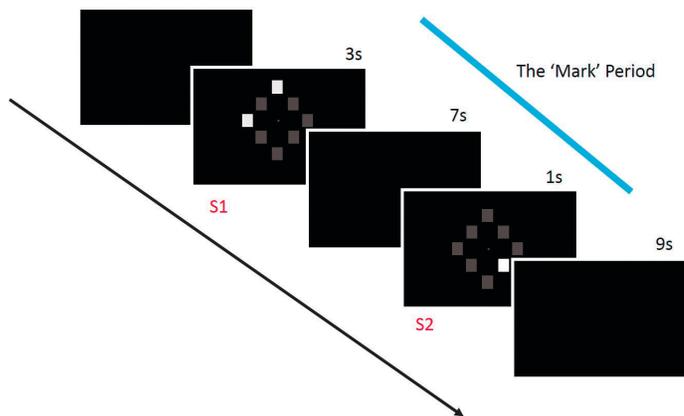


Fig. 1. The paradigm. The subject is to mentally rotate a shape made of two squares (see S1) and then asked if it matches a second shape (see S2). The post-stimulation period is highlighted by the “mark” period.

Prior to the experiment, the testing room was cleared of any articles that may be distracting to the subject, such as books and pictures, which could also induce cortical activation, potentially jeopardising the results as any activation may not be a result from the working memory test.

The test subjects were also given a questionnaire and required to sign a consent form. The purpose of the questionnaire was to check if the subjects have any conditions that could affect the results, and thus need to be considered. This could be anything such as their understanding of English, as they may find it difficult to understand instructions and this would induce cortical activation not caused by the paradigm.

The paradigm was then explained clearly to each of the three subjects, so that they knew exactly what to do to. They then had to wear the headset, making sure that the all the sources and receivers were in contact with the subject’s scalp. If there is a lot of hair in the way, it can be removed using a small tool. This minimises any interruption to the light signals being emitted, leading to more accurate readings.

SUBJECTS

In this experiment, three subjects were involved, all of which were healthy adults and presented no major neurological abnormalities.

- Set 1 – 25 y/o male
- Set 2 – 26 y/o male
- Set 3 – 25 y/o female

Having a very small standard deviation in age is important because it means that the results are very comparable, as it reduces the influence of age.

For each stimulation period, the mean concentration of O₂Hb and Hb was measured and recorded, during both pre stimulation and post stimulation. After all eight stimulation periods, a t-test was done, using computer software to work out the p-values for each type of haemoglobin for each data set. The statistical test was two-tailed, with a 5 % (0.005) significance level. Our null hypothesis (H₀) is that any change in haemoglobin levels was only due to natural biological processes that are not associated with functional brain activity (e.g. heartbeats) and the alternative hypothesis (H₁) is that the changes were induced by the working memory test causing prefrontal activation.

RESULTS

The results presented come from only one of the many channels that are present in the WOT-100 system. Changes in haemoglobin levels can be classified as rather task-related (induced by the paradigm) or due to natural processes, such as heartbeats and/or slight blood pressure changes. Conducting the t-test and working out p-values could distinguish between which of the two induced the haemoglobin changes.

After doing the t-test, the p-values for O₂Hb and Hb for each data set was calculated. The p-value is the probability that a change in concentration of the O₂Hb/Hb is caused by H₀. For this experiment, a 5 % significance level was used so for results to be valid, to show that any changes in O₂Hb/Hb concentrations was induced by the working memory test, the p-value has to be below 5 % (0.05).

P-VALUE	T-test					
	DATA SET 1		DATA SET 2		DATA SET 3	
	O ₂ Hb	Hb	O ₂ Hb	Hb	O ₂ Hb	Hb
	0.004687	0.135102	0.103573	0.394753	0.000104	0.005448

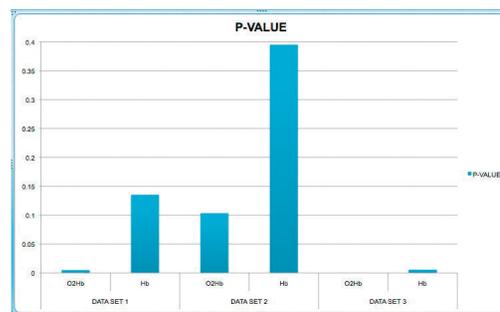


Fig. 2. t-tests have calculated the p-values for each of the variables measured (concentration of O₂Hb and Hb). These values are presented graphically (top) and tabulated (bottom), as some are almost negligible.

DISCUSSION

Over the course of the experiment, the mean concentration of O_2Hb increased for each data set, and that of Hb decreased. This is what is expected to happen, due to the haemodynamic response. If conclusions are to be simply based from basic averages, it can be said that the paradigm, which was a working memory test does induce cortical activation, as a result of an increase in cerebral blood flow (CBF), more specifically an increase in O_2Hb concentration and a decrease in Hb.

However, the results obtained start to seem statistically unreliable once the t-test has been conducted and the p-values calculated. From Fig. 2, it is clear that the results from the experiment aren't really statistically viable as three of the variables have p values much higher than 5 %, which is above the level of significance. This implies that the change that was observed was more likely to be caused by H_0 rather than the paradigm. For example, the p-values for O_2Hb and Hb levels for data set 2 were 0.104 and 0.395, respectively. This means that there was a 10.4 % chance that the change in their O_2Hb concentrations was merely due to H_0 and this percentage increases to 39.5 % for the change in Hb. This implies that there are no signs at all for prefrontal activation in data set 2.

The three other variables however have almost negligibly low p-values, and so signify prefrontal activation. Looking at data set 3, the p-values for their O_2Hb and Hb levels were 0.000104 and 0.00545, respectively, which are both almost negligible compared to the 5 % significance level. This means that the changes in O_2Hb and Hb concentrations had a very small chance of being caused by H_0 so that it can be said that it was caused by H_1 (due to the working memory test), which means that in data set 3, there is clear evidence that prefrontal activation has occurred.

Data set 1 is different in its p-values, such that for one (O_2Hb) is below the 5 % significance level, whereas that of the other (Hb) is significantly above it. This on one hand could suggest prefrontal activation due to the large enough change in the O_2Hb concentration, but on the other hand it could be said that the results for this data set are simply unreliable due to one p-value being above the significance level. For this data set, repeats need to be made in order to reach a valid and definite conclusion, whether prefrontal activation did occur or not. The inaccuracy in the results could be due to hair blocking the optic sources and detectors.

These were not really the set of results that were expected, as the prefrontal cortex ought to activate due to working memory tests so it was expected that all three data sets would imply prefrontal activation.

Studies have already shown that there are specific areas within the prefrontal region that activate when a subject is presented with a working memory test. More specifically it has been shown that the posterior mid-frontal region activated due to either verbal, spatial or object memory tests. This means that it contributes to working memory, independent of information type.^[6]

IMPROVEMENTS

If the experiment could be repeated, with more funding, there are various improvements that can be made so that the results could be slightly more accurate.

Firstly, the number of subjects that were used in the experiment could be made larger, which would result in a larger set of results and a much more definitive and statistically reliable conclusion. For this experiment, only three test subjects were involved and because of such a small group the results felt restrictive, in terms of coming to a conclusion.

There was also the possibility that some of the subjects were not willing to shave their heads, which would have improved signal resolution. A repeat of this experiment could be done with subjects that are willing to shave their heads so the measurements taken may be more accurate.

There was also the possibility of making measurements and presenting results from other channels in the system. Only having results from one channel is very restrictive also, as it may not be an accurate representation of the entire prefrontal cortex. This is because not all of the channels may experience activation, as working memory tests only cause sustained activity in three distinct prefrontal regions, which include one in the "posterior mid frontal cortex, another in the anterior mid frontal cortex and the next in the inferior frontal cortex and the anterior portion of the insula".^[1] This brings in the possibility that the channel whose results are represented in the graph may not be part of one of these regions and thus wouldn't lead to a reliable and fair conclusion.

Univariate methods could also be implemented as an attempt to remove signals that were included in measurements but were not associated with functional brain activity (e.g. heartbeats). Univariate methods are those that use only one signal to perform signal separation.^[1] Such methods include band-pass and low-pass filtering the signals, which would remove non-evoked components. In this method, a cutoff frequency of 0.2 Hz is used.^[7]

Gratton and Corballis also developed an adaptive average waveform subtraction algorithm. This method is used to remove heartbeat from the overall signals. This is quite important to do, especially when the timing intervals are roughly every second, as it is similar to a human's resting heart rate.^[8]

CONCLUSIONS

From the results of this experiment, it was shown that there are cases where a working memory test led to prefrontal activation. But there are also those where any recorded changes are too small, so it can't be said that this was caused by the working memory test, but rather by processes not associated with functional brain activity.

References

1. Courtney, S.; Petit, L.; Haxby, J.; Ungerleider, L. (1998) The role of prefrontal cortex in working memory: examining the contents of consciousness, The Royal Society
2. Fuster, J.M. (1990) Behavioral electrophysiology of the prefrontal Cortex of the primate, Amsterdam: Elsevier
3. Huettel, S.A.; Song, A.W.; McCarthy, G. (2009) Functional Magnetic Resonance Imaging (2 ed.), Massachusetts: Sinauer, ISBN 978-0-87893-286-3
4. Scholkmann, F. (2013) A review on continuous wave functional near-infrared spectroscopy and imaging instrumentation and methodology, Elsevier
5. Principles of pulse oximetry technology Oximetry.org/pulseox/principles.htm
6. Haxby, J.V.; Ungerleider, L.G.; Horwitz, B.; Rapoport, S.I.; Grady, C.L. (1995) Hemispheric differences in neural systems for face working memory: a PET rCBF study. *Hum. Brain Mapp.* 3, 68-82
7. Franceschini, M.A.; Fantini, S.; Thompson, J.H. (2003) Hemodynamic evoked response of the sensorimotor cortex measured noninvasively with near-infrared optical imaging. *Psychophysiology* 40 (4), 568-560
8. Gratton, G.; Corballis, P.M. (1995) Removing the heart from the brain: compensation for the pulse artifact in the photon migration signal. *Psychophysiology* 32 (3), 292-299
9. Atsumori, H. et al (2010) Noninvasive imaging of prefrontal activation during attention-demanding tasks performed while walking using a wearable optical topography system, *Journal of Biomedical Optics* 15(4), 046002

Figures

1. Data from:
 - i. Obrig, H.; Wenzel, R.; Kohl, M. et al (2000) Near infrared spectroscopy: does it function in functional activation studies of the adult brain? *Int. J. Psychophysiol.* 35
 - ii. Taroni, P.; Cornelli, D.; Pifferi, A. et al (2007) Absorption of collagen: effects on the estimate of breast composition and related diagnostic implications. *Journal of Biomedical Optics* 12 (1), 014021
 - iii. Uludag, K.; Steinbrink, J.; Kohl-Bareis, M. et al (2004) Cytochrome-oxidase redox changes during a visual stimulation measured by near-infrared spectroscopy cannot be explained by a mere cross talk artefact. *Neuroimage* 22 (1), 109-119
 - iv. Van Veen, R.L.P.; Sterenborg, H.J.C.M.; Pifferi, A. et al (2004) Determination of VIS-NIR absorption coefficients of mammalian fat, with time- and spatially resolved diffuse reflectance and transmission spectroscopy. *Biomedical Topical Meeting*, p. SF4
 - v. Vogel, A.; Venugopalan, V. (2003) Mechanisms of pulsed laser ablation of biological tissues. *Chem. Rev.* 103 (2), 577-644
 - vi. Ward, K.R.; Ivatury, R.R.; Barbee, R.W. et al (2006) Near infrared spectroscopy for evaluation of the trauma patient: a technology review. *Resuscitation* 68 (1), 27-44

About the authors

R. Clemeno is a Year 12 pupil at St Angela's and St Bonaventure's Sixth Form Centre. Ben Morris is a PhD student at University College London, where his research focuses on the development of portable photonic devices for monitoring the function of the brain.

PhD tutor's note

I have selected this article for submission to The Scholar as the student demonstrates a clear understanding of the context/motivation of the work. A clear and simple graph allows the student to fluently discuss the analysis of complex methods and techniques. Importantly, R. is careful to address the limitations of the experiment, too.

The student articulately describes potentially tricky concepts, bolstering his analysis with some well-researched proposals for future work (e.g. low-pass filtering the data to remove signals due to heartbeat etc.). The necessary detail and research context is provided where, though the student never loses sight of the focus of the report. Moreover, the style of writing is pitched at the right level for academic discourse- clear and succinct from the outset.

I was impressed by the professional presentation of the report (e.g. captioned figures and graphs, coherent division into sections) and the comprehensive list of references provided. This article serves to evince the student's conscientious approach to work throughout the Scholars Programme.

IN THIS ISSUE

Arts & Humanities Articles



28

WHAT IS FAIRNESS?

An interesting discussion of this challenging question.

I. Jopson and C. Mechie

29

A DISCUSSION OF CHANGING ATTITUDES TO THE POOR BETWEEN 1834 AND 1948

A. Ahmed and A. Glazzard

31, 33, 35

CAN TERRORISM EVER BE JUSTIFIED?

Three different approaches to the philosophical questions surrounding this difficult topic.

N.A. Pratama and A. Latter | O. Marsden and D. Alati | B. Moores and E. Folwell

38

HOW USEFUL IS JOSEPH CAMPBELL'S "HERO WITH A THOUSAND FACES" AS A TOOL FOR LITERARY CRITICISM?

A discussion of the utility of this seminal work, taking in *The Hobbit*, and *Diary of a Wimpy Kid* in the process.

S. Wilding and G. Goodwin

40

DO YOU THINK THAT THE HOLOCAUST IS BEST REPRESENTED THROUGH TESTIMONY OR FICTION?

Reflecting on various sources to consider the Holocaust.

H. Hassan and N. Woodward

42

SHOULD ARMED FORCE BE USED TO CONSERVE BIODIVERSITY IN REGIONS OF ARMED CONFLICT?

Gorillas and Guerillas – a fascinating insight into the world of conservation in warzones.

H. Walker and R. Millburn

46

NO NEED FOR PRONOUN ENVY? A COMPARATIVE ANALYSIS OF "THE LEFT HAND OF DARKNESS", "THE COOK AND THE CARPENTER" AND "THE DAUGHTERS OF EGALIA" IN RELATION TO ROBIN LAKOFF'S AND DALE SPENDER'S THEORETICAL POSITIONS

An in-depth exploration of this topical debate.

K. Booth and C. Luck

48

HUMANITIES – THAT'S THE QUESTION. SHOULD THE GOVERNMENT PAY FOR THE HUMANITIES?

A detailed discussion of the current debate around the funding of the Humanities.

O. Ligieza and G. Roberts

WHAT IS 'FAIRNESS'?

I. Jopson, C. Mechie

The dictionary defines fairness as the quality of being reasonable, right and just. The laws of countries across the world are founded on the principles of fairness and a belief in treating others in a fair way. As human beings, we should all strive to fulfil our potential to be a fair person who acts within the law and treats other people, animals and the environment with the respect that they deserve. However, there are situations where people can interpret fairness in different ways and what appears fair to one individual may not seem fair from another person's perspective.

An example of this is the current situation surrounding the teachers' strike action. Teachers work extremely hard; they work long hours and provide care and support for the children in their schools. Therefore teachers have the right to protest against working conditions, such as pay, pensions and working hours, which they believe are unfair. They have the right to stand up for themselves and for what they think is fair. On the other hand, children are losing a day's education, and possibly more if the strike action continues. If children lose more learning time due to strike action, it could prove to be detrimental to their long term educational prospects. The question is 'are the teachers being fair'? And the answer is that it depends on your perspective. This example helps to question the idea of fairness and to show that interpretations can differ from person to person.

On a personal level, I have experienced a situation which is fair or unfair depending on your point of view. I swim for a swimming club and enter competitions. One of the most important galas of the swimming season is the yearly Essex gala where all the clubs in Essex enter. All swimmers compete and aim for the title of best boy or girl in each age group. The competition is fair as the people you are racing against are the same gender and the same age as you. Referring back to my original definition of fairness, it is clear that the competition endeavours to create a situation where competitors are treated in a reasonable, right and just way. However, the point which I personally think is unfair is the cut-off date for each age group. My birthday is March 20th and the cut-off point is March 31st. Due to when my birthday is, I have to compete against people who can be almost a year older than me. This means the possibility of my becoming top girl in my age group is minimised and this does not appear fair. Nevertheless, it is important to recognise that I am not the only swimmer being affected by this; many people may have the same problem as me. In addition, if the cut-off was on a different date I presume other people would be affected just as I am. Therefore, I appreciate the difficulties that the Essex swimming team go through to create a fair competition.

An example of society trying to create fairness is the Fairtrade system. In certain parts of the world, people who are involved in, for example, the banana production process are paid a very low wage. Fairtrade means that the workers receive a guaranteed and fair price for their

work. The hope is that the quality of life for these workers is significantly improved. In addition, the children of the banana workers will also have opportunities as they may now be able to afford education to improve the child's long term prospects. Hopefully this will help minimise poverty in poorer countries.

However while banana production workers receive what is considered a fair amount of money it is still much lower than what Fernando Aguirre, CEO of Chiquita Bananas earns. The CEO of Chiquita Bananas receives £3,608,000 per year; the workers get £1,068. This difference in wages raises a question for Fernando Aguirre – are you being fair to your workers? Aguirre organises everything to do with his business. He took a huge risk to spend a large amount of his money to build a big, successful multi-national business; he could have easily lost all of his money. In addition, he has provided employment for many people who may have not have had jobs. On the other side of this argument the workers still do need an increase in the amount of money they earn a year without these reliable workers his business would be going nowhere.

In conclusion, although society believes in making everything fair, some problems people have in everyday life just can't be made fair. Different people interpret things in different ways and this changes a person's perspective of fairness. I believe that it is difficult to define and create a completely fair society because a person's idea of fairness can depend on their personal situation. I have commented on situations where attempts have been made to create fairness for all. However, I have also identified points of view within these situations where things still don't seem completely fair. Finally, to consider whether we can ever create a fair society, I refer back to my opening paragraph where I stated that the laws of societies are based on the idea of fairness and treating people, animals and environments with respect. I firmly believe that if we abide by these principles of respect, then we will be able to create a society where people are ultimately treated fairly.

About the authors

I. Jopson is a Year 6 pupil at RJ Mitchell Primary School in Essex. Dr. Calum Mechie completed his PhD at the University of Oxford, where his research focused on the work of George Orwell. The course was entitled 'What is Fairness?' and introduced pupils to philosophical concepts and approaches to answering this question.

A DISCUSSION OF CHANGING ATTITUDES TO THE POOR BETWEEN 1834 AND 1948

A. Ahmed, A. Glazzard

Abstract

This essay will show how provision for the poor improved, and it will also show people's views on these changes.

THE NINETEENTH CENTURY

Firstly, I will discuss the changes that occurred in the nineteenth century. In 1834, a "New Poor Law" was put in force; people were put into two groups, the "deserving" poor and the "undeserving" poor. The deserving poor were the ones who were physically unable to work; therefore, they deserved to be given help, for example the elderly, the sick, the disabled and orphans. The undeserving poor were those who were physically able to work but did not do so, therefore they did not deserve help as these people were classed as lazy.

The long-term effects of the 'New Poor Law' were so bad in most of the workhouses that the poor chose to live in poverty rather than seeking help as this was seen as living in shame. As government spending decreased on the poor, the 'deserving poor' were often supported by other organisations such as charities.

Edwin Chadwick, who helped produce the "New Poor Law", believed that it should be the central government, rather than local authorities that should be handling the poor situation. Economist Thomas Malthus and Edwin Chadwick agreed that money should not be given to the poor as it would increase the birth rate and make the problem worse. Those in desperate need should go for food and shelter in a workhouse, which was very uninviting and off-putting because conditions of the workhouses were terrible and extremely unhygienic; this resulted in hundreds of deaths each year. Only those desperately in need would accept the shame of being called a "pauper", and lose all their independence.

The *Commissioners Report of 1834* tells us that by making the extremely poor work in the workhouses and by not giving them any benefits other than the bare maintenance to survive, poverty was expected to decrease by one third.

However, as illustrated by *The Andover Bastille*, 16th September 1845, in *The Penny Satirist* newspaper, the poor suffered inhumane conditions inside 'The Andover' union workhouse. The picture from the newspaper showed the people fighting over bones and it showed how deprived and desperate they were in their facial expressions. The poor were given little food, so they ate the bones, which were meant to be used as fertilizer, in order to survive day to day.

The well known author, Charles Dickens, published a true

picture of how the poor suffered, were tormented and lived in filthy conditions inside the workhouse, which was infested with rats and was "putrefying in its rottenness" in his book *Oliver Twist* (1838): "Oliver Twist and his companions suffered the tortures of slow starvation for three months". *A Christmas Carol* (1843) by Dickens also referred to the poor and poverty: "They had better do it, and decrease the surplus population."

Later, British sociological researcher Mr Seebohm Rowntree, carried out an in depth study of poverty in 1899. He found out the minimum amount of money a family needed in order to survive daily life, and concluded that 30% of the population was living in poverty. He found that illness, low wages and old age were the real causes of poverty rather than laziness, which was the popular belief.

CHANGES AFTER WORLD WAR TWO

During the Second World War, the government was in control of many parts of people's lives; people of all classes now worked together. This included fighting overseas or producing goods in the factories, this mixing of social classes led to people taking more consideration into what was 'fair'. In addition, the need for a healthy, strong work force became important. Therefore, changes to policy had to be made.

Furthermore, it was declared by the MP H. W. Forster, that a majority of people have said that the health of the individual could no longer be seen as a concern for that individual alone.

As a result, as shown by an item in *The Evening Standard* in 1947, the National Health Service (NHS) was to be introduced to the public in 1948 at the cost of £152,000,000 a year.

Parliament also launched a leaflet explaining the new NHS. This was to be provided for everyone, rich or poor, it was not to be considered as a charity and everyone would be paying for it as taxpayers.

The government wanted a strong healthy work force, and felt that food and medical care was important for the welfare of this country. This followed other changes which had already been made earlier in the century, such as:

- It was compulsory for every child between the age of five and fourteen to go to school.

- Pensions were introduced for the elderly over seventy.
- For people who were unable to get a job, unemployment benefits were introduced.

CONCLUSION

In conclusion, from 1948 until this day, Britain has come a long way from the workhouse days when the poor lived in deep poverty. The government has introduced many policies to give provision to the poor and needy. In addition to the NHS, benefits are given to the jobless, the disabled and the single parent families, to name a few. The government also realised that many people, including women, were treated unfairly and laws were changed, so for example jobs were provided equally for these people.

In some areas poverty still exists in Britain, but today's government seems to handle poverty in a much more caring and thoughtful manner, compared to the way it was handled back in the 1800's.

About the authors

A. Ahmed is a Year 6 pupil at Monega Primary School in Newham, east London. Dr. Andrew Glazzard completed his PhD at Royal Holloway, University of London, where his research focused on character types in Joseph Conrad's urban fiction. The course was entitled 'Poverty and Progress' and introduced pupils to the poor laws of the 19th century in Great Britain, asking them to consider shifting attitudes towards poverty.

CAN TERRORISM EVER BE JUSTIFIED?

N.A. Pratama, A. Latter

Abstract

This essay will talk about whether terrorism can be justified or not. I think terrorism cannot be justified because I believe that it is wrong to cause terror in any sort of way, even if it is for a political goal. This essay will begin by exploring different historical examples of acts which have been classed as terrorism that tell us about the different meanings of the word terrorism. This will be followed by a definition of terrorism, a discussion about wide and narrow definitions of terrorism, and an explanation on how historical and philosophical definitions relate. Then, I will explain in more detail why I believe terrorism cannot be justified, show a philosopher's view on terrorism, and explain how his view is similar to mine. The essay will then be closed with a conclusion that summarises my arguments and viewpoints.

The different historical examples of acts/groups classified as terrorism tell us that the word 'terrorism' has multiple meanings. It can mean using violence to reach a political or religious goal or it can also mean using violence to cause rebellion or terror. For example, the IRA wanted to gain independence for all of Ireland, but they couldn't beat the British in open battle, so they resorted to terrorism because they claimed that it would make "regular government impossible, and the cost of holding the country so great that the British would be compelled to withdraw". This kind of terrorism they did was to reach a political goal. An example of terrorism that meant to cause terror was the Ku Klux Klan movement. This movement attempted to intimidate blacks and Republicans with the threats and violence, such as beatings, whippings, raped women, burned down houses and schools, and shooting, burning or lynching hundreds of victims. The two meanings of terrorism above have similarities. They both use violence and attack on infrastructures, people, or both. These two also have different goals. The first 'terrorism' has a political goal, whilst the other actually wants to cause terror.

In my opinion, what is important is not the definition of the sources of the terror but the results. The reason is clear. Whether it affects 'innocent' people or 'guilty' people or infrastructures, it still counts as terrorism. No matter which of the three are affected, there is a high chance that some people might feel terrorised, get maimed or – worse – have their life taken away. All of these would go against The Universal Declaration of Human Rights:

Article 3.

Everyone has the right to life, liberty and security of person.

Article 5.

No one shall be subjected to torture or to cruel, inhuman or degrading treatment or punishment.

It is quite difficult to find the right definition of 'terrorism'. Despite this fact, this will most likely count as a wide definition. It is simply because a wide definition means that terrorism can be against anyone or anything. A wide definition describes the thought of historians. It encompasses the entire history of 'terrorism' from the early age to the present, for instance, the attacks caused by the IRA until the 9/11 attack on the WTC. Whilst a narrow definition of terrorism, used by philosophers, means that it can only be against 'innocent' people. The narrow definition focuses on the morality of terrorism. The problem is that there are values of morality.

I believe that terrorism cannot be justified because it mostly involves humans' lives. More or less, I have a similar thought with Nicholas Fotion. He states that "In the view of the terrorist, the innocent victim is not a human in the sense of simply having value as a human being... They are victimized and thereby treated as objects because they are humans." Fotion's justification is consequentialism as he claimed that the outcomes which use innocent people as a means to an end are always bad. He also believed that terrorism is never the last resort to bring about change. I totally agree with his opinion that so far human beings are victimized in the terrorist's plan. However, I want to add something important to that statement. I think that terrorism is not only the victimizing of humans, but also the destruction of vital infrastructures, which can threaten people's lives. One example of this was in the 9/11 incident, when a terrorist's plane hit the Twin Towers of the World Trade Center. The attack caused 2,996 casualties, 19 being the hijackers and 2,977 the victims. So with my additional point, I made it clear that the victimizing of humans and the destruction of vital infrastructures can sometimes be equal.

Nevertheless, I will never agree to see the terrorists from their religious background. When we talk about terrorists, we should see what they do, and not who or what they are. I found one of Juan Cole's articles quite interesting. "Since 9/11, American law enforcement has taken a disproportionate interest in American Muslims across the country, seeing a whole community as a national security threat, particularly in California and New York City. But here's the thing: the facts that have been piling up ever since that date don't support such suspicion. Not at all." This quote tells us that America was just being afraid and paranoid.

The suicide-committing hijackers in this incident were Muslims.

However, it is not fair to judge the entire Muslim community from what a couple of hijackers did. Although what the attackers did was claimed to be Jihad, which means “to struggle in the way of Allah”, they were misled by Osama Bin Laden into thinking that suicide was a part of Jihad, which is clearly not how it is stated in the Qur’an. Suicide is, in fact, one of the 70 major sins in Islam.

Rudolf Bittner, a philosopher, claimed that terrorism is always wrong. His justification is deontological as he claimed that the act of terrorism has the property of being morally wrong, no matter what the circumstances or the consequences are. I could not agree more with this statement as I, myself, am a ‘deontologist’.

Another philosopher I agree with – more or less – is Per Bauhn. According to Igor Primoratz, “He (Bauhn) attempts to show that terrorism that targets non-combatants or common citizens can never be justified by deploying a slightly amended version of Alan Gewirth’s ethical theory. Freedom and safety are fundamental prerequisites of action and therefore must be accorded paramount weight. The need to protect them generates a range of rights; the right pertinent here is ‘an absolute right not to be made the intended victims of a homicidal project’ all innocent persons have (Gewirth 1981: 16)”. There is no doubt that what he pointed out resembles to my view. Additionally, I consider terrorizing the government and the destruction of infrastructures also the acts of terrorism.

In conclusion, I’d like to say that from my point of view, terrorism cannot ever be justified. As a deontologist, I believe that it is morally wrong to cause terror in any sort of way whatever the reason is, whatever the target is. I find the wide definition of terrorism more relevant to my answers because terrorism is not only targeted at innocent people, but anyone, and – sometimes forgotten – important infrastructures. This definition is mainly used by historians, whilst philosophers use the narrow definition of terrorism. As I have said before, Foiton’s consequential statement about terrorism is something that I agree with, that terrorists often victimize human beings in their plan, which is not humane.

Religious background also does not become a factor of whether an attack can be categorized as a terrorism act. There is no religion that supports inhumane terrorism. Any sort of judgement that relates to terrorism and is based on someone’s religion is wrong.

Bittner’s deontological justification is agreeable as well because the act of terrorism in itself is always wrong. Aside from this, Per Bauhn’s view strengthens mine by claiming that terrorism cannot be justified when innocent people are affected, although I also include attacks towards the government and infrastructures.

References

1. Asprey, R.B., *War in the Shadows: The Guerrilla in History*, pp. 274, 1975.
2. United Nations, *The Universal Declaration of Human Rights*, available

at: <http://www.un.org/en/documents/udhr/index.shtml> (accessed date), publication year.

3. Fotion, N., “*The Burdens of Terrorism*” in Leiser, B. *Values in Conflict*, New York: Macmillan, pp. 464, 1981.
4. Wikipedia, *September 11 Attacks*, available at: http://en.wikipedia.org/wiki/September_11_attacks#Casualties (accessed date), 2013.
5. Cole, J., *FBI Discriminates Against American Muslims & Lets White Terrorists Off the Hook* (Harwood), available at: <http://www.juancole.com/2013/07/discriminates-american-terrorists.html> (accessed date), 2013.
6. Wikipedia, *Jihad*, available at: <http://en.wikipedia.org/wiki/Jihad> (accessed date), 2013.
7. Al-Kaba’r, *The Major Sins*, available at: http://www.themodernreligion.com/misc/hh/major_sins.htm (accessed date). Publication year.
8. Primoratz, I., *Terrorism*, available at: <http://plato.stanford.edu/entries/terrorism/#TerAbsWro> (accessed date). 2007, 2011 (rev.).

About the authors

N.A. Pratama is a Year 8 pupil at Whitefield School in north London.

Dr. Alex Latter completed his PhD at Birkbeck College London, where his thesis looked at postwar British poetry, in particular The English Intelligencer worksheet 1966-1968. The course was entitled ‘Can terrorism ever be justified?’ and looked at the moral and philosophical dilemmas behind terrorism.

CAN TERRORISM EVER BE JUSTIFIED?

O. Marsden, D. Alati

Abstract

I believe that terrorism can be justified if certain conditions are met. In this essay, I will explore three main areas of terrorism: historical forms of terrorism in the literature review; the definition of the word terrorism; and an analysis of the main question of ‘Can terrorism ever be justified?’. In the literature review I go over a brief history of the Sicarii and Al-Qaeda, and follow on to discuss how the word terrorism has changed over time by using my previous examples. This is followed by a section on definitions where I go over how there is not one set definition that the world uses, and I explain why I use the FBI’s definition instead of the many others. In the analysis section, I go over how Nicolas Foiton and Kai Nielson agree and disagree with my points, and I use the examples of Nelson Mandela and other ‘terrorists’ to prove my points. Also, I explore how terrorism is often only universally justified after the actual event, often many years after the actual act of terrorism. I will then explore how different terrorist groups, people and justifications have changed over time.

LITERATURE REVIEW

In history many people have committed acts that have been classified as ‘terrorism’. In this section I will explain how the definition of terrorism has changed over history.

My first example is the Sicarii. This group was established in 50 AD and carried out assassinations in public to intimidate the public. The name Sicarii originates from Latin meaning dagger (Sica), and the Sicarii’s assassinations were often using short daggers (Zalman, 2013).

Another example of a classified terrorist group is the Al-Qaeda. The Al-Qaeda began as a group that were supporting Muslims fighting against the Soviet Union. After the war, the group separated but carried on to defy the presence of foreign residents in Islamic lands. Al-Qaeda’s most well know attack was on the 11th September 2001. On that day two airliners were hijacked and flown into the World Trade Centre in New York, resulting in the deaths of almost 3,000 people (BBC 2011).

I think the word terrorism has been used to describe both small groups that have performed individual assassinations (Sicarii) to widespread attacks on the state of countries that are based around whole religions (Al-Qaeda). Its meaning has also changed from easily killing very important people, to killing a great amount of people as an act of intimidation.

DEFINITIONS

There isn’t one universal definition of the word terrorism. Some organisations have tried to define it but the world hasn’t yet agreed on a single definition. In this section, I will explore the definitions so as to help me on the main question.

I shall adopt a narrow definition as I am looking at this as a philosopher and looking into the morality of terrorism. Striking fear into the innocent is less moral then intimidating the unjust. If a historian were to look at this, they would use a wide definition, as it includes the entire history of terrorism from the Sicarii to the modern day.

The definition that I shall be using for this essay is that of the

FBI: ‘The unlawful use of force or violence against persons or property to intimidate or coerce a Government, the civilian population, or any segment thereof, in furtherance of political or social objectives.’ (FBI, 2013). I know that this is plausible because it links to the events of 9/11 where around 3,000 innocent people died and more than 5,000 people were injured (Statistic brain, 2012) by illegal means causing a government to react.

ANALYSIS

In this section I explore how terrorism can be justified, and also analyse other philosophers’ theories in order to discuss how my argument refutes them.

I believe that terrorism can be justified in specific scenarios. If all means of peaceful protest have failed, and what you are doing is for the greater good of the people (a consequentialist argument), then I believe terrorism can be justified. If you’re killing 3,000 people in a bombing for the sake of 100 of your own people then that cannot ever be justified. An example of this is Nelson Mandela. He may have been involved in the management of acts that resulted in the deaths of people, but in the end it was for the greater good of millions of black people across the world.

An example of a philosopher who agrees with my point is Kai Nielson. He believes that the innocence of the victims of terrorism makes no difference to its justification. Nielson goes so far as to point out that when the U.S. bombed Japan with nuclear weapons killing thousands of innocent people, they must have believed that these actions were justifiable (Nielson 2003).

Nicolas Foiton also believes that terrorism can be justified if certain conditions are met (Foiton, 1981). These parameters are as follows:

1. That the end sought is good enough to justify the means.
2. That the end will be achieved by means of terrorism.
3. That the end cannot be achieved in any other way that is morally and otherwise less costly.

As such, Foiton argues that if you take advantage of innocent people then terrorism cannot be justified.

I believe that this is not a plausible theory because nearly every disputed act of terrorism has involved innocent civilians. A good example to prove my point is Nelson Mandela. As I previously stated, he was involved in bombings, rebellions and burning down properties. All of these actions could fall under the definition of terrorism, as it would have created fear in the civilian population and the aim was to coerce a government. All of this said, these actions that would have seemed terrible at the time have turned into actions that have helped millions of black people all over the world. I believe that that is a justifiable act of terrorism because it was for the greater good of millions of people.

Foiton does state that that 'The end sought is good enough to justify the means' (Foiton, 1981) which clearly fits with Mandela's actions. However, Foiton also states that to justify terrorism, the acts must encompass all of the conditions, and he states that if you take advantage of innocent people then terrorism cannot be justified. This is what Nelson Mandela did. He may have been responsible for the death or injury of innocent civilians but in the end, years later, his actions have been justified, which brings me on to my next point.

Terrorism is often only justified many years after the actual event has happened. Mandela is again a good example to show that it took over twenty years for people to understand how he justified his actions, but in the end his views became universally respected. The gunpowder plot is another example. This was the plan to blow up parliament for the good of the country (Club B, 2013, 28). Even though it has been hundreds of years since this event, it isn't universally accepted that blowing up parliament was the last resort and it probably wasn't. Saying this, will we ever agree that the 9/11 attacks could be justified? It is hard to say because it hasn't been a very long time since that event.

In summary, it often takes a long time for an act to become socially accepted but the original operation must meet my theory of how terrorism can be justified: if all means of peaceful protest have failed and what you doing is for the greater good of the people. However, there are some other philosophers that would disagree entirely. For example, Bittner (2005) looks at the matter from a deontological perspective. He believes that it will never be correct to kill innocent people for political purpose.

CONCLUSION

The word 'Terrorism' has been used throughout history but the meaning of it has changed. I believe that it has changed from meaning easily killing very important people, to killing a great amount of people as an act of intimidation.

There is also a constant struggle to define terrorism. Many organisations have tried but there isn't one universally accepted definition. The one I chose to use for this essay was that of the FBI, as I think it is a suitable and plausible definition that brings up moral questions in the analysis.

I believe that terrorism can be justified in specific scenarios: if all means of peaceful protest have failed and what you are

doing is for the greater good of the people. I am backed up on this point by Kai Nielson who also believes that if everything is considered and the least costly action is that of terrorism then it can be justified. Foiton's theories also somewhat coincide with my theory. However, he believes that terrorism cannot be justified if innocent civilians have been victimised. I do not think that this is a plausible theory as this would make people like Nelson Mandela terrorists when their intentions are (arguably) for the ultimate greater good of a majority.

References

- BBC (2011) *How many people were killed on 9/11?* available at: <http://www.bbc.co.uk/newsround/14854816> (Accessed 7 December 2013).
- R. Bittner, *Ethics of Terrorism and Counter-Terrorism*, ed. G. Meggle, Ontos Verlag, Frankfurt, 2005.
- The Brilliant Club, PH301 *Handbook: Can Terrorism Ever Be Justified?* Brilliant Club Publications, London, 2013.
- FBI (2013) *Reports and Publications: 2002 – 2005*, available at: <http://www.fbi.gov/stats-services/publications/terrorism-2002-2005> (Accessed 7 December 2013).
- N. Foiton, *Values in Conflict*, ed. B. Leiser, Macmillan Publishers, New York, 1981.
- K. Nielson, 2003, *On the moral justifiability of terrorism* (state and otherwise), available at: http://www.ohlj.ca/archive/articles/41_23_nielson.pdf (Accessed 8 December 2013).
- Statistic Brain (2012) *9/11 death statistics*. available at: <http://www.statisticbrain.com/911-death-statistics/> (Accessed 8 December 2013).
- A. Zalman, 2013, *PhD. Thesis – Sicarii: First Century Terrorists*, available at: <http://terrorism.about.com/od/groupsleader1/p/Sicarii.htm> (Accessed 7 December 2013).

About the authors

O. Marsden is a Year 8 pupil at Kennet School in Berkshire. Dr. Daniel Alati completed his PhD at the University of Oxford, where his research in the Law Faculty focused on the global/local divide in the realm of national security. The course was entitled 'Can terrorism ever be justified?' and looked at the moral and philosophical dilemmas behind terrorism.

CAN TERRORISM EVER BE JUSTIFIED?

B. Moores, E. Folwell

Terrorism can be justified under certain, infrequent circumstances. On these rare occasions, terrorism is used as a last resort to protect the lives and rights of entire populations or societies. Furthermore, when the beneficial consequences outweigh the immorality of the terrorism itself, it is the most effective action and therefore, it is morally admissible. In support of my argument, I will explore the history of terrorism, analysing various historical examples of terrorist organisations in order to demonstrate how terrorism and its definition have evolved and compare the different uses of terrorism throughout history. Subsequently, the essay will discuss the different definitions for terrorism and I will use my justified choice to set additional parameters for the purpose of this dissertation. This definition will allow me to justify some acts of terrorism when it is strengthened and backed up with good rationale. Then, I will explore and evaluate other philosophical views in order to substantiate terrorism, without showing bias and mentioning relevance, reliability and a justification for agreement. Supported by this analysis, I provide a concise justification for terrorism and summarise the previous points of the essay in order to warrant my consequentialist views.

The following section will explore, analyse and compare different historical examples of terrorist organisations. An ancient, controversial terrorist group, called the Sicarii, began operating around 50 CE. The members all shared one goal: to liberate Judea from Rome. They assassinated innocent people, raided villages and captured areas of land in attempts to achieve their shared objective. However, when the Romans threatened to capture the Sicarii, most of its members committed suicide. Unlike the members of the 'gunpowder plot', the Sicarii targeted innocent people, using them as means to an end. Terrorism that targets innocent civilians is usually portrayed as a worse offence than terrorism that does not. The Sicarii's victims were killed in daylight or in large crowds to psychologically affect other innocent people, so that terror could be used to achieve a political objective (Law, 2009, pp. 27-29). In 1605, a famous terrorist organisation was formed by a band of Catholic conspirators. They smuggled eighteen hundred pounds of gunpowder into the cellar beneath the House of Lords in an attempt to assassinate James I of England. Guy Fawkes was trusted to detonate the explosives on the 5 November 1605, which was the opening day of Parliament. Unlike the Sicarii and the Palestinian Liberation Organisation (PLO, see below), this form of terrorism only targets the people who are directly to blame for injustice and oppression, or people who are considered to be guilty by the terrorist group. This act of terrorism is generally seen as more justifiable, because the majority of people hold that it is morally wrong to use innocent people as a means to an end (Law, 2009, p. 52-55). In 1964, the Palestinian Liberation Organisation (PLO) was created. With the aim of destroying Israel and creating a Palestinian state, its members murdered Israelis

in many different countries, therefore starting the infrequent occurrence known as international terrorism. This historical example of a terrorist group differs from the others, as the acts of terrorism committed by its members occurred in many countries and Israelis and Palestinians fought across the globe. This terrorist organisation is, however, similar to the Sicarii, as its members targeted anyone of a certain race, not just the people responsible for oppression or injustice (Law, 2009, pp. 217-223). These examples of terrorist networks throughout history show that although terrorism used to be defined as literally using terror, as a military or political weapon, it can now mean attacking innocent people and civilians or going outside of the normal democratic process. In addition, these examples reveal that over time, terrorism has become more international due to modern technology and that the term terrorism can cover a broad range of events.

It is difficult to define terrorism; however, for the purpose of this dissertation I will use a similar definition to America's Federal Bureau of Investigation. Therefore, throughout this essay, terrorism will be defined as: the unlawful use of force or violence against civilians and non-combatants or property to intimidate or coerce a government, a civilian population or any society, in the furtherance of social or political object (Arizona Department of Emergency and Military Affairs, 2014). This is a narrow definition, as it only encompasses terrorism against innocent people. A wide definition encompasses violence against anyone and considers the entire history of terrorism. A wide definition can apply to numerous situations, including wars. This creates a problem, as violent acts are committed during wars and therefore a wide definition would imply that most armies are terrorist organisations. In addition, using a narrow definition creates some difficulties, as it is a matter of opinion, whether someone is innocent or not. Osama Bin Laden believed that: civilians who benefit from unjust societies are complicit in the perpetuation of these societies, which is an action that is morally wrong. Therefore, they are legitimate targets for violence (Bin Laden, 2005). This demonstrates that it is hard to prove innocence and it shows that some people believe that whole nations are responsible for oppression or injustice, as they pay taxes and participate in the political process of their society. I have chosen to adopt a narrow definition, because it will allow me to decide if an act of terrorism is morally justifiable. The philosopher Igor Primoratz notes that philosophers usually utilise a narrow definition of terrorism, as it is helpful in moral discourse and helps them to decide if terrorism is ever justifiable and if so, under which circumstances (Primoratz, 2007).

The following section will discuss and analyse different philosopher's deontological and consequentialist views. Consequentialists consider the consequences of an action when judging whether it is morally justifiable. However, deontologists maintain that some form of moral code exists,

so actions themselves are morally right or wrong, despite the consequences or circumstances (Primoratz, 2007). I believe that consequentialism is a useful philosophy to maintain when considering whether terrorism can be morally warranted, as deontology can lead philosophers to absurd conclusions and the ethics and results of an action are taken into account when considering morality with consequentialism. Furthermore, once an action has been perpetrated, whether decided upon using consequentialist or deontological arguments, the consequences are what remain.

I believe that terrorism is morally justifiable under certain, infrequent circumstances. Michael Walzer offers an argument as to when terrorism is an acceptable occurrence, stating that if a community is facing an imminent threat to its survival or an entire population is going to be enslaved, terrorism is justifiable, assuming that all else has failed and it is used only against the source of the threat, to ensure the survival of the community (Walzer, 2000). This argument is useful, because it fits with my narrow definition. A whole community can never be responsible for injustice and therefore require enslaving and only the people who were responsible for the threat of extermination will be victims of the terrorism. However, it does not support my consequentialist views, as Walzer is a deontologist. Additionally, Walzer's views may be based on his religious beliefs, as he is a Jewish professor. Definitively, I concur that in the circumstances highlighted by Walzer, terrorism is needed to protect the community.

Kai Neilsen offers a similar theory as to when terrorism can be morally vindicated. He argues that if an act of terrorism can be proven to be the most effective action, which will result in the least bad consequences in order to bring about a desirable social order, it is justifiable (Neilsen, 1981, pp. 435-49). Despite his consequentialist perspective, for Neilsen the PLO, the Sicarii and the catholic conspirators who established the Gunpowder plot were not justified in using terrorism. These acts of terrorism did not bring about desirable social orders nor did the good consequences outweigh the devastation caused by the terrorism itself. However, he would justify other, more effective acts of terrorism. This source is considerably reliable, because it was written by a professor, who will have conducted lots of research. Neilsen is also an atheist, so his views will not be influenced by religious beliefs. In addition, this view is relevant, as Neilsen supports my consequentialist opinions. Nevertheless, he does not consider whether the innocence of victims impacts on the justifiability of an act of terrorism. Moreover, I agree that terrorism is morally justified in the circumstances emphasised by Neilsen.

Virginia Held proposes another case as to when terrorism is acceptable. As a professor and a feminist, who studied ethics of care and roles of women, she believes that human rights are essential and that if a society's human rights are being neglected, as a last resort it would be acceptable to commit acts of terrorism against a society with protected rights, in the pursuit of equality (Held, 2004, pp.65-79). Unlike Neilsen, Held understands that the innocence of victims is important when considering terrorism in

moral discourse. Consequently, this theory uses a narrow definition. Furthermore, Held is a deontologist, because she does not believe that consequences justify terrorism, but good intentions do. Although I am not a deontologist, I agree with Held's criteria for justifying terrorism. However, only when essential rights are being violated, such as the right to live and the right to not be kept as a slave. This reveals that if fundamental rights are being abused, Held's argument is comparable to that of Michael Walzer.

Holding an opposing viewpoint, Rüdiger Bittner argues that committing an act of terrorism is always morally wrong as a deontological principle, despite the circumstances, intentions or consequences (Bittner, 2005, pp. 207-213). Bittner's argument is extremely limited, as he fails to consider any circumstances in which terrorism may be justifiable as a last resort. In addition, his views could be influenced by his political considerations. I do not agree with Bittner, because deontological views have led him to draw a narrow and overly simplistic conclusion, without consideration of circumstances in which terrorism may be required to protect entire populations from injustice and oppression. Bridget Lennon also expresses a deontological viewpoint in her belief that terrorism against innocent people is never justifiable and that killing civilians for any reason other than self-defence is morally reprehensible (Lennon, 2008). Lennon argues that terrorism, under the narrow definition, is admissible regardless of the circumstances or corollaries. I do not agree with this deontological opinion, as although terrorism would preferably only target people, who are directly responsible for prejudice and inequality, on very rare occasions the limited deaths of innocent people can save thousands of lives and as a consequentialist, these results can render the act justifiable. This source is untrustworthy, because the website does not supply any information about the author's education or qualifications, so this could just be an opinion, rather than a researched discussion.

By analysing terrorism based on a narrow definition and evaluating the consequentialist views of Neilsen and the deontological views of Lennon, Bittner, Held and Walzer, I have shown that terrorism can be morally vindicated under certain, rare circumstances. An example of one of these infrequent circumstances occurs when there is an oppressive government and terrorism is used as a last resort against the people who are directly responsible for injustice, assuming that the helpful consequences outweigh the devastation caused by the action itself. I have utilised a narrow definition of terrorism to argue that any acts of terrorism can be morally vindicated, depending on the circumstances, intentions and consequences. I primarily explored the consequentialist validation for terrorism advocated by the philosopher Kai Neilsen and employed it to three historical examples of terrorist organisations: the Sicarii, the PLO and the Gunpowder plot conspirators. I concluded that Neilsen would not believe that these acts of terrorism were admissible, as they were not vastly successful and therefore did not lead to many desirable consequences. Subsequently, I studied the deontological justifications for terrorism promoted by the philosophers Walzer, Held, Bittner, the ANC and Lennon, extracting that good intentions customarily result in beneficial

consequences. Accordingly, deontological justifications can substantiate acts of terrorism for consequentialists. To conclude, I believe that terrorism is only justifiable when it is used to stop oppression or injustice, as a last resort, assuming that the consequences outweigh the immorality of the terrorism itself. I maintain this opinion, even though I adjusted the framework for my research and therefore had to evaluate more deontological viewpoints. In addition, despite appraising more deontological perspectives, I retain my consequentialist understandings, because consequentialism is useful when analysing historical acts of terrorism even though it is not as useful for evaluating future acts of terrorism, as it can be difficult to accurately predict what the consequences of an action are going to be.

Bibliography

- Bin Laden, O. (2005) in Lawrence, B. *Messages to the World: The Statements of Osama bin Laden*, New York: Verso.
- Bittner, R. (2005) *Morals in Terrorist Times* in Meggle, G., *Ethics of Terrorism and Counter-Terrorism*, Frankfurt: Ontos Verlag, pp. 207-214.
- Held, V. (2004) *Terrorism, Rights, and Political Goals* in Primoratz, I *Terrorism: The Philosophical Issues*, New York: Palgrave Macmillan.
- Law, R. (2009) *Terrorism: A History*, Cambridge: Polity Press.
- Lennon, B. (2008) *Is Terrorism Ever Justified?* Available at: <http://www.myyogamentor.com/Blog/9E2CE826-915D-4E56-9DC1-BE294C57D5C6.html> (Accessed: 16/07/14).
- Nielsen, K. (1981) *Violence and Terrorism: Its Uses and Abuses* in Leiser, B. *Values in Conflict*, New York: Macmillan, pp. 435-449.
- Primoratz, I. (2007) *Terrorism*. Available at: <http://plato.stanford.edu/entries/terrorism/#WidNarDef> (Accessed: 12/07/14).
- Arizona Department of Emergency and Military Affairs (2014), *Various Definitions of Terrorism*. Available at: <http://www.azdema.gov/museum/famousbattles/pdf/Terrorism%20Definitions%20072809.pdf> (Accessed: 12/07/14).
- Walzer, M. (2000) *Just and Unjust Wars*, New York: Basic Books.

About the authors

B. Moores is a Year 8 pupil from Thomas Estley Community College in Leicester. Dr Emma Folwell is a postdoctoral researcher at the University of Leicester, where her research looks at twentieth century American history, in particular the racialised nature of social welfare, conservatism in the Deep South and Massive Resistance to the Civil Rights Movement.

PhD tutor's note

I have submitted this essay for consideration for publication in The Scholar as I believe it demonstrates the exceptionally high standard of work that students participating in the Scholars Programme can achieve. The essay illustrates the engagement of the student, B., with the issues we addressed in the tutorials as well as her ability to provide complex analysis and sustain an argument based on independent research at a considerably advanced level. The essay contains a range of sources, which the student found independently and utilised in an analytical and highly effective manner. B. learned to reference and utilised references correctly throughout the essay, to illustrate this impressive research. The most remarkable aspect of B.'s essay was its analytical depth and quality, shown in her continual assessment of her sources which she utilised to sustain a coherent and well-supported argument. I believe B.'s essay showcases the importance and value of the Scholars Programme, by displaying the potential latent in its students, and providing them with an outlet to display and develop this potential.

HOW USEFUL IS JOSEPH CAMPBELL'S "HERO WITH A THOUSAND FACES" AS A TOOL FOR LITERARY CRITICISM?

S. Wilding, G. Goodwin

Abstract

This essay will interrogate the usefulness of Joseph Campbell's monomyth as a tool for literary criticism by examining texts such as: *The Hobbit* by J.R.R Tolkien, *Diary of a Wimpy Kid* by Jeff Kinney, *Shrek*, directed by Andrew Adamson and Vicky Jensen, and Suzanne Collins's *The Hunger Games*.

Literary criticism is a lens through which we can look at a piece of literature. Different theories allow us to focus on different aspects of the text. The monomyth is a literary theory that presents a seventeen-stage model that can be applied to many stories, films and plays. The first stage is the Call to Adventure where the hero starts in an everyday situation and is called to take part in an adventure. This is followed by the Refusal of Call where the hero ignores or refuses to take part in the adventure – this may be for any number of reasons. Supernatural Aid finds the hero being guided by a magical being, and Crossing the Threshold is when the hero crosses the barrier into the unknown. During the Belly of the Whale stage 'the hero finally separates from the known world' (Brilliant Club Booklet: p14). During the Road of Trials the hero has to complete a number of tests or tasks and in Meeting with the Goddess the hero experiences love. If the hero strays from his quest, this is known as the Temptation stage. Atonement with the Father is where 'the hero confronts the person who has the ultimate power in his or her life – this is normally a father figure' (Brilliant Club Booklet: p14). In Apotheosis, the hero faces failure – either in a physical or spiritual sense, often shown by the willingness of the hero to sacrifice him or herself. In a film, this might be the big action scene. At The Ultimate Boon stage, the hero reaches his goal – the thing the hero came for; all previous stages lead to this point. The Refusal of Return finds the hero not wanting to go back to his world whereas in Magic Flight the hero makes his way back with the prize – though returning may be just as dangerous going on the journey itself. It is not unusual that the hero needs to be Rescued from Without by a powerful ally who guides him/her back to everyday life. In Crossing the Return Threshold the hero keeps much of the wisdom and knowledge gained on the quest, making use of that wisdom in everyday life and maybe sharing it with the rest of the world. From this point, the hero may become a Master of Two Worlds (both material and spiritual). Finally, in Freedom to Live the hero is able to get on with life peacefully. These seventeen monomyth stages can be condensed into three: separation (the first five), initiation (the next six) and return (the last six).

My first argument is that the monomyth is very useful and can be used in literary criticism to analyse the structure of a given story and help the critic to understand it better. It

can also be used to see how effective the plot of the story is. To illustrate my point, here is a brief summary of the book *The Hobbit* by J.R.R Tolkien. I will be comparing it to the monomyth and identifying the key stages, evaluating if it strengthens or weakens the monomyth's case.

Gandalf the wizard and some dwarves come to Bilbo Baggins' house. They want him to come on an adventure with them. Bilbo stubbornly refuses; but then later agrees to join them. They take long treks past mountains and valleys, through caves and forests and across lakes and rivers (which is all very new to Mr. Baggins). At times Bilbo is even tempted to abandon his quest to regain Erebor. They battle trolls, goblins, and at the end, a dragon named Smaug over who will claim Erebor's treasure, which is enough to satisfy even the greediest man's dreams. Bilbo finds a magic ring that can turn him invisible, and at the end some of the dwarves die in a war against the goblins. The team escapes after slaying Smaug, to be hunted by goblins and saved by anthropomorphic eagles. Bilbo eventually returns home with his special sword and the magical ring. He shares his tale with his nephew, Frodo, long after.

The story covers Call to Adventure when the dwarves come to Bilbo's house. His reluctance to go can be seen as Refusal of the Call. Gandalf is the magical being representing the Supernatural Aid stage. Crossing the Threshold and Belly of the Whale are both seen when Bilbo journeys to Erebor. The stage Road of Trials happens when they face trolls, goblins and Smaug. One stage that does not occur within the novel is Meeting with the Goddess. Temptation is covered when Bilbo considers abandoning the quest. Atonement with the Father is also not featured. The ultimate boon is arguably regaining Erebor (some may say the ring or the treasure is the prize or achievement). Another stage that does not happen in the book is Refusal of Return. Magic Flight is when they are hunted by goblins. Rescue from Without happens when the eagles save them. Crossing the Return threshold is met when he shares his tales with Frodo long after. And finally, Master of Two Worlds and Freedom to Live are not mentioned. The book does not fit six; but that is to be expected – most stories do not fit all stages. So, having just given my evidence, I have shown that in cases like this, the monomyth is most helpful indeed as a tool of literary criticism.

Now I will provide a summary of the book *Diary of a Wimpy Kid* by Jeff Kinney. This is an example of a book that does not fit the monomyth.

This story is more like a diary – it is about a boy called Greg Heffley who is struggling in life. He complains about his friend, his school and even his family. He gets chased by hooligans at Halloween; goes to wrestling club (which he thinks will be like ‘WWE’ but turns out to be old-fashioned wrestling where you wear embarrassing costumes); he accidentally breaks his friend’s leg; and gets the worst Christmas presents ever. Although Greg’s life isn’t the best he may be exaggerating quite a lot.

This story clearly does not fit the monomyth – the only stage that is evident is ‘Meeting with the Goddess’, when Greg falls in love. This is one of the flaws of the monomyth – it does not fit every story.

Another problem with the monomyth is that there may be a danger that it lumps things together – not paying attention to difference. An example to explain my point is Shrek (from *Shrek*) and Katniss (from *The Hunger Games*). The monomyth tells us that these two characters are both protagonists of their stories, setting out on an adventure. But it doesn’t say anything about the differences between such heroes – Shrek is a male ogre, whereas Katniss is a female human. This means that solely using the monomyth in literary criticism may not be ideal as you can miss out many important features of the book, play or film.

Furthermore, the monomyth makes it look like all stories are mythical legends, where the main character changes both physically and mentally, gaining happiness and wisdom by the end of their journey. A lot of stories I know are just about solving a problem, and the protagonist doesn’t drastically change in most of them. An example would be the *Captain Underpants* series of children’s books. In these stories, two schoolboys accidentally hypnotise their head teacher making him believe he is a superhero from one of their comics. The books follow their adventures as they try to keep Captain Underpants out of trouble. However, the structure of each story and the boys’ characters remain the same throughout the series. This weakens the monomyth’s usefulness, as this means it can only be applied to journeys of transcendence, rather than stories about solving problems.

CONCLUSION

This essay has presented various pros and cons regarding the monomyth. On balance though, I think the monomyth is a very useful tool for literary criticism. Most stories fit it and it helps the reader/viewer work out how the story is organised and has been planned out. I think all literary critics should use the monomyth more often because it could help them understand the choices the author (or director) makes – in relation to characters, plots and themes – and what their significance is.

References

- A. Adamson, V. Jenson (dir.), *Shrek*, Dreamworks Pictures, Universal City CA, 2001.
- J. Campbell, *Hero with a Thousand Faces*, Princeton University Press, Princeton, 1968.

- S. Collins, *The Hunger Games*, Scholastic, New York, 2008.
- J. Kinney, *Diary of a Wimpy Kid*, Amulet Books, New York, 2007.
- D. Pilkey, *Captain Underpants*, Scholastic, New York, 1997.
- J. R. R. Tolkien, *The Hobbit*, George Allen and Unwin, Crows Nest NSW, 1937.
- The Brilliant Club, *The Hero’s Journey*, Brilliant Club Publications, London, 2013.

About the authors

S. Wilding is a Year 8 pupil at Rokeby School in Newham, east London. Dr. Gavin Goodwin completed his PhD at the University of Surrey, where his research focused on the uses of poetry in areas of social exclusion. The course was entitled ‘Monomyth’ and introduced pupils to the principles of literary criticism using Joseph Campbell’s Monomyth as a focal point.

DO YOU THINK THAT THE HOLOCAUST IS BEST REPRESENTED THROUGH TESTIMONY OR FICTION?

H. Hassan, N. Woodward

Many great writers have attempted to recall or reconstruct the dreadful events of the Holocaust. The Holocaust was the immoral actions of the fanatical, fascist and anti-Semitic Nazi Party. It was the attempted annihilation of an entire race – Jews. The events of the Holocaust have been depicted to further generations through both testimony and fiction. A testimony is a ‘statement or declaration of a witness under oath or affirmation’.^[1] In this, a Holocaust testimony is someone’s account of their experiences as a Holocaust survivor. I have chosen to analyse such testimonies because sometimes they might not be entirely accurate as the witness may not be in the right state of mind, which is frequently the case for trauma narratives. Fiction, on the other hand, is ‘the class of literature comprising works of imaginative narration’.^[2] In the cases of the fictional novels I will analyse here, they are written by authors who have not experienced the Holocaust but wish to represent it through literature. I have chosen to analyse works of Holocaust fiction because although they may not be entirely historically accurate, they are still a means of passing down stories. Indeed, these two contrasting methods of writing encourage us to remember these atrocious events.

Testimony represents the Holocaust through memories of the past. This is shown in the graphic novel, *Maus*, where the artist, Art Spiegelman, memorializes his father’s experiences of the Holocaust in one of the biggest concentration camps – Auschwitz. In the novel, the graphic representation of Art says the sentence: “No matter what I accomplish, it doesn’t seem like much compared to surviving Auschwitz”.^[3] Although this shows Spiegelman’s admiration for his father, it portrays a jealous mood towards the reader. The use of the verb ‘accomplish’ shows how, however much he perseveres to do good, he believes his father’s survival is a greater achievement. Therefore, this accentuates that testimony best represents the Holocaust because the very fact that the person survived is seen as so commendable in society, but to write about the horrors for everyone to see is yet another milestone. *Maus* is Art Spiegelman’s father’s testimony and Spiegelman’s autobiography. Vladek – his father – answered Spiegelman’s questions about the Holocaust and Spiegelman records him before translating his testimony into the graphic novel, interjecting his father’s narrative with snippets from his own life. Vladek did not write his testimony down; Art Spiegelman did it instead. Conversely, they may be so traumatised by the events that trauma may influence their testimony in other ways: the style may seem fragmented, or it may mean that survivors return to one particularly traumatic memory again and again. Sometimes, memory is such that events may not be recalled entirely as they happened; for example a date may be wrong or the sequence of events may seem muddled. On the other hand, people say that they will be so troubled

that they will tell the truth and only the truth. There is a difference between truth and truthful. Truth is completely factual making it non-fiction. However, truthfulness is what in the person’s eyes is seen as the truth. For example, in Holocaust testimonies, truthfulness is when the author writes about his experiences which may not be exactly true but because they are so traumatised by the events they believe it to be true. This can be further argued by Jean Améry’s experiences, where he writes, ‘It is totally senseless to try and describe here the pain that was inflicted on me. Was it [...] and another [...] in the hopeless merry-go-round of figurative speech.’

Testimonies best represent the Holocaust because they experienced the “Horrors”^[4] that took place in the concentration and death camps. This is evident in the text *The Holocaust and the Postmodern* by Robert Eaglestone where he writes: “‘Who is this who uses the lives of the dead?’ is a fair question’.^[5] Eaglestone’s use of the rhetorical question shows his beliefs on both testimony and fiction alike. In the quotation, he is saying that you cannot put the horrors into words unless you were there. Therefore, this clearly accentuates to us that Eaglestone believes that you cannot write a story about something without experience about what happened inside the camps. Eaglestone’s use of the antithesis ‘lives’ and ‘dead’ clearly shows that he believes you cannot resurrect the Holocaust unless you were there at the death camps or lost relatives within them. Questioning the reader has a dramatic effect because this oxymoron shows us that you may not be able to ‘use’ the lives of the Jews physically or directly but you are indirectly using their lives as a plot for a work of fiction mostly for your own personal benefits. On the other hand, this could show that you should not write about the Holocaust at all, because Eaglestone uses the word ‘dead’ and victims of atrocity would not be able to write their testimony unless they survived, so like Art Spiegelman he suggests that the very act of survival shows you cannot talk about others who died in your testimony because you never experienced death in the camps. This is accentuated to us using this using survivors guilt – ‘feelings of guilt for having survived a catastrophe in which others died’^[6] – and this shows that a person may feel distraught and might not have the strength in writing down this book whereas a person writing it as a fiction will feel more strength because they never experienced the Holocaust themselves. However, Art Spiegelman was born after the concentration camps so he feels guilty as a second generation survivor because he is told all these stories of the Holocaust and like us he did not experience it. Therefore, you could argue that *Maus* is a mixture of testimony (his father’s experience) and Art’s own personal autobiography.

Most people who survived the Holocaust were and still are

too afraid to write about what happened to them because they feel too ashamed. In the metatextual fiction *Beatrice and Virgil*, Yann Martel depicts how Holocaust survivors who wish to write testimonies about their experiences end up writing trauma narratives because they do not have a clear periphery between reality and sentiments. Martel does this through his allegory which is apparently about animal cruelty but in reality about the Holocaust and the character in the allegorical novel is trying his best to hide the true message. The writer's intention is to show that the atrocity is so bad it cannot be conveyed in words. This is evident in the text where he says, 'That's the key question in the play, how they are going to talk about what happened to them. They come back to the same question again and again'.^[7] This quote shows that you cannot talk about everything because how can you communicate the incommunicable and from this Postmodernism was born. This shows that the Holocaust is best represented through fiction because it shows that the authors of Holocaust testimonies frequently, usually because of survivor's guilt, are not able to put emotional distance in their writing so they end up putting down things that are not necessarily true. Therefore, writing fiction is better because the person never experienced the 'Horrors' making them more immune to emotions and generally people who write fiction about the Holocaust after it happened are skilled writers so they are able to put the emotional distance between pen and paper. This shows insight into testimonies. However, without testimonies and people 'attempting' to talk about the Holocaust Postmodernism would not have come about because this is literature after the Holocaust that talks about how you cannot talk about everything. This is further backed up by the secondary source, *New Literary History*, where James Young writes 'Saul Friedländer [...] suggests that, beginning with the First World War and culminating in Auschwitz, reality itself became so extreme as to outstrip language's capacity to represent it altogether'.^[8] This source shows that however hard you try you will not be able to put the Holocaust into words and if you do put them into words it will lose their power because it will not be seen as traumatic and incommunicable. However, if no one puts these events into words, how will these people be remembered?

Testimony and fiction both give the writer different stylistic guidelines. Testimony allows the writer to talk about the events of the Holocaust objectively. This is because they inform us about the Holocaust from first-hand experience as they are survivors. This is shown in *Night*, by Elie Wiesel, where he writes, 'HIS RECORDS OF CHILDHOOD IN THE DEATH CAMPS OF AUSCHWITZ AND BUCHENWALD'. This clearly shows that *Night* is a first-hand experience and like most testimonies, it empowers future generations to be aware of the events of the Holocaust, using it as an example. As George Santayana once said, "Those who do not learn from history are doomed to repeat it".^[9] This shows that it has helped ensure that the horrific events of the Holocaust are 'never to be forgotten or repeated'. Fiction, on the other hand, allows the writer to interpret factual events of the Holocaust. He is therefore able to dramatise the events subjectively. This could be seen as immoral as they are using dead people as their basis of the story. Again this is evident in the text *The Holocaust and the*

Postmodern by Robert Eaglestone where he writes: "Who is this who uses the lives of the dead?" is a fair question'.^[10] This shows that you cannot write about the Holocaust if you have not experienced it. This, again, links back to the birth of Postmodernism. However, if people cannot write about the Holocaust as a fiction with all of its figurative tropes and dramatising it however they want, then survivors cannot, in their testimonies, include people who have died if they have not experienced death in the death camps themselves. This is evident in *Writing and Rewriting the Holocaust* where James Young writes: 'To leave Auschwitz outside of metaphor would be to leave it outside of language altogether'.^[11] This shows that you should be allowed to write Holocaust fiction because how else will we know about the atrocities of the Holocaust after all the survivors have died.

In conclusion, I think that the Holocaust is best represented by both testimony and fiction equally. This is because although testimony is a first-hand experience and some may see it as immoral to write about it, fiction dramatises the Holocaust and makes it more memorable through figurative tropes. Fiction allows the writer to have an emotional distance when writing and it usually bases its plots on facts from the Holocaust and even though some people find that using these people's lives is immoral, it helps us remember these people who were almost annihilated. On the other hand, although testimonies do not have a lot of emotional distance, it is from the time and based on experience. There is not a lot of information in the history books about how people felt in the Holocaust, so we have to believe and take the words of the survivors as actual facts. Therefore, these testimonies are as close as we get to the truth about what life was like in the Holocaust for Jewish prisoners. Who else deserves the right to write about the Holocaust than those who have survived it? In summary, Holocaust fiction and testimony are not different because *Fragments*, a fiction, was mistaken for a testimony so overall I think both testimony and fiction represent the Holocaust the best.

References

1. Dictionary.com (no date), Testimony | Define Testimony at Dictionary.com. Available at: <http://dictionary.reference.com/browse/testimony?s=t> (Accessed 28/03/2014).
2. Thesaurus.com (no date), Testimony Synonyms, Testimony Antonyms | Thesaurus.com. Available at: <http://thesaurus.reference.com/browse/testimony?s=t> (Accessed 28/03/2014).
3. Art Spiegelman, Maus, p.204.
4. Yann Martel, *Beatrice and Virgil*, p.136.
5. Robert Eaglestone, *The Holocaust and the Postmodern*, p.109.
6. Dictionary.com (no date), Survivor guilt | Define Survivor guilt at Dictionary.com. Available at: <http://dictionary.reference.com/browse/survivor+guilt?s=t> (Accessed 17/04/2014).
7. Yann Martel, *Beatrice and Virgil*, p.133.
8. James Young, *Interpreting Literary Testimony*, *New Literary History*, p.405.
9. Thinkexist.com (no date), George Santayana quotes. Available at: http://en.thinkexist.com/quotation/those_who_do_not_learn_from_history_are_doomed_to/170710.html (Accessed 23/04/2014).
10. Robert Eaglestone, *The Holocaust and the Postmodern*, p.109.
11. James Young, *Writing and Rewriting the Holocaust*, p.91.

About the authors

H. Hassan is a Year 9 pupil from Challney High School for Boys in Luton. Natalie Woodward is a PhD student at Royal Holloway, University of London, where her research focuses on English literature and the study of the Holocaust.

SHOULD ARMED FORCE BE USED TO CONSERVE BIODIVERSITY IN REGIONS OF ARMED CONFLICT?

H. Walker, R. Millburn

INTRODUCTION

The illegal trade in wildlife is becoming increasingly lucrative. The huge amount of money that can be made is attracting organised criminal networks and fuelling the high levels of poaching. The effects of this criminal activity are very damaging for endangered species, including iconic animals like the African elephant, but also for local people who rely on the natural resources for their livelihood.

Militarised responses to poaching from governments, including 'shoot-to-kill' policies, are controversial but there is evidence that they are extremely effective. Some people argue that alternative policies can also be effective in protecting wildlife, without the need for loss of human life.

In areas of armed conflict, many of which are the habitats of endangered species, the combined effect of lawlessness, poverty and weaponry, create circumstances that encourage illegal poaching. Poachers might be civilians deprived of their usual livelihood due to the conflict, or warlords who have an easy source of money to buy weapons and ammunition, leading to an escalation in violence and further loss of human and animal life.

By focussing on the illegal ivory trade and the iconic African elephant, this essay will argue that in war-zones the use of armed force is the only effective way to combat widespread illegal poaching.

LITERATURE REVIEW

The Monitoring the Illegal Killing of Elephants (MIKE) programme has identified that elephant populations have a natural annual growth rate of 5-6 %. Illegal poaching is estimated to reduce numbers by over 7 %, leading to an unsustainable trend that must be reversed (UNEP/CITES, 2013). Advocates of using armed force to protect elephants point to successful programs implemented in Kenya, Tanzania and Zimbabwe (Gibson, 1999). When Tanzania suspended its controversial 'shoot-to-kill' policy, elephant deaths rose from two in October 2013 to sixty in November-December (Smith, 2013).

Those who argue against a military response to poaching object on moral grounds, that it is wrong to take a human life (Pollard, Wilkinson and Chan, 2014). Others claim that it is an abuse of human rights, because suspected poachers are being shot dead without having been subject to a legal process (Burlleson, 2010).

WWF believes the most effective form of conservation is a non-violent approach, focussing on educating locals in community conservation and developing sustainable practices of mitigating conflict (WWF, 2014).

This essay will show that the illegal trade in ivory, driven by demand from the growing economies of Asia, is now similar in scale to the international drugs trade (Russo, 2012). Furthermore, ivory, 'the white gold of jihad', has become a significant source of funds for terrorist groups like al-Shabaab. The use of armed force against poacher now needs to be seen as much in the context of the 'war on terror' as in protection of endangered species (Kalron and Krosta, 2012).

DEFINITIONS AND PARAMETERS

In this essay, 'armed force' is defined as the use of lethal weapons by rangers, police and soldiers, mandated by a government or organisation such as the United Nations. This definition is used to make a distinction between the official, legal use of force by authorities and unofficial, illegal action.

According to the Department of Peace and Conflict Research at Uppsala University, an 'armed conflict' is defined as "a contested incompatibility which concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths' (DPCR, 2013).

Biodiversity can be defined as the species, bacteria and ecosystems diversity in a specific area (Swingland, 2001) or "a concept which refers to the range of living organisms within the living world" (UNEP, 2014). This is a broad definition and no-one would seriously suggest that armed force can be justified to protect abundant species. For the purposes of this essay, the definition will be narrowed to mean species that are endangered, i.e. considered to be 'facing a very high risk of extinction in the wild' (WWF, 2013).

Wildlife is valued both for what it is and what it can provide. 'Intrinsic value' is the value of an object it has within itself and is valuable for its own sake (Vilkka, 1997). 'Instrumental value' is when something provides the means for obtaining something else valuable (Holsinger, 2013).

The debate on conservation contrasts 'fortress' and 'community' approaches. Fortress conservation is when people are forcefully removed from their land and then further excluded from participating in conservation or even tourism ventures (Kaminski, 2010). Community conservation refers to wildlife conservation efforts that involve rural people and communities. It aims to make rural people protect biodiversity (Hackel, 2001).

THE INTERNATIONAL IVORY TRADE

No animal illustrates the issues of the illegal wildlife trade better than the African elephant, one of the world's most

iconic and magnificent species and one that has long been illegally hunted. The national parks of East Africa, especially in Kenya and Tanzania, were early examples of fortress conservation projects that made areas of land off-limits to local people and to farming, although the tourist industry has created jobs and an important source of hard currency for these countries (Ekdahl, 2012).

Poaching has become a more common occurrence in recent years as a result of a rising demand for ivory, especially in the rapidly growing economies of Asia, specifically China (Russo, 2012). Illegal ivory trade also thrives in Africa itself, with unregulated local markets and a growing number of potential Asian buyers who are living and working in Africa due to building projects and mining. The situation is made worse by widespread corruption in many African regions (UNEP/CITES, 2013).

Data gathered by the programme known as MIKE (Monitoring Illegal Killing of Elephants) led by the Convention on International Trade in Endangered Species, suggests that an estimated 17,000 elephants were illegally killed in 2011 (UNEP/CITES, 2013).

According to the Animal Welfare Institute, a poacher can expect to earn \$80 per kilogram of ivory, or \$800 for the 10 kg of ivory from a typical elephant – a significant sum of money in most African countries. However, the biggest profits are to be made further down the line, by smugglers and traders in Asia. Smuggled ivory is estimated to be worth \$1,800 a kg (i.e. \$18,000 per typical elephant) at wholesale and the ‘street value’ is in the region of \$6,000 per kg (or \$60,000 per elephant) (AWI, 2013).

Such financial rewards are attracting organised criminals, leading to an escalation in poaching activity, violence and increased pressure on endangered species like the African elephant. The recent London Conference on the Illegal Wildlife Trade (LCIWT, 2014), brought together representatives from over 50 countries and concluded:

1. There is a serious threat to the survival of many species if action is not taken.
2. Poaching and trafficking undermines the rule of law and encourages corruption.
3. The illegal wildlife trade has become a well-organised, international criminal activity.
4. Rangers are being killed or injured in significant numbers.
5. Serious poaching incidents are more frequent and are more devastating in scale.
6. Poaching robs states and communities of their natural capital and cultural heritage, with serious economic and social consequences.

CONFLICT IN AFRICA

Africa is a continent that has been continually affected by war in recent decades, with over 20 major civil wars since 1960, (Pike, 2014). Of the 16 current UN peacekeeping operations, 8 are in Africa (UN, 2014).

The lawlessness of war zones, combined with an abundance of weaponry, creates situations that encourage the illegal

poaching of elephants. Poachers might be civilians deprived of their usual livelihood by the conflict or warlords and terrorists seeking a profitable way to fund their campaigns. Ivory has been called the ‘white gold of jihad’ and is said to finance terrorist organisations like al-Shabaab (Kalron and Crosta, 2012).

Poverty resulting from war makes it easier for criminals to recruit, bribe or threaten locals and underpaid police and wildlife rangers. The extreme threat to elephants in war-torn regions of Africa requires an extreme response. This has led to military action against poachers and ‘shoot-to-kill’ policies.

ARMED FORCE IN CONSERVATION

When Richard Leakey founded the Kenya Wildlife Service (KWS), he decided something extreme had to be done to conserve endangered species. He obtained updated equipment and weapons – including helicopter gunships – as well as uniforms and better pay for rangers. He also convinced President Moi to burn \$3 million worth of elephant tusks. He then pushed a ‘shoot-to-kill’ policy against poachers. Poaching decreased and elephant numbers rapidly increased (Gibson, 1999). Even though Kenya may not be a region of armed conflict, this example highlights the fact that armed force can be extremely effective in conservation.

Few would disagree that elephants and other endangered species have a high intrinsic value to humankind. However, it is the instrumental value of African elephants that is mostly driving the ‘shoot-to-kill’ policies adopted by countries like Kenya and Tanzania.

As early as 1948, TGC Vaughan-Jones, Director of Game in Northern Rhodesia, stated ‘It cannot be too strongly emphasised that in a country where vast rural areas carry small populations, the wildlife in one shape or another is a main economic force, just as much as the soil or the water supply’ (Gibson, 1999).

Wildlife is considered a national asset because it creates tourism, an important source of employment and money. These countries are protecting a national economic asset by military force, as any other nation would protect its own valuable assets (Pollard, Wilkinson and Chan, 2014).

In the relatively stable countries of East and South Africa, it could be argued that alternative conservation strategies do exist. Although it may be distasteful to some conservationists, controlled ‘trophy hunting’ can be successful as a kind of ‘community conservation’ project. The legalisation of white rhinoceros hunting motivated private landowners in South Africa to re-introduce the species. As a result of increased areas of habitat, the country saw an increase in white rhinos from fewer than one hundred individuals to more than 11,000 (Goldman, 2014).

Such schemes are not possible in war-torn countries of Africa, which lack a functioning government and the rule of law. Poaching in such war-zones is the result of organised criminal gangs operating outside of the country, who make

large profits from illegal activity that does not benefit Africans. The money that is received by the poachers is often used to buy weapons that prolong conflict, bringing more death and misery.

Those who object that it is morally wrong to take a human life (Pollard, Wilkinson and Chan, 2014) or an abuse of human rights (Burlleson, 2010) must recognise that poachers will be aware of the potential consequences of their illegal activity and the risks they are taking. As a KWS spokesman has said, the purpose of armed response is to make poaching “a high- cost, low-benefit activity” (BBC, 2012).

In many respects, the illegal wildlife trade is similar to the international drugs trade. The use of deadly force against armed drug traffickers is generally accepted by society. It is seen as an appropriate response to the problems caused by drugs.

Because wildlife trafficking is so profitable for organised criminals, they are prepared to buy more powerful weaponry for poachers to outgun the rangers, which risks leading to an arms race and greater bloodshed (Pollard, Wilkinson and Chan, 2014). There are again parallels with the war on drugs, where law enforcement agencies face similar challenges. In neither case should an escalation in firepower be a reason to back down from confronting serious criminal activity.

Conservationist Karl Ammann summarises the view of those who support the use of armed force in areas of conflict. “You’re in countries where [poachers] are coming in, heavily armed, there’s no jails, no effective administration, and they’re massacring the country’s wildlife, which should be a resource for the people of that country. In these circumstances I agree absolutely with the use of force” (Wasley, 2008).

CONCLUSION

Armed conflicts create the ideal situations for illegal poaching. Warlords take advantage of valuable wildlife resources, like ivory, to fund their military operations, creating further death and prolonging violence. Well-resourced and organised criminal gangs, often from other countries, exploit the lawlessness and human suffering of warzones. They make immense profits whilst depriving local people of their natural resources, with serious short and long term effects.

The ethics of ‘shoot-to-kill’ policies against poachers, as used in countries like Tanzania and Kenya as part of wider ‘fortress conservation’ projects, are much debated, but there is strong evidence to suggest they are effective in protecting endangered species. The governments of these countries, reliant on tourism, are using military force to protect an important national asset, as all countries do.

Those who are against armed force being used to protect biodiversity, argue that killing poachers is morally wrong and that other ‘community conservation’ projects can offer effective alternatives to protect the endangered species by

extending their habitats.

However, such alternative schemes almost always require a functioning government and the rule of law, which are not present in areas of armed conflict, and so if we are to protect endangered species – both for their intrinsic value to humankind and their instrumental value as a natural resource for local people – we must accept that using armed force against destructive criminals is necessary.

Bibliography

- Animal Welfare Institute (2013) *Elephant Slaughter Escalates as Illegal Ivory Market Thrives*, Available at: <https://awionline.org/awiquarterly/2013-winter/elephant-slaughterescalates-illegal-ivory-market-thrives> (Accessed 30th March 2014).
- BBC (2012) *Kenya rangers shoot dead five suspected poachers*, available at: <http://www.bbc.co.uk/news/world-africa-17798914> (Accessed 21st April 2014).
- E. Burlleson (2010) *The War Against Poaching in Africa: Learning from our mistakes*, available at: <http://www.elizabethburlleson.com/Poaching%20in%20Africa%20by%20Tricia%20Patel.pdf> (Accessed 30th March 2014).
- Department of Peace and Conflict Research, Uppsala University, Sweden (2013) *Definition of armed conflict*, available at: http://www.pcr.uu.se/research/ucdp/definitions/definition_of_armed_conflict/ (Accessed 30th March 2014).
- C. Ekdahl (2012) *Attitudes towards Wildlife Conservation in Kenya*, available at: http://stud.epsilon.slu.se/4616/1/ekdahl_c_120814.pdf (Accessed 18th April 2014).
- C. Gibson, (1999) *Politicians and Poachers: The Political Economy of Wildlife Policy in Africa*, p.108, available at: http://books.google.co.uk/books?id=kmD-P9L-lrEC&dq=he+fred+more+than+two+thous+and+employees+o+f+the+KWS&source=gbs_navlinks_s (Accessed 20th April 2014).
- J. Goldman (2014) *Can Trophy Hunting Actually Help Conservation?* available at: <http://conservationmagazine.org/2014/01/can-trophy-hunting-reconciled-conservation/> (Accessed 30th March 2014).
- J. Hackel (2001) *Community Conservation and the Future of Africa's Wildlife*, available at: <http://onlinelibrary.wiley.com/doi/10.1046/j.1523-1739.1999.98210.x/abstract> (Accessed 30th March 2014).
- K. Holsingr (2013) *Intrinsic vs. instrumental value*, available at: <http://darwin.eeb.uconn.edu/eeb310/lecture-notes/value-ethics/node2.html> (Accessed 30th March 2014).
- International Fund for Animal Welfare (2013) *About IFAW*, available at: <http://www.ifaw.org/international/about-ifaw> (Accessed 13th April 2014).
- N. Kalron, and A. Crosta, (2012) *Africa's White Gold of Jihad: al-Shabaab and Conflict Ivory*, available at: <http://elephantleague.org/project/africas-white-gold-of-jihad-al-shabaab-and-conflict-ivory/> (Accessed 21st April 2014).
- A. Kaminski (2010) *The development and conservation paradox*, available at: http://www.consultancyafrica.com/index.php?option=com_content&view=article&id=592:community-based-conservation-or-nature-based-participation-protecting-nature-and-people-in-africa&catid=92:enviro-africa&Itemid=297 (Accessed 30th March 2014).
- London Conference on the Illegal Wildlife Trade (2014), available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/281289/london-wildlife-conference-declaration-140213.pdf (Accessed April 2014).
- J. Pike (2014) *The World at War*, available at: <http://www.globalsecurity.org/military/world/war/index.html> (Accessed 30th March 2014).
- C. Pollard, C. Wilkinson, and C. Chan, (2013) *Enforcement of conservation: how far is too far?*, available at: <http://www.iccs.org.uk/enforcement-of-conservation-how-far-is-too-far/> (Accessed 30th March 2014).
- C. Russo, Yale Environment 360 (2012) *How China is driving the grim rise in illegal ivory*, available at: <http://www.theguardian.com/environment/2012/jan/23/china-rise-illegal-ivory> (Accessed 20th April 2014).
- D. Smith, (2013) *Elephant deaths rise in Tanzania after shoot-to-kill*

poachers policy is dropped, available at: <http://www.theguardian.com/world/2013/dec/31/elephant-deaths-rise-tanzania-shoot-to-kill-poachers> (Accessed 20th April 2014).

- I. Swingland (2001) *Biodiversity, Definition of*, available at: http://moodle.telhai.ac.il/pluginfile.php/29168/mod_resource/content/0/section01/biod-_biod.Encyclopedia_definition.pdf (Accessed 30th March 2014).
- UNEP, CITES, IUCN, TRAFFIC (2013) *Elephants in the Dust – The African Elephant Crisis*, available at: http://www.cites.org/common/resources/pub/Elephants_in_the_dust.pdf (Accessed 30th March 2014).
- UNEP (2013) *What is biodiversity?* available at: http://www.unep-wcmc.org/what-is-biodiversity_50.html (Accessed 30th March 2014).
- United Nations (2014) *Current peacekeeping operations*, available at: <http://www.un.org/en/peacekeeping/operations/current.shtml> (Accessed 30th March 2014).
- L. Vikkla, *The Intrinsic Value of Nature: Volume 59*, Rodopi, Atlanta, 1997.
- A. Wasley, (2008) *Ecologist Magazine: A Green Army*, available at: http://www.theecologist.org/investigations/society/269501/a_green_army.html (Accessed 30th March 2014).
- World Wide Fund for Nature (2013) *About Species*, available at: http://wwf.panda.org/about_our_earth/species/about_species/ (Accessed 30th March 2014).
- WWF (2014) *What WWF is doing*, available at: <https://worldwildlife.org/species/african-elephant> (Accessed 20th April 2014).

About the authors

H. Walker is a Year 10 pupil at Esher High School in Surrey. Richard Millburn is studying for his PhD at King's College London, where his research focuses on wildlife conservation in conflict environments.

Phd Tutor's note

I have nominated this essay because it is the highest quality essay I have read during my time with The Brilliant Club, which means it is better than essays on the same topic written by sixth formers. The article is exceptionally well researched – there are more than twenty references all of which H. found herself. The essay is particularly impressive because the pupil has taken a very broad question and independently narrowed it down to produce an effective answer that allowed for greater in-depth analysis and conclusions to be drawn that apply to the broader question as a whole.

The essay is very well-structured and includes an effective and concise literature review and definitions section as well as an analysis section that flows logically and builds the argument up in layers to draw to an effective and well-argued conclusion. The answer to the question is clear and well-sustained throughout, and effectively addresses counter arguments to her line of reasoning. H. put a huge amount of effort and independent research into this essay and has produced a well-written and well-argued essay that warrants publication in *The Scholar*.

NO NEED FOR PRONOUN ENVY? A COMPARATIVE ANALYSIS OF “THE LEFT HAND OF DARKNESS”, “THE COOK AND THE CARPENTER” AND “THE DAUGHTERS OF EGALIA” IN RELATION TO ROBIN LAKOFF’S AND DALE SPENDER’S THEORETICAL POSITIONS

K. Booth, C. Luck

Lakoff and Spender both believe that language indicates existing gender inequalities and that some linguistic differences should be addressed, but while Spender suggests that using ‘he/man’ as default contributes to the erasure of women, Lakoff argues that the use of male pronouns as default does not cause harm to women and could not be easily changed. *The Left Hand of Darkness*, *The Cook and the Carpenter* and *The Daughters of Egalia* reflect on and respond to the positions of both Lakoff and Spender in different ways and explore the issue of gender and language using different techniques to varying effect, how do they compare to one another in this respect?

In *The Left Hand of Darkness*, LeGuin makes it clear that the narrator tries to avoid using gendered terms to describe the Gethenians, but resorts to using male pronouns. The narrator, Ai, first attempts to avoid gender by referring to Estraven as “the person on my left” (LeGuin 4), but then resorts to use of “he”, “his” and “man” (LeGuin 4, 5), suggesting that, as Lakoff claims, using gender-neutral pronouns would be too difficult a change for society as a whole to attempt (Lakoff 75).

LeGuin makes it clear that the narrator is only able to see Gethenians as alternating between male and female; “my efforts took the form of self-consciously seeing a Gethenian first as a man, then as a woman” (12). However, he does not use a female pronoun to describe the Gethenians, even when he sees them as feminine, as he does with his ‘landlady’ (46, 47, 104). Nor does Ai express any discomfort at their masculine attributes, only the feminine – his distrust of and annoyance at Estraven, for example, is linked to ‘his’ effeminate behaviour – showing that for the most part he sees the Gethenians as male and is surprised when they do not behave as such. He uses male pronouns because he is used to treating maleness as the default state of being, reflecting Lakoff’s position; his use of masculine pronouns is indicative of the androcentric views held by himself and the world he comes from, rather than the cause of them. The phrase “Though I had been nearly two years on Winter I was still far from being able to see the people of the planet through their own eyes” (LeGuin 12) indicates that Ai comes to better understand the Gethenians despite continuing to use male pronouns – implying that the use of male pronouns as default is harmless, in contradiction to Spender’s views (157, 162) and in line with Lakoff’s (75).

While gender is explored throughout *The Left Hand of Darkness*, via the narrator’s experience of Gethen, the use of pronouns is barely touched on. We find out that the Gethenians have two separate pronouns for people ‘in kemmer’ who have taken on masculine or feminine attributes, as the narrator describes a man using “the pronoun that designates a male animal, not the pronoun for a human being in the masculine role of kemmer” (LeGuin 63) and the Gethenians must use another, gender-neutral, pronoun, but no such pronoun is given in the text, despite many other invented terms being used throughout, such as ‘kemmer’ and ‘shifgrethor’.

Ursula LeGuin herself admitted to having not explored the Gethenian’s gender as much as she should have, she limited herself

because she expected the average reader of the novel to be male, due to the male-dominated readership of science-fiction (LeGuin “First Contact...”), and there are clear reasons for criticism of *The Left Hand of Darkness*. The use of male pronouns and terms as default in *The Left Hand of Darkness* would be far more effective if it were limited to Ai’s narrative, with a neutral pronoun used for the hearth tales and Estraven’s narrative, as this would illustrate something about gender and pronouns and how androcentric language is linked to patriarchy, rather than merely following a common grammatical rule. Instead, LeGuin’s use of androcentric language serves to undermine the Gethenians’ lack of gender, making the reader see them as predominately male – the effect of he/man language as demonstrated by studies (Gastil, Khan).

While Lakoff believes (75), and LeGuin supports, that it’s too difficult to try to change pronoun use, Spender makes a case for the use of new, neutral pronouns (Spender 162). *The Cook and the Carpenter*, indicates that this is possible, as the text is not made difficult to read by the use of invented neutral pronouns; the reader quickly grows accustomed to them, which suggests that it would be possible for neutral pronouns, such as the one used, to become the norm. This is further demonstrated by use of ‘na’ by not only June Arnold’s narration, but by characters within the book. Not only the group that the cook and the carpenter belong to but supportive outsiders, such as the woman who comes to warn them, use the ‘na’ pronoun (Arnold 5); understanding and adopting their pronoun system when talking to them. As the pronouns are used by the protagonists and other sympathetic characters, but not by outsiders, it could be inferred that Arnold is, like Spender, in favour of the use of neutral pronouns such as ‘na’. The way the theorists’ views in regards to the impact of pronouns are shown in *The Cook and the Carpenter* is somewhat dependent on the interpretation of the reader. If the characters are seen as male throughout, male pronoun use may be seen as indicative of seeing male as default, rather than the cause, reflecting Lakoff’s views (Lakoff 73). However, given the pronoun use, the reader is free to interpret gender as they choose throughout; the characters’ gender may be fluid in their mind, and more likely to be interpreted as female than with the use of male pronouns. The reader may find their interpretation of the characters’ gender varying depending on their actions – seeing the characters as female when they are linked to childcare, or male when they are drinking at a bar.

The use of the pronoun ‘na’ throughout allows the reader to explore how they see the gender of the characters as they are able to see whether or not they see male as the default gender even when neutral pronouns are used. The text does not make a clear case in itself towards which of these it is, but may provoke the reader to consider how they personally see pronoun use and how it affects them. Arnold’s introduction points out that if men and women are as different as we believe, it should be easy to tell them apart based on their personalities and actions (Arnold introduction). The author goes on to show quite how ridiculous the idea of universal gender differences is, as the reader is unable to determine the gender of the characters when they are not referred to by gendered

pronouns, and must either view the characters as alternating between male and female in their mind's eye depending on their actions, or must come to terms with the fact that gender is not as simple as they may believe.

Many different gender-neutral pronouns have been proposed over the past century (Baron), some neater and more easily used than others. Examples of these include co/co/cos (Orovan), e/em/eir (Spivak, Shaviro), ve/vem/vir and the debatably grammatically correct singular they/them/their. The use of the gender-neutral pronoun 'na', while effective, could be improved upon. 'Na' seems unrelated to conventional pronouns and lacks an objective form, making it less easy to read than it might otherwise be. While gender-neutral pronouns do not need to be similar to existing pronouns, those which are may often be easier to read, for example, ho/hom/hos (Darnell) in contrast to Arnold's na/na/nan, which has a separate objective form and clearly mirrors the existing he/him/his. However, this is far less gender-neutral, as it is so close to the male pronoun, so alternatives such as e/em/eir (Spivak, Shaviro), and ve/vem/vir, which instead mirror they/them/their, may provide a better option.

In *The Daughters of Egalia*, the use of 'her' to describe both female and male children, as in "the thought of being brought up in front of her desk filled every pupil with terror" (Brantenberg 19) makes sense in context, but is clearly a product of the patriarchal setting, reflecting Lakoff's view that male as default pronouns, and other gendered terms, are indicative of inequality (73). This is shown throughout, by the different terms used, such as 'Msass', which may be assumed to mirror 'Mrs', indicating the marriage status of the 'housebound'. The need for language to differentiate between married and unmarried women is shown as a result of patriarchy by showing that it might be reflected in a patriarchal society. The use of 'wom' and 'manwom' is shown as unhealthy because it positions women as the default gender and men as secondary. The same applies to gendered terms e.g. 'seawom' and 'frogwom', which is highlighted when the idea of men in these jobs is mocked by Ba; "a mafele seawom! Ho ho! Or perhaps you're going to be a cabin boy or a seamanwom, or a helmsmanwom?" (10), mirroring Spender's view that gendered terms which position women as secondary are harmful (157, 162).

The role reversal in *The Daughters of Egalia* is so effective because its subversion is so thorough. It fully explores how gender differences are linked to patriarchy and shows male as default pronouns as clearly being both a product of inequality and something that can be used to normalise it. The reversal highlights and ridicules gendered terms and stereotypes which may be seen as normal in a setting that we are used to; Petronius' mother acts as a distant father figure, Spinnerman Owlmoos is the, assumed to be lonely and desperate (17), spinster teacher, and the girls in the class are more disruptive and rowdy than the boys (19), unlike the opposite which may typically be assumed to be an inherent quality rather than a result of gendered socialisation. For reversal of this sort to be truly effective, it should both evoke empathy and make apparent those more subtle elements of the way things are, in such a way that the reader may see absurdity or pointlessness in something that they might otherwise ignore as the norm. Other examples of this technique include the book *Noughts & Crosses* (Blackman), which depicts a world where black people are oppressors and white people are oppressed, one of the more interesting parts of which is the invented insults against each race; 'blanker' (42, 57, 245...) and 'dagger' (32, 33, 51...) as they bring to mind where their real-life equivalents come from and how they differ in severity; one

oppressive, one reactionary. Another, more similar, example is the film *Majorité Opprimée* (Pourriat), which shows the day of a man in a world where the gender roles have been reversed. This example may evoke empathy, but lacks the level of detail and the linguistic changes of *The Daughters of Egalia* and as such is far less effective and thought-provoking. While 'feminist' is swapped for 'masculinist' the terms 'man' and 'woman' remain unchanged and other similar gendered terms are not addressed, along with the way each gender dresses, suggesting a world where this is not linked to the dominance of one gender, but incidental.

While *The Left Hand of Darkness* reflects the views of Lakoff far more than Spender, *The Cook and the Carpenter* and *The Daughters of Egalia* show both the theorists' views, with *The Cook and the Carpenter* better representing Spender's views, while *The Daughters of Egalia* is more ambivalent. *The Left Hand of Darkness* explores gender in language, but in a way that could be more thorough and more consistent, and is limited by the continued use of male pronouns. *The Cook and the Carpenter* pushes the reader to reflect upon the way they see gender and how that is influenced by language, but *The Daughters of Egalia* manages to illustrate more broadly the issues with gendered language.

Bibliography

- Arnold, June. *The Cook and the Carpenter*. Plainfield: Daughters, Inc., 1973.
- Baron, Dennis E. *The Epicene Pronoun: The Word That Failed*. *American Speech* 56.2 (1981): 83-97. JSTOR. Web. 01 Aug. 2014.
- Blackman, Malorie. *Noughts & Crosses*. London: Random House, 2006. Print.
- Brantenberg, Gerd. *The Daughters of Egalia* (1977) Translated by Louise Mackay. London: Journeymen Press, 1985.
- Darnell, Donald K., and Wayne Brockriede. *Persons Communicating*. Englewood Cliffs, NJ: Prentice-Hall, 1976. Print.
- Gastil, John. *Generic Pronouns and Sexist Language: The Oxymoronic Character of Masculine Generics*. *Sex Roles* 23.11-12 (1990): 629-43. Web.
- Khan, Manizeh, and Meredith Daneman. *How Readers Spontaneously Interpret Man-Suffix Words: Evidence from Eye Movements*. *Journal of Psycholinguistic Research* 40.5-6 (2011): 351-66. Web.
- Lakoff, Robin. *Language and Woman's Place. Language in Society* 2.1 (1973): 45-80
- LeGuin, Ursula. *First Contact: A Talk with Ursula K. Le Guin*. Interview by Ligaya Mishan. *The New Yorker*. Condé Nast, 24 July 2009. Web. 01 Aug. 2014.
- LeGuin, Ursula. *The Left Hand of Darkness*. 1969. New York: Ace Books, 2003.
- Orovan, Mary. *Humanizing English*. Hackensack, New Jersey: S.n., 1971. Print
- Pourriat, Eléonore. *MAJORITE OPPRIMEE*, Un Film D' Eléonore Pourriat (2010). YouTube. YouTube, 14 June 2012. Web. 01 Aug. 2014.
- Shaviro, Steven. Chapter 3: *Bilinda Butcher in Doom Patrols: A Theoretical Fiction about Postmodernism*. New York: Serpent's Tail, 1997. N. pag. Print.
- Spender, Dale. *Man Made Language*. 1980. London: Pandora Press, 2001
- Spivak, Michael. *The Joy of TEX: A Gourmet Guide to Typesetting Technical Text by Computer. With Numerous Explicit Illustrations*. Providence, R.I. (P.O. Box 1571, Providence, 02901): American Mathematical Society, 1982. Print.

About the authors

K. Booth is a Year 12 pupil at Haberdashers' Aske's Hatcham College. Christiane Luck is a PhD Student at University College London, where her research focuses on the study of English and German texts that thematise gendered language.

Phd Tutor's note

K. Booth's article 'No need for pronoun envy?' reflects both her ability to engage critically with the texts we have been discussing as well as contribute new and unique insights. The essay is well-structured, her argument progresses in a logical way and her writing style is fluid and engaging. This allows the reader to focus on her discussion – and it is this discussion which really stood out among all other essays. K. presents a clear and insightful analysis, whilst engaging with several layers of meaning. For example, she goes beyond considering the use of the masculine pronoun 'he' in *The Left Hand of Darkness* in purely linguistic terms and also discusses its social significance. In relation to another novel, *The Cook and the Carpenter*, she introduces the concept of 'gender-fluidity' and thereby makes the reader think about the need for sex-distinction. Additionally, K. integrates her own literary and theoretical examples, which support and enrich her discussion. Her exploration of the novel *Noughts & Crosses* is not only relevant but highly productive. In short, she has created an outstanding piece of work!

HUMANITIES – THAT’S THE QUESTION. SHOULD THE GOVERNMENT PAY FOR THE HUMANITIES?

O. Ligieza, G. Roberts

Humanities subjects are fields which concentrate on learning or literature concerned with human culture, especially literature, history, art, music, and philosophy (Knowles 2006). The subject matter which I am going to expand upon isn't only the humanities. I will argue about the current debate: whether humanities subjects should be funded by the Higher Education Funding Council of England (HEFCE). I personally believe that humanities subjects should receive more funding compared to what they receive today. This is the main idea I am going to argue in my essay. In order to back up my argument, I am going to use a variety of sources such as articles, books, TV programs, debates, secondary internet research and videos.

In the last 40 years of the twentieth century, the higher education system in the UK has gone through a number of changes. According to the Teaching and Learning website (University of Hong Kong), I know that the changes were: an increase in the number of universities since the 1960s; growth of consumers, outweighing growth in providers; a change in the balance between private and public funding; a change in the mechanism of distribution of public funds; and a significant increase in regulation and compliance requirements. All of those changes affected universities, students, teachers and the government. These changes were first recognised by the National Committee of Inquiry into Higher Education, chaired by Lord Dearing in 1996. Further recommendations were indicated to the government in July 1997 by the 'Dearing Report' (Dearing 1997). In this report, recommendations were made on training and staff development, quality assurance and the challenges of new technology.

However, major changes have been introduced by the Browne Report (Browne 2010). From this we know that Browne proposed to "scrap the existence of block grants". This meant that higher education no longer received extra money which the academics decided how to spend. Furthermore, this created a problem because less money was distributed to areas of research and any less productive areas such as the humanities. Government now had more control of university spending. Another important change outlined by the Browne Report is the idea of universities becoming more of a free market. This basically meant that universities now offered a service in order to increase competition between universities to raise teaching standards. Browne also wanted universities to be regulated by the state. Each university was to be completely controlled by the state it is located in. This meant that teaching and research was controlled by the government. It was the government that indicated any changes and made the big decisions. Universities no longer had the freedom and were controlled by the government as never before. The last and most significant changes occurred in 2009 and included

setting a cap on teaching fees at £9,000 per year and complete removal of teaching grants for almost all humanities subjects, but retaining them at various levels in other subjects.

Before considering why we should protect the humanities it is important to note the comparison of humanities with hard sciences. The book *The Public Value of the Humanities* by Jonathan Bate (Bate 2011) outlines why the humanities are an important aspect of our lives. Bate describes the humanities as "addressing the messy, debatable and unquantifiable but essential human dimensions of life". He means that humanities subjects change the way we look at ourselves, our past, our future and overall the whole of our society. He implies that humanities ask hard questions and answer them in order to gain a better understanding of our society, ourselves and the things that surround us.

Bate describes the relationship between the humanities and other subjects as "vital" in today's world. He explains that the humanities "engenders and fosters critical thinking", which is important for innovative work in any field. Furthermore, he constantly reinforces the idea that the humanities are a foundation to any other subject. They link to other subjects by asking questions like "why do we use hard sciences?" in order to improve our quality of life. This improves our critical thinking, which is valuable in all other subjects. Take, for example, experiments in science-based subjects. In this case, critical thinking improves the quality of those experiments by constantly asking the question of what can be done better. He also describes the relationship between the humanities and other subjects as a starting point for any type of research. For example, he states that Bertrand Russell's philosophical investigations "paved the way to artificial languages, essential to computer science". This means that Bates believes that the humanities work along with other subjects in the creation of background information and basics on which other fields can expand and use in their research. Therefore this highlights that humanities are an essential starting point in any other type of research or subject.

In comparison, the book *The Value of the Humanities* by Helen Small (Small 2013) also describes the value of the humanities, although she brings completely new ideas to this topic. In her book, she enforces the idea that the humanities promote individual or collective happiness. More importantly, she gives the humanities a far more important role in our society. She states that they are necessary for an effective democracy, which in today's world is a very important role. Subsequently, Small gives the humanities a meaning in our society. She implies that humanities subjects create a social structure in which people are better able to attain happiness and make sure that our society functions properly. In the same way, both Bate and Small describe the humanities as essential to

our society and constantly highlight that in order for humans to be happy, function properly and create a sustainable and well managed environment for ourselves they need the humanities. Another significant factor in assessing the value of humanities and generating a valuable conclusion is the difficulty of measuring them. In my opinion, the hardest form of impact to measure is economic prosperity and the easiest is the cultural life. This is because economic factors are really hard to measure as it is sometimes difficult to take notice of the impact of humanities on other subjects, such as hard sciences, which are responsible for creating wealth in the manufacturing, service, creative and cultural sectors. The humanities do not have a direct impact on those subjects which can be measured by, for example, using mathematical data on income generated after the application of a humanities subject to a business. Humanities research cannot be proven to have an impact on economic prosperity because it does not directly work to enhance our economy. Therefore, there are no ways of measuring its impact on the economic side.

However, an indirect impact may be generated, for example, by a museum using humanities research to change their exhibits or develop a new marketing or management strategy. This will allow the value of humanities to be measured in terms of an increase in people visiting the museum and/or revenue. On the other hand, I believe that cultural life is the easiest aspect to measure because it can be directly seen and measured through opinion of others about a place or a country, figures such as the number of native Welsh speakers. One of the problems about measuring cultural value is that people disagree about what is culturally valuable. This creates the problem of how to actually measure the value of humanities; people always disagree about what an actual value is in a particular case and how we should measure that value. In today's world it is very hard to agree between ourselves about what values we are looking for. Some people may be looking for economic values, whereas other people might be looking for cultural values and social values which enrich our environment and improve our comfort of living.

From a video by Eucharika Meehan about 'Challenges in Measuring the Public Value of Humanities Research', she argues philosophically that "all knowledge is useful". If we lose this idea we will damage research in all subjects. This brings with it the idea that every single type of research whether it's the humanities or engineering brings something to our society. Some subjects bring more benefits and some less, but all of the research contributes to our society in one way or another. Meehan also brings a new idea into the debate. She says that what we need to concentrate on is to measure the value of humanities through the knowledge users, not just academia itself (YouTube 2012). It can be seen that we often measure the value of research in academia itself, but this doesn't give an accurate account of the impact research has on our society. What we need to concentrate on is to get the opinions of the users of that research, like the community or companies and ask them what impact the research had on them, their business or their life.

We should also consider the mathematical point of view. Georgetown University released a detailed report in 2013 on current unemployment rates among graduates of

different type of subjects (although the report is confined to the American context). Based on usual stereotypes and anecdotes, we would consider theatre majors, literature majors and philosophy majors to have very high unemployment rates compared to most of the hard sciences. Interestingly, that is not the case. Theatre majors have an unemployment rate of 6.4 %, literature majors are at 9.8 % and philosophy majors are at 9.5 %. In addition to this, information systems (14.7 %) and architecture (12.8 %) have the highest unemployment rates. Computer science (8.7 %) and accounting (8.8 %) are fairly close to humanities subjects (Carnevale 2013). This suggests that the humanities are not as bad as people consider them to be. If we look at measuring the practical value of the humanities in some cases like those above, the humanities do a better job in getting people employed. However, there are people who are against this idea of measuring the value of humanities because the occupations are not as valuable to our society as those of hard sciences. This creates a constant debate on how to measure the value of humanities and how hard it really is to measure its value. We cannot just take statistical data that was directly influenced by humanities research and use it as a value indicator. The humanities are a lot harder to measure because they do not have a direct application to our society, such as the economy. They cannot be measured by the revenue they create or physical objects they produce.

Having considered why it is important to protect the humanities, it is also reasonable to talk about why to decrease funding for the humanities. There was a reason why the humanities received a sudden 100 % decrease in funding for teaching in the Browne Report. According to the report, "priority subjects" are science and technology courses, clinical medicine, nursing and other healthcare degrees, as well as "strategically important" language courses. After the Browne report, the government completely changed the whole structure of higher education. It now only funds subjects which contribute to business, innovation and manufacturing. The government believes that humanities subjects do not really benefit the country in any way and they insist that humanities subject only fulfil students' interests and never really earn them a living because they are unnecessary in today's world. Subsequently, the government aims to make a higher profit rather than create better people. More importantly, the new policy of scrapping teaching funds for humanities degrees means that students were put off from humanities degrees because high tuition fees created a lot of personal debt for students. This debt was very hard to pay off because humanities degrees very rarely develop higher income earner compared to hard sciences like engineering. Overall, while there is a very strong opposition to all of this, it is the government which has all the power to make the most important decisions. What supporters of the humanities need to do now is to convince the government that the humanities are equally important as the hard sciences and social sciences.

To conclude, let us move back to the question asked: should the government pay for the humanities? The answer is simple for some of us but quite challenging for others. I believe that we should increase funding for the humanities because it benefits our society and economy indirectly and without it our world would be much different. But on the other hand,

the government itself would consider humanities unnecessary because they never really generate a direct benefit to the economy. For some people, the answer is difficult because they may work in the field of the humanities and would consider it important, but on the other hand not really vital for our society. They may love the subject they mastered, but after a while it is possible that they could develop the belief that subjects of this type are not beneficial to the knowledge users, as they enrich academia but not society. So why should we increase funding for the humanities? Firstly, they benefit other fields of research and are considered as paving blocks for other subjects. Secondly, they enrich our cultural sense of belonging and cultural value. They create and sculpt our culture while enriching our social life through the arts. Thirdly, they encourage and develop critical thinking which encourages improvements and new developments in other fields of research. Finally, they change the way we look at ourselves, our past, our future and overall the whole of our society. The humanities develop new ideas in today's world and benefit every single part of our economy, environment and social life. Without our humanities subjects, we would never develop so quickly and so effectively. Our world would look totally different if we did not know our history or asked questions which were hard to answer like: do we really need God? It has been shown that humanities are fundamental subjects which are used in every type of research and have paved our way through the world's history.

Bibliography

- Elizabeth Knowles (ed.) (2006), *The Oxford Dictionary of Phrase and Fable*, Oxford: Oxford University Press.
- Sir Ron Dearing (1997), *The National Committee of Inquiry into Higher Education: Report of the National Committee*. Available at: <https://bei.leeds.ac.uk/Partners/NCIHE/> (Accessed: 19/07/2014).
- Browne et al (2010), *Securing a Sustainable Future for Higher Education: An Independent Review of Higher Education Funding & Student Finance*. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/31999/10-1208-securing-sustainable-higher-education-browne-report.pdf (Accessed: 19/07/2014).
- The University of Hong Kong, Teaching and Learning (no date), *Higher Education Reform In United Kingdom*. Available at: <http://tl.hku.hk/higher-education-reform-in-united-kingdom/> (Accessed: 19/07/2014).
- Jonathan Bate (ed.) (2011), *The Public Value of the Humanities*, London: Bloomsbury.
- Helen Small (2013), *The Value of the Humanities*, Oxford: Oxford University Press.
- YouTube (2012), "Challenges in Measuring the Public Value of Humanities Research" Eucharia Meehan. Available at: <https://www.youtube.com/watch?v=JcFdZFAIPI0> (Accessed 28/07/2014).
- Anthony P. Carnevale, Ban Cheah (2013), *Hard Times: College Majors, Unemployment and Earning, Georgetown University*: Georgetown Public Policy Institute. Available at: <http://journalistsresource.org/wp-content/uploads/2013/07/HardTimes.2013.2.pdf> (Accessed 28/07/2014).
- Thought Out (no date), *The case for the Humanities*. Available at: <http://thoughtoutproject.com/politics/the-case-for-the-humanities/#entry> (Accessed 27/07/2014).

About the authors

O. Ligieza is a Year 13 pupil at Uxbridge High School. Gabriel Roberts is a researcher at the University of Oxford, where he focuses on historical argument in the writings of the English Deists.

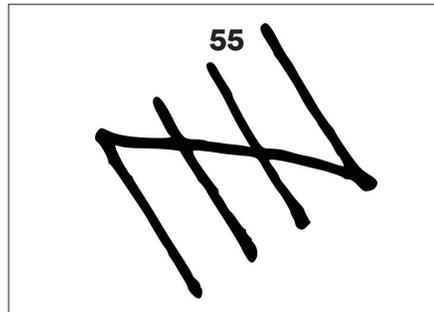
PhD tutor's note

I have selected the essay primarily because the author made excellent use of resources which we had not discussed in class, such as Helen Small's *The Value of the Humanities* and the Georgetown University report *Hard Times: College Majors, Unemployment and Earnings*. Additionally, the author wrote clearly, showed an excellent grasp of the main historical facts, demonstrated powers of verbal and numerical analysis, and pursued a hard-nosed but un-dogmatic line with respect to the question of how the humanities should be measured.

IN THIS ISSUE

Social Sciences

Articles



52

EATING DISORDERS ARE A PURELY CULTURAL PHENOMENON: DISCUSS

Eating disorders have proved controversial amongst mental health professionals from psychological, biological and sociological academic backgrounds.

A. Polius-Aimable and J. Allan

55

SHOULD MY LOCAL AREA USE NUDGES TO IMPROVE THE NUMBERS OF WOMEN ATTENDING CERVICAL SCREENING?

A discussion of the application of behavioural nudges.

H. Parmar and M. Savani

58

MADELEINE'S CREPES – A BUSINESS PLAN

Specialising in the sale of crepes with various toppings and sides, the French-themed Madeleine's Crepes will introduce a new food culture into the UK.

M. Johns and N. Rose

EATING DISORDERS ARE A PURELY CULTURAL PHENOMENON: DISCUSS

A. Polius-Aimable, J. Allan

Abstract

Eating disorders have proved controversial amongst mental health professionals from psychological, biological and sociological academic backgrounds; there is little agreement among these professionals regarding diagnosis and treatment. This will be an exploratory insight into the strengths and flaws of the psychological, cultural and biological perceptions of eating disorders, and also this will assess the current paradigms of eating disorder treatment with respect to the aetiology of the disorders.

Cultural ideologies pertaining to eating disorders are well founded. The first well-documented investigation into the correlation between cultural pressure/exposure, and changes in eating behaviours and patterns was the Fijian study conducted by Becker, Burwell, Gilman, Herzog and Hamburg (2002). Their study was of two separate samples of adolescent Fijian girls: one group was studied with minimal exposure to Western television and another with three years' exposure to Western television. The results collated reinforced the literature supporting the argument of the cultural causes of eating disorders: as they conclude in the study, "key indicators of disordered eating were significantly more prevalent following exposure [to Western television]." To accentuate this, the narrative data collected from interviews suggests that Western culture exposure led to the Fijians growing a sense of body dissatisfaction and image insecurity – one of the girls claimed that they (as a generation of Fijian girls) feel that "it's influencing me so much that [she has] to be slim," another girl commented that they feel that "it is bad to have this body" (Fijian girls were traditionally brought up on heavy food diets, she says that most of them were brought up on heavy foods) and that "[they] have to have those thin, slim bodies [on TV]" (Becker, Burwell, Gilman, Herzog & Hamburg, 2002).

The fact that the Fijians, at the time of the study, had just gained access to Western television makes this study a truly empirical study into the influence of media on the development of eating disorders because adolescents in other countries that are well-versed in the Western lifestyle such as the United Kingdom, if studied, have been exposed to such media that promote a certain way of body maintenance. This supports the cultural aetiological ideology for eating disorders, meaning that an argument of eating disorders being a solely sociocultural malady, on the basis of this study, is justifiable.

However, this study is not wholly definitive. As Becker et al acknowledged the increased prevalence of "key indicators of disordered eating" brought upon significant exposure to Western cultures does not generally mean that the relative prevalence of eating disorders increased in equal measure because "clinical diagnoses were not sought in [the] study." Therefore, only assumptions can be made about the topic; and although the quantitative data may be convincing such as the rise in induced-vomiting from 0 % in 1995 to 11.7 % in

1998, certain pieces of data contradict the idea that Western television has a significant, "profound" impact on eating values like the fact that bingeing dropped from 7.9 % in 1995 to 4.6 % in 1998, which Becker et al classified as not being "significantly different". With that being said, it is equally difficult to denounce the impact of Western culture and television on the eating attitudes of the Fijian subjects (Becker, Burwell, Gilman, Herzog & Hamburg, 2002).

Outside the introduction of different cultures in a traditionally relaxed country in terms of attitudes towards body image, the influence of family is also believed to be a very prominent sociocultural feature of eating disorders. The familial impact on the development of eating disorders is intrinsically linked to circumstances and the scenarios within the family complex – as Mazzeo and Bulik (2009) argue in the case of anorexia nervosa, parents' susceptibility to disordered eating patterns and habits to restrain eating habits to change their body shape, or the "maternal drive for thinness" as Mazzeo and Bulik describe it, are linked with the development of overeating behaviours among children "in their first five years of life" (as cited from Stice, Agras and Hammer, 1999). This 'do as you do' relationship between the parent and child is conceivable as young children often look up to their parents as role models as their parents care for them, and nurture them; furthermore, the maternal environment is also one of the first environments that the children are exposed to, so it can be argued from this perspective that eating disorders are borne from this idea of exposure to certain environments.

The debate between nature and nurture is complex. Some researchers explore the development of eating disorders through the field of epigenetics – the study of the interplay between nature and nurture (as simplified through the analogy, often used to describe certain health problems, of the gun and trigger; Olden and White, 2005). Mazzeo and Bulik investigated the interaction of these two factor types in their 2009 study and attests to this gun notion: "... an individual with a genetic predisposition to an eating disorder may disproportionately seek out appearance-related comments from parents or peers."

This hints at the relationship between genetic vulnerability and environment stimulus for development of eating disorders, as

the strive for reassurance on appearance only goes to enhance an appearance-centralised environment in which the person becomes more susceptible to developing eating disorders (“... may promote the initiation or maintenance of eating disorders behaviours.”), if their search for reassurance ends up in harsh criticism or bullying. A common example of how this environment may exist could be the parent-child connection, as a young girl who may suffer from body dissatisfaction may ask her mother for reassurance that she does not look fat (as elucidated by Mazzeo and Bulik). What this could insinuate is that culture may not be as important or essential in the aetiology of an eating disorder, as this study highlights the perpetuating role that the environment plays in the development of an eating disorder, whilst the genetic makeup determines the level of vulnerability to a certain disorder.

In addition, there is more evidence that supports the epigenetic theory for the eating disorder pathogenesis, which stems from neurobiology: behavioural illnesses are widely regarded to be inextricably linked to neurotransmitters, i.e. the information-transmitting chemicals in the brain's nerves that regulate hormones such as serotonin and dopamine which in turn regulates mood, appetite and reward, and so it is considered that the genes involved in the receptors of these hormones, for people with behavioural illnesses, are variations of the normal genes which alter behaviour and mood.

Similarly, in eating disorders this gene variation exists too: doctors at London's Maudsley Hospital, with a particular focus on serotonin as part of it controls appetite levels, found variations in the gene for serotonin receptors in anorexic patients, concluding that they were “twice as likely” to have such variations than others. The doctors suggested that the fact that people with high levels of serotonin are prone to anxiety explains the ability of anorexic patients to curb their appetite, as in a state of intense anxiety, the “heart rate and blood pressure rise” and the priority of eating, as the report states, is “put on hold” – thereby leading to the possibility that anorexic people are continually in a state of stress and anxiety (BBC, 1999). This theory distances eating disorders and their causes from the realm of society and culture, and it shows that the disorders require attention from different avenues, not just through a cultural route.

Further studies into the neurobiology of eating disorders link back to the theory of epigenetics: neuroimaging studies suggest that people with variations in the serotonin transporter (5-HTT) gene — having “one or two copies of the short allele of the 5-HTT promoter polymorphism [5-HTTLPR]” — show greater amygdala activity in response to fearful stimuli compared to those who are homozygous for the long allele (Hariri et al, 2002). With reference to this, Caspi et al (2003) took this investigation in the more specific area of depression and stress and realised that the effects of life events on self-reports of depression were mediated through the 5-HTTLPR genotype, with those carrying the short allele having significantly stronger self-reports of depression symptoms than those homozygous with the long allele.

This is indicative of the gene-environment interaction and the epigenetic argument as this forms evidence of genotype variations creating a ‘genetic susceptibility’ to developing

depressive symptoms via traumatic life events. This argument, therefore, reinforces the epigenetic argument as depression and other emotional disorders are considered to be risk factors for developing an eating disorder (Mayo Clinic, 2012).

While the gene-environment interaction thesis has convincing evidence, it is possible that the exposure to environment is not arbitrary, leading to the belief that there is a ‘nature’ to the nurture of behavioural disorders (Plomin and Bergeman, 1991) which could be interpreted in the same light for eating disorders.

The evidence of the polymorphism moderating the effect of life events on depression “does not constitute unambiguous evidence of a [gene-environment] interaction”, because of the possibility that people may have an inherent tendency to end up in situations in which they encounter stress-inducing life events more frequently than others, which cannot be effectively ruled out (Caspi et al, 2003). Investigated by Kendler and Karkowski-Shuman (1997), the genetic ‘liability’ to major depression (outside depressive episodes) was found to be associated with significantly increased risk for personal and network stressful life events (assault, serious marital problems and breakup amongst four others). To add, they found that the genetic liability to alcohol consumption influenced the risk of being robbed and having law problems, thus strengthening the link between mental disorders, such as eating disorders (which, as discussed before, could be developed through emotional disorders such as depression), and genetic risk factors. This communicates how genes effectively place individuals in stressful situations and so allowing room for a pure genetic aetiological argument for eating disorders to grow.

Moreover, twin studies may provide a strong case for eating disorders to be considered as a biological phenomenon because the environmental effects on the emergence and development of eating disorders such as anorexia are less prevalent in the young twins than they are in older twins who have been subject to greater environmental exposure, therefore these studies provide a clearer view into the heritability (or lack of heritability) of such disorders.

In an amalgamation of all the published controlled familial studies Kipman, Gorwood, Mouren-Siméoni and Adès (1999) estimated that the heritability of anorexia was 0.72, which indicates that anorexia is highly heritable (a rate of heritability of 1 means that the trait is wholly genetic). Moreover, Kipman et al (1999) also accentuate the ‘significance’ of genetic factors in anorexic development, stating that an “excess of concordance in monozygotic [identical, MZ] compared to dizygotic [non-identical, DZ] twins, as shown in their summary (an average of 44 % concordance in MZ twins compared to an average of 12 % in DZ twins), favours the role of genetic factors. Similar rates of concordance have also been observed in other prominent eating disorders such as bulimia and binge-eating disorder (Bulik, Sullivan and Kendler, 1998) – thus allowing generalisations to be made about genetic factors’ significance in the eating disorders phenomenon, beyond the cultural realm.

However, the studies only add to the biological/genetic aetiological literature of eating disorders without adding much-needed definition to what is an extremely complex and multifaceted issue; as Kipman et al (1999) summarise,

to demonstrate the importance of genetic factors in anorexia, “genetic polymorphisms analyses” are required, which have been discussed in the effects of the variations in the serotonin transporter gene, but also prospective and adoption studies are needed.

Results and data taken from studies of the treatment of disordered eating behaviours may enhance the mental health profession’s understanding of the way in which eating disorders work and how they are aggravated and moderated.

In a study looking at medical and psychological treatment of bulimia nervosa, Walsh et al (1997) evaluated the effects of psychological treatment (cognitive-behavioural theory, CBT, or supportive psychotherapy) alone (with placebo), medication alone and the effects of psychological treatment in addition to medication. The study found that psychological treatment when coupled with active medication was more effective at reducing symptoms of bulimia nervosa (bingeing and purging type) than psychological treatment with placebo medication on the basis of patient diaries in which bouts of binge eating were recorded. In addition the patients receiving medication alongside treatment had greater reductions in their Eating Attitudes Test (Garner and Garfinkel, 1979) scores (a greater score in the test indicated a greater level of disordered eating).

This study inadvertently advocates the interplay between the different avenues (psychological, biological and sociocultural) through which eating disorder development can be explored as the efficacy of the combination of the treatment methods, over the individual methods’ effectiveness, provides a concrete proof for this.

Furthermore, the tentative, inconclusive diction adopted by Walsh et al in their conclusions reflects the need for a holistic approach to eating disorders: from observing a correlation between CBT and “small but statistically significant” weight gain (relative to supportive psychotherapy) and the association between “small weight loss” and medication (relative to placebo), they deduced that the “mechanisms” by which CBT and medication affect bulimic patients’ eating behaviour differ, and so hinting at the requirement for further investigation into other branches of eating disorders.

In conclusion, what has been shown is that eating disorders are not purely cultural, nor are they purely biological or psychological. As this discussion suggests, there is a multitude of ways in which eating disorders can be viewed and moderated; whether it be through the exposure to certain environments, or the genetic susceptibility to developing an eating disorder, or even the genetic inclination to end up in a scenario where eating disorders can easily develop. Complete understanding of eating disorders requires an assessment of all areas of the phenomenon; a holistic overview of what constitutes an eating disorder and which method, or combination of methods, is the most efficacious for the treatment and diagnosis of eating disorders.

References

- Becker, A, Burwell, R, Gilman, S, Herzog, D & Hamburg, P. (2002). *Eating behaviours and attitudes following prolonged exposure to television among ethnic Fijian adolescent girls*. The British Journal of Psychiatry; 509-514.
- Mazzeo, S., Bulik, C. (2009). *Environmental and genetic risk factors for eating disorders: what the clinician needs to know*. Child Adolesc Psychiatr Clin N Am. 2009 Jan; 18(01):67-82. doi:10.1016/j.chc.2008.07.003. Review. PubMed PMID: 19014858; PubMed Central PMCID: PMC2719561.
- Stice, E., Agras, W. S., & Hammer, L. D. (1999). *Risk factors for the emergence of childhood eating disturbances: A five year prospective study*. International Journal of Eating Disorders; 25(4), 375-387.
- Olden, K., & White, S. L. (2005). *Health-related disparities: influence of environmental factors*. Medical Clinics of North America; 89(4), 721-738.
- British Broadcasting Corporation News. (1999). *Genetic clues to eating disorders*. Retrieved from <http://www.news.bbc.co.uk>
- Hariri, A., Mattay, V., Tessitore, A., Kolachana, B., Fera, F., Goldman, D., ... & Weinberger, D. *Serotonin Transporter Genetic Variation and the Response of the Human Amygdala*. Science 2002; 297(5580), 400-403.
- Caspi, A., Sugden, K., Moffitt, T., Taylor A., Craig, I., Harrington, H., et al. (2003). *Influence of life stress on depression: moderation by a polymorphism in the 5-HTT gene*. Science 2003; 301(5631), 386-389.
- Mayo Clinic. (2012). *Diseases and Conditions: Eating disorders – Risk Factors*. Retrieved from <http://www.mayoclinic.org>
- Plomin, R., & Bergeman, C. S. (1991). *Nature and nurture*. Behavioral and Brain Sciences; 14(3), 414-427.
- Kendler, K. S., & Karkowski-Shuman, L. (1997). *Stressful life events and genetic liability to major depression: genetic control of exposure to the environment?*. Psychological medicine, 27(03), 539-547.
- Kipman, A., Gorwood, P., Mouren-Siméoni, M. C., & Adès, J. (1999). *Genetic factors in anorexia nervosa*. European psychiatry; 14(04), 189-198.
- Bulik, C. M., Sullivan, P. F., & Kendler, K. S. (1998). *Heritability of binge-eating and broadly defined bulimia nervosa*. Biological psychiatry; 44(12), 1210-1218.
- Walsh, B., Wilson, G., Loeb, K., Devlin, M., Pike, K., Roose, S., ... & Wateraux, C. (1997). *Medication and Psychotherapy in the Treatment of Bulimia Nervosa*. American Journal of Psychiatry; 154(04), 523-531.
- Garner, D. M., & Garfinkel, P. E. (1979). *The Eating Attitudes Test: An index of the symptoms of anorexia nervosa*. Psychological medicine; 9(02), 273-279.

About the authors

A. Polius-Aimable is a Year 12 pupil at St Angela’s and St Bonaventure’s Sixth Form Centre in Forest Gate, East London. Jacqueline Allan is a PhD student at Birkbeck College, University of London, where her research is on the interaction between eating disorders, diabetes and technology.

Phd Tutor’s note

A.’s article showed maturity and style well beyond his years. If I had received this at any level of university I would have been impressed. His essay showed all of the requirements for a solid first and I hope he takes these skills on to whatever he chooses to do in further education.

SHOULD MY LOCAL AREA USE NUDGES TO IMPROVE THE NUMBERS OF WOMEN ATTENDING CERVICAL SCREENING?

H. Parmar, M. Savani

INTRODUCTION

Trying to get people to do something by imposing your opinion on the individual or making a law is unsuccessful in the long term. However a combination of both can lead to a winning formula.

The term 'libertarian paternalism' coined by R.H. Thaler and C.R. Sunstein (2003) means that people are influenced to make better choices, yet people are given the freedom of choice to opt in or out to their own discretion.

A method which uses libertarian paternalism is a behavioural nudge. A Rotmann video explains the term simply: "a behavioural nudge is getting you to do something without restraining your freedom of choice or changing financial incentives".

This paper discusses how nudges can be used to increase the number of women attending cervical screening in the London Borough of Hounslow. Women are invited annually for a cervical screening. All woman aged 25-64 receive a letter in the post as a reminder. The individual then books a screening if they wish to attend.

This essay focuses on the questions 'Can a Default nudge increase the number of women in their 20s attending cervical screening?' and 'Can a Messenger nudge increase the number of woman in their 50s attending cervical screening?' It then goes on to present research strategy.

PROBLEM

In the London Borough of Hounslow, according to Hounslow Clinical Commissioning Group report on cervical cancer, 2012: "The total number of women eligible and invited for screening was 72,800, while only 17,700 (24.4 %) were screened." To conclude, 75.6 % of women are not getting screened. In order to understand how to tackle a problem, one must understand from where the problem arose in the first place. According to J. Waller et al (2011) there are many reasons as to why women are not attending their screenings, each age group offered the screening possesses different reasons:

1. For younger women in their 20s the main issue is the lack of time to attend a screening, another factor is the difficulty of actually booking an appointment via the booking system used in their respected GP practices.
2. For older women in their 50s booking the appointment was not an issue, but they did not attend the screening "because of embarrassment and fear of pain". The study also shows that the overall majority of older women do not feel that they are at risk of having cervical cancer and therefore do not attend.

HOW DO WE TACKLE THIS ISSUE?

P. Dolan et al (2011) introduced the MINDSPACE framework in which 9 nudges are discussed; how they are used to influence behaviour is also signposted. As there are two age groups which have completely different problems with the cervical screening, two different nudges are being proposed, one addressing women in their 20s and above, another addressing women in their 50s and above. This is due to the problems being on different ends of a spectrum – only two different nudges can address each issue.

THE NUDGES

Nudge 1: 'Can a Default nudge increase the number of woman in their 20s attending cervical screening?'

Using the MINDSPACE framework a nudge has been designed using the 'Default' nudge. The MINDSPACE framework defines the nudge as: "Defaults exert influence as individuals regularly accept whatever the default setting is". As stated by J. Waller et al, with younger woman the issue is making time for the appointment – women are left with the responsibility to make it themselves. That is where the problem stems from. The women forget to make the appointment, and the screening is forgotten, pinpointing one of the reasons why only 24.4 % of women in Hounslow attend their screening. This figure alone proves that the invitation is not enough.

This nudge proposes that alongside the letter inviting the individual for a screening, pre-set dates of days and times available for a screening should also be sent, including an envelope to send back the reply slip to the GP. Therefore women will be more likely to make an appointment. "We 'go with the flow' of pre-set options", a key definition stated in the MINDSPACE framework. As stated by N. Adkins (2014): "Cervical cancer is the second most common cancer in women under 35." Therefore, screening is ever more important.

Nudge 2: 'Can a Messenger nudge increase the number of woman in their 50s attending cervical screening?'

Using the MINDSPACE framework a nudge has been designed using the 'Messenger' nudge. The MINDSPACE framework defines the nudge as follows: "We are heavily influenced by who communicates information to us". The main concern with women over 50s according to J. Waller et al was that they felt embarrassed to go for their screening. No one should feel embarrassed to attend a potentially lifesaving screening, so this nudge proposes an outlet for these women. An outlet can be a person of similar age with whom they can discuss these issues, hopefully diminishing the fear of attending a screening. On the topic of cervical screening E. Johnson expressed: "While it's not always comfortable, it's free and could save your life."

With more women having to book an appointment due to the pre-set options and with fewer women feeling embarrassed about attending the screening, the desired outcome is that the percentage of women attending the screening in Hounslow increases.

HOW WILL WE KNOW IF THE NUDGE IS SUCCESSFUL?

Firstly, one way to see if the proposed nudges are working is to organise a focus group with both respective age groups after the nudges have been carried out for a certain amount of time. This would be a form of qualitative data. In the research of J. Waller et al, for example, they stated that older women felt embarrassed and younger women had a lack of time for screenings. The focus group would then discuss whether or not these two nudges have in fact encouraged them to attend their screening. Especially in the age group of the 50s and above a focus group would not only be good in terms of collecting data to analyse but would still be nudging the women. Figures can also be derived from this method: in each group, the numbers who attended the screening and who did not can be recorded. Then, the reasons for attending or not attending can also be recorded.

As reported by J. Kitzinger (1995): "Focus group methods are also popular with those conducting action research and those concerned to 'empower' research participants because the participants can become an active part of the process of analysis."

However, the key outcome variable is the number of cervical screenings being attended after the nudges are carried out. This form of collecting data is quantitative. If the numbers increase after the nudges have been carried out, it shall be a causal, positive correlation. The data for the number of screenings being attended would be collected from the respective GP practices who are taking part. If the numbers increase the nudges have been successful. When analysing the data, there will be a clear division of the two age groups due to the two different nudges. If the nudges work the expected outcome is that both age groups screenings increase. However if one or neither does, then its evident proof that the nudges do not work.

WHY USE A NUDGE?

As stated by D. King et al (2013): "Policies that change the environment or context in which decisions are made and "nudge" people toward particular choices have been relatively ignored in health care." That is very true.

The Economist (2012) explains that "the nudge revolution encourages the use by government of plain language; favours the design of policies that actually take account of real-world behaviour; and allows the testing of ideas on a small scale before wider implementation. It deserves to be pushed."

Default nudges have had beneficial impacts in terms of decision making. E. Bronchetti et al (2011) explains: "Defaults are generally simple and inexpensive to implement and have the appeal of simultaneously influencing behaviour without ultimately limiting choice." They have been used when an increase in organ donations was needed. "Nations that require citizens to opt-out of organ transplant donation have

a significantly higher organ-donor rate than nations where the citizens must affirmatively choose to take part (opt-in)". This is very similar to what nudge 1 is suggesting, as instead of inviting women to a screening which they "opt in" for, the default nudge is designed in a manner which women will be less likely to "opt out" from.

Defaults are successful as they do not restrict freedom, they are options which are structured in ways that increase the benefits to the individual and maximise the rates of picking a more beneficial choice, and the choice is structured in a way where you are nudged to make a favourable choice. Since structure is key when designing a nudge, Nudge 1 is appropriate and it is not restricting an individual's choice yet is helping them make the choice that is in their best interest. The default nudge makes it more likely for a woman in her 20s to attend a screening, as by giving them the options the likelihood of not attending shall diminish as the sheer presence of an option can influence behaviour.

Messenger nudges can influence decisions made, as the choices we make can be heavily influenced by who is delivering the information to us. Hofling et al (1966) illustrated how the messenger nudge works – nurses sometimes without thinking will agree with what the doctor says even if what they are saying is wrong. Nudge 2 is using the messenger technique effectively as P. Dolan et al stated that we are more likely to act on information when the person delivering the message has similar qualities to us – that is because we feel more at ease with the person delivering the message and the sense of authority is felt in the message, but it is more relatable. The messenger nudge is more likely to increase the number of women in their 50s attending the screening as the evidence of people taking information on board from people like themselves is increasing.

IT IS A PROBLEM

At present there is a lack of campaigning to increase the rates of cervical screening in Hounslow, which correlates directly into the low number of women not attending a screening. Other local areas which also have rather low rates of attendance are actively initiating campaigns to increase the rates. The "Are you ready for your screen test" campaign promotes attendance of cervical screening. Admittedly, this is a different strategy compared to the nudges being proposed but it is an active step the local area is taking to raise awareness.

At present there is a lack of action happening in Hounslow to increase the rates of cervical screening, which I consider abysmal.

CONCLUSION

The cost of introducing a nudge compared to the cost of treating cancer is relatively low. In the long term the Government will be saving money as the chances of the cancer being detected in earlier stages will increase, meaning perhaps no or reduced cost for the treatment of cancer. Earlier diagnosis equals less cost in the future.

Nudges have been used in commercial fields, and have been used successfully, therefore why not use a nudge in the medical sector where they can also be beneficial.

Last and most importantly, cervical cancer screening can and will save lives. Screening is a preventative measure of cancer, yet if only 24.4 % continue to get screened the number of women with the cancer without any knowledge of it will remain high. These women endure a lot of suffering, along with their families, which may have been prevented had they been screened.

Screening Lead for the NHS, P. Jackson says: "... the important fact is that early detection is the best way to protect ourselves. So screening for all women aged between 25 and 64 is very important." The two nudges proposed can increase rates of cervical cancer screening. Attending a screening is not a law, it's a choice. The nudges proposed encourage patients to make a choice which benefits their future wellbeing.

Bibliography

- Thaler, R. and Sunstein, C. (2003). *Libertarian Paternalism*, American Economic Review.
- YouTube (2013), *Nudge, the Animation: Helping people make better choices*. Available at: <https://www.youtube.com/watch?v=jsy1E3ckxIM> (accessed 24/7/14).
- McLaughlin, E. (2012). *Hounslow Clinical Commissioning Group report on cervical cancer*, London Borough of Hounslow.
- Waller, J., Jackowska, M., Marlow, L. and Wardle, J. (2011) *Exploring age differences in reasons for nonattendance for cervical screening: a qualitative study*. *BJOG: An International Journal of Obstetrics & Gynaecology*, pp 264-277.
- Adkins, N. (2014), *Young women in Thames Valley urged to take up cervical screening offer*. Available at: <http://www.getreading.co.uk/news/health/young-women-thames-valley-urged-7488208> (accessed 26/07/14).
- The Lesbian & Gay Foundation (no date), *Cervical Screening*. Available at: <http://www.lgf.org.uk/screening> (accessed 04/08/14)
- King, D., Greaves, F., Vlaev, I., Drazic, A. (2013). *Approaches Based On Behavioral Economics Could Help Nudge Patients And Providers Toward Lower Health Spending Growth*, *Health Affairs*, pp-661-668.
- Bronchetti, E., Dee, T., Huffman, D., Magenheimer, E. (2011). *When a Nudge Isn't Enough: Defaults and Saving Among Low-Income Tax Filers*, *National Tax Journal*.
- Hoffling et al (1966). *An experimental study of nurse-physician relationships*, *Journal of Nervous and Mental Disease*, pp 49,171-180.
- Wikipedia (2014), *Choice Architecture*. Available at: http://en.wikipedia.org/wiki/Choice_architecture (accessed 03/04/14).
- The Economist (2012), *Free Exchange: Nudge Nudge, Think Think*. Available at: <http://www.economist.com/node/21551032> (accessed 28/07/14).

About the authors

H. Parmar is a Year 12 pupil at Lampton School in West London. Manu Savani is a PhD student at University College London, where he is pursuing research in behavioural public policy, focusing on commitment strategies to encourage behaviour change in health and other sectors.

MADELEINE'S CREPES – A BUSINESS PLAN

M. Johns, N. Rose

INTRODUCTION

Specialising in the sale of crepes with various toppings and sides, the French-themed Madeleine's Crepes will introduce a new food culture into the UK. I believe there is a significant gap in the market that is yet to be exploited, selling a product that is already a staple in the diet of many in Europe (France, Belgium etc.). To ensure the success of my venture, I will carefully plan my marketing, ambidexterity approach, product, operational, pricing and financial strategies. In addition to this, I will detail my plans for the growth I wish to achieve in the future, as crepes are slowly introduced to the mainstream market.

EXECUTIVE SUMMARY

The UK's 'fast food' industry has been valued at around £30bn, a figure that only seems to be growing (Hardwick, 2014). There is a demand for food to be both delicious and time-saving, meaning now is the perfect time to launch Madeleine's Crepes in the UK.

Despite the undeniable success of the crepe industry across Europe, the UK crepe market is yet to significantly take off. Madeleine's Crepes could offer Crepes with sides ranging from nuts to chocolate and fruit to meat, at an average price of £4.

The simplicity of the cooking process means that only small unit spaces would be required. This would allow initial branches to open up in high-profile shopping centres such as Lakeside and Bluewater, generating initial publicity before even purchasing promotional materials. On top of this, publicity will be gained through posters, local newspaper advertisements, promotional deals and free samples. The latter in particular will be useful in building an initial customer base, especially as primary market research has found that 80 % of local students have never tried a crepe before, but would be willing to do so.

It is the absence of a market leader within the UK that will allow the brand to grow, propelling crepes from speciality cafes in major cities to readily-available goods. This is the vision that drives this business plan.

COMPANY DESCRIPTION

Originating in Thurrock, Madeleine's Crepes is a speciality eatery that aims to provide an authentic French-eating experience through the sale of crepes. With a clear emphasis on taste, speed and experience, I hope to provide an innovative new eating experience for the UK market. While there are a limited number of establishments within the UK offering sweet and savoury crepes, they are few and far between. Therefore, a gap in the market is available for the business to exploit.

Company Ownership

Madeleine's Crepes will be a sole trader business, a risky but ultimately hassle-free organisational structure that will be driven by my passion for this brand. Finance will largely be secured through loans and investment.

Ambidexterity Context

Madeleine's Crepes will pursue both innovation and improvement as its ambidexterity context. Innovation will be achieved through a pursuit of the company's unique selling proposition (USP), selling crepes of both savoury and sweet flavours in a cultured and relaxed environment. Improvement will be achieved once trading has begun through new recipes, healthier options, increased efficiency in services and striving to be a sustainable business. The latter can come from a continuous reduction in waste and a year-upon-year increase in food donations.

SERVICE/PRODUCT OUTLINE

Crepes can appeal to all members of the family, all year-round. To be successful, Madeleine's Crepes will need to have an extensive menu. This means offering a wide variety of drinks, sides and toppings with the crepes. It should also be noted that customers will have the option of buying the sides/toppings individually, e.g. just buying ice cream and a drink.

Sweet Crepes

The sweet variety of crepes will include: ice cream, fruits (strawberries to grapes, bananas to passion fruit), chocolate, jam, sugar, cinnamon, nuts (almonds, hazelnuts etc.) and cream.

Savoury Crepes

Meat (Chicken, mince, beef, pork, bacon, ham) and Quorn /vegetarian options; also vegetables (peppers, carrots, mushrooms etc.) and salad (lettuce, tomato, cucumber etc.), fish (salmon, tuna), cheese and egg.

The Restaurant

While Madeleine's Crepes will be referred to as a restaurant, the simplicity of the production process means that the business can also operate as a market stall and in a van at a festival site. It is important to note this for future expansion into other markets. A colour theme of red, white and blue will be used to complement the French history of the crepe. Background music playing at any Madeleine's Crepes establishment would be French-themed instrumental melodies for two main reasons. Firstly, using a more neutral music choice ensures that Madeleine's Crepes will not isolate any potential customers. Secondly, the music choice will create a relaxed atmosphere that compliments the French theme, celebrating the origin of crepes while creating a USP that will assist the introduction to the UK market. Gaygen (2013) has found that there is a relationship between music and consumer behaviour.

Based on my secondary market research, I will be able to aim my service at 4 of the main food segments (Morgan, 2014):

MARKET ANALYSIS

Food segment	Description	Why they'll be a stakeholder	How we'll target them
Trendsetters	Consumers who pursue new foods, flavours and experiences	Because we are offering a relatively new product (in the current UK food market) with a range of exciting flavours and experiences that are not yet widely available	The use of free samples and initial sales promotions to establish early sales.
Entertainers	Consumers who enjoy the social side of food	Because of the atmosphere and theme around the business	Through our aesthetics and sensory experience
Zappits	Their name a reference to microwave meals, consumers who see food preparation as time-consuming and so seek out faster options	Because of the convenience of the service	By striving to improve the efficiency of production, communicating this through our advertising and word-of-mouth.
Just Feed Me	Consumers who don't want to cook and will eat anything they're given	Because of our extensive and varied menu	I can use our menu to target this group by including it on the website and promotional materials.

*In the future, Madeleine's Crepes may look to grow the business through online ordering and takeaways. If this were to happen, I would then be able to target Take-It-Aways, consumers who look for great-tasting takeaways. I would be able to attract Take-It-Aways through a heavy online and social media presence, because this is where 21st century consumers tend to look for food. For example, Madeleine's Crepes could be featured on the increasingly successful Just-Eat.co.uk service.

COMPETITIVE ANALYSIS

Competitor Analysis

Crème de la Crepe is possibly our biggest competitor within the UK. Based in Covent Garden, the business began in 2004 (Cremedelacrepe, 2014) and uniquely offers event planning. The popular consumer-feedback forum, Yelp.co.uk, gives Crème de la Crepe an average of 4 stars. However, reading individual reviews revealed common criticisms that I will take on board for the business.

The most praised aspect of Crème de la Crepe is the menu. Reviewers liked the varied options, sweet and savoury offerings and the fun names of the flavours. This is a positive sign for Madeleine's Crepes, due to our extensive menu. Based on this research, I have decided that my menu will be designed in a way that is fun and humorous (e.g. Using puns to name the products). Other positives singled out in the reviews included promotional deals, a friendly atmosphere and the crepes themselves (in terms of size and the amount of filling). These are positives for my business because I have already considered the atmosphere in developing my brand and outlined my intention to use sales promotions, generating initial sales and then repeat custom. Furthermore, the crepes themselves link to my ambidexterity context in terms of improvement, as I will be using feedback from my first few weeks of trading to perfect the recipes of my crepes.

In terms of criticisms within these reviews, the common theme was crowding. Many people complained about the lack of seating and how busy the shop got during peak hours. While my initial intention will be to use a small location with minimal seating to lower costs, any future expansions or franchises could have a bigger premises with plenty of seating. Another concern was the average price, which some felt was on the expensive side at £5. When buying multiple crepes, the crepes were no longer value for money. Based on this, I will try to keep average crepe prices to £4 and do deals when buying more than one per person. Others were unhappy with the wheelchair access and ability to locate the store. Because Madeleine's Crepes is centred on the vision that crepes will become a food that everyone can enjoy, I will ensure that all of my branches will be wheelchair accessible and heavily marketed.

Other rivals include Crepeaffaire, who may be more long-term competitors because they are "looking to expand and are always open to new ideas", as their Crepeaffaire.com website states. Additionally, Crepe Fun-Tastic could be considered future rivals if I were to branch into takeaways, an area in which they specialise. This business also offers create-your-own crepes, an idea that my business will also be using to enhance the individual experience of eating a crepe. These businesses will be continually monitored once trading, but research suggests that they are not widely known or remarkably successful. This will therefore give Madeleine's Crepes the room to become a market leader.

Crepes De France, a leading competitor in the international sale of crepes, will serve as a reference point if Madeleine's Crepes were able to trade internationally in the future. The business operates in over 15 countries, including Bosnia and Nigeria, but the biggest UK branch is only at Bath University (Crepes De France, 2012). While this may suggest that crepes

are unlikely to achieve significant success in England, I see this as evidence that there is a gap in the UK market that just requires the right entrepreneur. This links to the innovation side of my ambidexterity context and has been summed up by the Crepes De France co-founder himself. “The concept of being unique or different is far more important today than it was ten years ago; companies which are innovative generally defeat those that are not” (Lavorel, 2009).

Competitive Edge – Marketing

In order to attract customers from rivals, Madeleine’s Crepes needs to promote the brand. However, before I can do that, I have to establish what my brand actually is. The Madeleine’s Crepes brand is based on taste, experience and accessibility to everyone. This is in addition to the USP of an authentic French eating experience. I can use this clear business ideology to attract and communicate with potential customers, bringing them on board with the company vision. This identification was based on the idea that “you have to know who you are before you can convince anyone of it” (Stenthal and Tybout, 2002, p6).

Once the brand is established, it can be communicated to the customer through promotions and marketing. “The central task of advertising is to place the brand in the desired position in the prospect’s mind” (Sengupta, 2007). Based on this, Madeleine’s Crepes will use a range of promotions to both raise awareness and communicate brand values. These will include:

- Buy one get one half price when buying multiple crepes per person
- A card-system, whereby one crepe bought receives one stamp and 8 stamps will equal one free crepe
- Free sample tasters outside opening branches
- Local poster advertising
- ‘Crepe of the Week’ specials at 25 % off
- Chance of a “3 free crepes” prize for completing a feedback survey
- Local radio and newspaper advertising
- Heavy presence on Twitter, Facebook and YouTube

SALES AND GROWTH PLAN

Initial Sales

As previously stated throughout this plan, initial crepe sales will be generated through heavy promotion. As well as raising brand awareness, the methods I have outlined will start to build a solid customer base that will eventually lead to brand loyalty.

Not only will sales come from within our stores, Madeleine’s Crepes would be ideal at festivals and markets. Just one example is Camden Lock Market, who charges £15-£45 (Camdenlockmarket, 2014). This market is very popular, well-respected and affordable. Madeleine’s Crepes would initially have a presence at smaller festivals like End Of The Road, who charges £300 (Endoftheroad, 2014). English festivals are infamous for cold, rainy weather and as such, crepes would fit perfectly because they must be cooked and are generally served hot. However, in the instances of hot weather at festivals, crepes are likely to still be popular with more fruit-based fillings.

Growth in Sales

Striving for improvement, Madeleine’s Crepes will aim for sales growth year-upon-year. One way of doing this is through increased advertising – expanding to TV and national radio as profits increase. In addition to this, Madeleine’s Crepes will look to branch out into other markets like Borough Market, who are still very affordable at around £102.50 for 3 days (Boroughmarket, 2014) and bigger festivals like Reading and Leeds who will have start-up costs of around £12000+ (UK Business Forums, 2014). Furthermore, the business may look into the increasing popularity of international festivals (E.g. Spanish-based Benicassim) when looking to grow internationally.

As previously mentioned, Madeleine’s Crepes could offer takeaways in the future. This requires careful operational planning and trading experience, but will modernise the brand and appeal to the 21st century consumer. It is important to note that Madeleine’s Crepes, although specialising only in the sale of various crepes, will always have the option of selling additional products such as pancakes and sandwiches. While the original plan is to focus only on one product with many variations, “a critical success factor for businesses is the ability to adapt to changing business or market conditions” (Kets de Vries and Carlock, 2010).

Growth in Branches

To achieve sales growth, the business must be able to communicate with new audience demographics in different locations. This can be achieved by franchising out the brand across the UK and is central to the company vision: making crepes popular and readily-available nationwide.

OPERATIONS AND MANAGEMENT PLAN

Resources Outline

In terms of production, the main resources required would be a Double Crepe Machine/hot plate at £329.99 (Ecatering, 2014), an industrial fridge at £884 (Shop-Equip, 2014) and a cooker with a hob at £1000, (Secondtek, 2014). Crepe mix will be made within the business to cut costs. The crepe fillings/sides, varying in quantity and price, will need to be purchased from wholesalers like Costco to receive a bulk discount. Finally, the required furniture and decorative items will vary from branch to branch. Higher-than-expected costs is one of the main reasons for business failure, so Madeleine’s Crepes will strive to keep costs low and quality high. This can be achieved through bulk discounts, investment in new production technology and continuous product development (e.g. finding cheaper alternatives to recipes and production methods).

Personnel

In terms of personnel, Madeleine’s Crepes will require a minimal number of employees. I will be able to make the crepes and develop the recipes, as the process is relatively easy and available online. I would require the services of an accountant/finance manager and an assistant to specialise in promotions and design. A chef will also be needed at all times to help with cooking and preparation. If, after trading for a few weeks, the workload is significant or another area requires special attention, I can revise this strategy and take on the appropriate staff members by advertising in the store window. Initially using a maximum of 4 permanent staff members

allows the business to save money on wages and create a more communal, family feel. This would also mean that more routine tasks like cleaning and washing up can be shared.

FINANCIAL PLAN

Unit Costs

Based on Costco.co.uk (2014) estimates and a batter recipe from Allrecipes.com (2014), the average cost of a simple crepe would be 4p. The average price for 'sides' is around £0.45, based on a scoop of Ben & Jerry's Ice Cream (Ocado, 2014). As an example, bags of almonds from Costco.co.uk (2014) cost £12.99 each (1.36kg) and Nutella can be bought from Wholesaleitalianfood.com for £27.70 per 3kg. Based on average serving sizes, these fillings would add up to £0.40 per crepe. I expect that a Nutella and almond crepe would be very popular and so I would take this to be a reference price. Adding all of this together, the approximate unit cost of a crepe and side would be £0.89.

Pricing

Based on the unit cost calculation, market research and competitor research, the average price of a crepe would be £4. This would mean a gross profit of £3.11 per crepe, less operating expenses, a figure that would only go up as the business establishes more bulk deals and cheaper suppliers, thus representing a sustainable business idea.

CONCLUSION

In conclusion, I truly believe that the Madeleine's Crepes model can be the foundation of a successful and sustainable business. By outlining my various strategies, I hope to have laid the foundations of a viable idea. Overall, I believe my enthusiasm will allow me to see out this plan and my sensible nature will help to avoid any under/overestimations. This idea began in the Christmas markets of Lille and Brussels, where I first noticed the popularity of the crepe in those countries and the potential of the crepe over here. My vision – crepes becoming widely sold and available across the UK – has developed ever since and I am confident that Madeleine's Crepes can be at the forefront of this market development.

Bibliography

- Allrecipes.com (2014). *Basic crepes*. Available Online: <http://allrecipes.com/recipe/basic-crepes/> Accessed: 4 August 2014.
- Borough Market, (2014). *Application for a Market Pitch at Borough Market*. Available Online: www.boroughmarket.org.uk/3040/new+&cd=1&hl=en&ct=clnk&gl=uk. Accessed: 23 July 2014.
- Camden Lock Market (2014). *General Information*. Available Online: <http://www.camdenlockmarket.com/traders/> Accessed: 23 July 2014.
- Costco (2014). *Food, wine & household*. Available Online: http://www.costco.co.uk/view/category/uk_catalog/cos_6 Accessed: 4 August 2014.
- Costco (2014). *Kirkland Signature Whole Almonds*, 1.36 kg. Available Online: <http://www.costco.co.uk> Accessed: 30 July 2014.
- Crème de la Crepe (2014). *Our Story*. Available Online: <http://cremedelacrepe.co.uk/> Accessed: July, 2014.
- Crepe Fun-Tastic (2014). *The Big Difference*. Available Online: <http://www.crepesfun-tastic.co.uk/> Accessed: 19 July 2014.
- Crepeaffaire (2014). *About us*. Available Online: <http://www.crepeaffaire.com/home/about-us/about-us> Accessed: 19 July 2014.
- Crepes de France (2014). *Crepes de France around the world*. Available Online: http://crepes.com/en/2-our_business/64-Crepes_de_France_through_the_World Accessed: 19 July 2014.
- Crepes de France (2014). *The Shop*. Available Online: http://crepes.com/en/4-Shop/4-CONSUMABLES/70-Wheat_flour_for_crepes_2_x_5_kg_ Accessed: 25 July 2014.
- Ecatering (2014). *Quattro Heavy Duty Double Crepe Machine*. Available Online: http://www.ebay.co.uk/itm/e/251114497779?limghp_sr=true&hlpv=2&ops=true&viphx=1&hlpht=true&lpid=108&device=c&adtype=pla&crdt=0&ff3=1&ff11=ICEP3.0.0&ff12=67&ff13=80&ff14=108 Accessed: 25 July 2014.
- End Of The Road Festival (2014). *Trading Terms & Conditions 2014*. Available Online: <http://www.endoftheroadfestival.com/information/trading-applications-for-2014/> Accessed: 23 July 2014.
- Gaygen, N. (2013). *Effects of ambient music exposure on simulated buy decisions*. International Journal of Business and Social Science. 4(4), p184-194.
- Hardwick, N. (2014). *Is the UK's £30bn-a-year taste for takeaways getting healthier?* Available Online: <http://www.theguardian.com/lifeandstyle/wordofmouth/2014/apr/01/uk-takeaways-healthier-fast-food-industry> Accessed: 5 July 2014.
- Keller, K.L., Sternthal, B. & Tybout, A. (2002). *Three Questions You Need to Ask About Your Brand*. Harvard Business Review. September, p3-8.
- Kets de Vries, M.F.R. & Carlock R.S. (2010). *Family Business on the Couch: A Psychological Perspective*. John Wiley & Sons.
- Lavorel (2014). *Interview with Frederic Lavorel*, Master Crepe Maker and Entrepreneur. Available Online: <http://www.world-of-crepes.com/crepes-de-france.html> Accessed: 19 July 2014.
- Ocado (2014). *Ben & Jerry's Peanut Butter Cup Ice Cream 500ml*. Available Online: http://www.ocado.com/webshop/product/Ben--Jerrys-Peanut-Butter-Cup-Ice-Cream/200030011?gclid=CjwKEAjwMieBRcB3bqB94e9ID4SjABW3sTNQ8IAKfDHQwPG6eVHwj44UzusvnrVtZsSoY1_F8pujhoCWjBw_wcB Accessed: 25 July 2014.
- Roy Morgan Research (2014). *Food Segments*. Available Online: <http://www.roymorgan.com/products/segmentation-analytics/food-segments> Accessed: 12 July 2014.
- Secondtek (2014). *All your Appliances*, Burco TITAN RG90NG 90cm Gas Range Cooker in Stainless Steel M-GRADE Available online: <http://www.secondtek.com/burco-titan-rg90ng-90cm-gas-range-cooker-in-stainless-steel-mgrade.ir?cName=commercial-cookers&src=froogle> Assessed: 25 July 2014.
- Sengupta, S. (2007). *Brand Positioning: Strategies for Competitive Advantage*. Tata McGraw-Hill Publishing Company Limited.
- Shop-Equip, (2014). *Polar CC663 Double Door Gastro Refrigerator*. Available Online: <http://www.shop-equip.com> Accessed: 25 July 2014.
- UK Business Forums (2014). *Food/drink trading at music festivals*. Available Online: <http://www.ukbusinessforums.co.uk/threads/food-drink-trading-at-music-festivals.139896/page-2> Accessed: 23 July 2014.
- Wholesale Italian Food (2014). *Nutella: 1 tub x 3kg BULK*. Available Online: <http://www.wholesaleitalianfood.com/nutella-3kg.html> Accessed: 30 July 2014.
- Yelp.co.uk (2014). *Crème de la Crepe reviews* (online) <http://www.yelp.co.uk/biz/cr%C3%A8me-de-la-cr%C3%A8pe-london-3> Accessed: 18 July 2014.

About the authors

M. Johns is a Year 12 pupil at Harris Academy Chafford Hundred. Natasha Rose is a PhD student at The University of Bath, where her research considers organisational ambidexterity and its enablers.

PhD tutor's note

M. excelled at writing a business plan for a new venture. Her work conveys academic rigor supported by extensive theoretical foundation, empirical evidence and practical application. In addition, the business plan is of such an exceptionally high standard that it could convincingly be funded as a viable business. She excelled at every part of completing a business plan, which seasoned professionals often battle to do. In addition, her detail of understanding core business practices is exemplary including such attention to detail as recipes and costing the components of a crepe in her financial plan. I believed a Financial Plan was much too difficult for the age group and recommended pupils not consider it. M. provided a truly impressive, professional and financially viable final assignment that one would expect from someone several years her senior.

For permissions relating to the work in The Scholar, please contact The Brilliant Club.

Images Attribution

STEM Contents

Page 8

Northern Mocking Bird Display ('Mexican Whitejay'), Manjithkaini, CC BY 3.0
Antarctica ice shelves, USGS, Public Domain: Photograph courtesy of the US Geological Survey
Synapse Illustration2 tweaked, Nrets, CC BY-SA 3.0
fMRI Brain Scan, DrOONeil, CC BY 3.0
HIV protease 1KJF, Boghog, Public Domain: Image courtesy of Boghog

STEM Essays

Pages 9-11

Northern Mocking Bird Display ('Mexican Whitejay'), Manjithkaini, CC BY 3.0
Eggs in a nest, ZooFari, Public Domain: Image courtesy of ZooFari
Red winged blackbird, natures pics (sic), Alan D. Wilson, CC BY-SA 2.5

Pages 11-13

Antarctica ice shelves, USGS, Public Domain: Photograph courtesy of the US Geological Survey, (edited for emphasis)

Pages 13-16

Neuron1, Unnamed Author, CC BY-SA 3.0
Synapse Illustration2 tweaked, Nrets, CC BY-SA 3.0

Pages 16-19

LobesCapsLateral, Sebastian023, CC BY-SA 3.0
EM spectrumrevised, Philip Ronan, Gringer, CC BY-SA 3.0

Pages 19-23

Induced fit diagram, TimVickers, Public Domain: Image courtesy of TimVickers
HIV protease 1KJF, Boghog, Public Domain: Image courtesy of Boghog

Arts & Humanities Contents

Page 27

Punch Poor Law, Public Domain: Image courtesy of Punch
UA Flight 175 hits WTC south tower 9-11 edit, UpstateNYer, CC BY 2.0
Loxodontacyclotis, Thomas Breuer, CC BY 2.5
National Humanities Medal, US National Endowment for the Humanities, Public Domain: Image courtesy of US National Endowment for the Humanities

Social Sciences Contents

Page 51

Tanita HD 372-bathroom-scale-l, Thinking Tree, CC BY 2.0
Tally, rejon, openclipartorg
Crepes con chocolate, Juan Fernández, CC BY-SA 2.0

Editorial:

Dr Tom Wilks, Academic Editor
Martha McPherson, Sub-Editor
with special thanks to
Rachael Curzons
Penny Wilson
and all of the team at The Brilliant Club

Direction & Design:

Andy Welland / Process & Production

For general enquiries, please get in touch:

hello@thebrilliantclub.org

Website:

www.thebrilliantclub.org

Postal Address:

The Brilliant Club
Oasis Academy South Bank
75 Westminster Bridge Road
SE1 7HS

Telephone:

0207 921 4540

The Brilliant Club

Charity number: 1147771,

Company Limited by Guarantee number: 7986971

HAVE YOU EVER THOUGHT ABOUT ENTERING AN **ESSAY** COMPETITION?

The **Brilliant** Club

Essay competitions are a great way to get you thinking more widely and deeply about a topic, and to write at length on something that really interests you.

They are set by institutions of Higher Education and Research across the country and could also be a chance for you to win a prize!

Christopher Tower Poetry Competition (Christ Church, Oxford), Poetry

Deadline 27th February 2015,
£3,000

No more than 48-line poem
on the theme of 'cells'.

www.towerpoetry.org.uk/prize

Edgar Jones Philosophy Essay Prize (St Peter's College, Oxford), Philosophy

11th September 2015
£250

Many questions available, some examples are: Will being dead be bad for you? Is there any reason to believe that there are things about which science cannot tell us?

www.spc.ox.ac.uk/content/essay-prize-year-12lower-6th

Peterhouse Champion English Prize, English Literature

Deadline 20th March 2015
£500

Many questions available, some examples are: Should we be more surprised by the violence or by the tranquillity of later medieval England? Could slavery have been ended without imperialism? Are debt and democracy inextricably linked?

www.pet.cam.ac.uk/prospective-students/essay-prizes

Peterhouse Champion English Prize, English Literature,

Deadline 20th March 2015
£500

Many questions available, some examples are: Should we be more surprised by the violence or by the tranquillity of later medieval England? Could slavery have been ended without imperialism? Are debt and democracy inextricably linked?

www.pet.cam.ac.uk/prospective-students/essay-prizes

Connell Essay Prize, English Literature

Deadline: 15th Jan 2015
£500

Which novel, play, or poem has made an impact on you, and why you find it interesting and enjoyable?

www.connellguides.com/webform/essay-prize

Peterhouse Vellacott History Prize, History

Deadline 20th March 2015
£500

Many questions available, some examples are: 'Literature is what is taught, period.' (Roland Barthes). Is there a more substantial definition of 'literature' than this? Does digital text mean the end of the book?

www.pet.cam.ac.uk/prospective-students/essay-prizes

The Scholar

