



## **Additional Final Assignments**

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## History

### Who was to blame for the Becket dispute?

Thomas Becket was born 1118, London, England. He was born into a merchant class family, this meant that his family earned their money from buying then selling or trading goods. He grew up with a moderate education, first he attended the Augustinian Merton Priory grammar school, then a school in London, and finally at a university in Paris. Thomas started off his adult hood as a city clerk and accountant in service of the sheriffs. After a few years he was introduced, by his father, to Archbishop Theobald. In 1154, Archbishop Theobald, assigned Thomas archdeacon of Canterbury, this was an important role, less than three months later - in 1155, King Henry II made Becket chancellor. Henry II was the king of England who reigned from December 1154 to July 1189, he was born 1133 in Le Mans, France. Henry's mother, Empress Matilda was the daughter of King Henry I and his father was Geoffrey Plantagenet, Count of Anjou." On April 18th 1161, Archbishop Theobald died after a long period of him being severely ill, this meant that there was no one in role of archbishop, this was for a whole year. Until Becket was nominated as Archbishop of Canterbury in 1162, several months post Theobalds death. Becket's election was established on May 23rd 1162 by a royal council of bishops and noblemen. Once Becket became Archbishop, Henry had anticipated that Becket would continue to put the royal government first, not the church." As time went on a cavity between Henry and Becket grew as Becket vacated his chancellorship. This led to a series of conflicts between the two. In 1163, the king attempted to turn the other bishops against Becket, the king endeavoured approval of the traditional rights of the royal government in consideration to the church. This led to the Constitutions of Clarendon, where Becket was officially asked to agree to the king's rights or become accustomed to political reverberations. During the dispute, many people got involved, King Louis IV, who was the ex husband of Eleanor of Aquitaine - King Henry's current wife, became allies with Becket during the dispute, they both despised Henry.

On 14 June 1170, Henry's son, Henry the young king was crowned junior king of England, this was because Henry was still alive, he was crowned by the archbishop of York, which violated Becket's right as archbishop of Canterbury to crown English monarchs<sup>1</sup>. On 22 July 1170, the king allowed Becket to return to England which he did in early December that year. The dispute ended when Thomas Becket was murdered on 29 December 1170, by four knights who imposed their actions because of the angered king's words "will no one rid me of this turbulent priest?".

For the ten years that the dispute carried out, King Henry could not assign a new bishop in England to replace the ones who had died. It was only until a new bishop was finally appointed in 1173.

Many historians would say that Thomas Becket was a "shallow and flashy cleric"<sup>2</sup> and he was very "self-centered"<sup>3</sup>, but on the other hand, others would argue that he was "a proud man". Some chose blame Becket for being the major reason the dispute occurred and maybe making it worse, A. Duggan states that "Becket should have been willing to sacrifice himself to bring the dispute to an end."<sup>4</sup> and that maybe the dispute would have proceeded differently if another man had been archbishop at that current time.

During the first fifteen months of Thomas' episcopate<sup>5</sup>, the relationship between him and King Henry II began to slowly decay, this was because of the aims of the two men. In 1162 when Becket became the Archbishop of Canterbury. He started to become a strong defender of the church and the rights of the clergymen.<sup>6</sup> Henry viewed Becket as a nuisance, "the turbulent priest", but Becket has been viewed as an example and martyr to many religious people and was canonised almost immediately after his murder on December 29th 1170.

Some historians believe that the biggest "shadow" over Thomas Becket's career was the sin of pride.<sup>7</sup> Most churchmen confessed that Thomas was fighting for the rights of the church, as he may of saw

them, be that as it may many others thought from beginning to end Becket was an “ignorant and incompetent general, with the great weakness of uncompromising obstinacy.”<sup>8</sup>

Even though there are many historians who blame Thomas Becket for the dispute, some other believe it may have been King Henry II. Many thought that Henry II gave unneeded threats and unnecessary violence. Before , when the dispute only just began, King Henry already had several reasons to be agitated by Becket. For instance, Becket returned to England in 1163, and almost instantly clashed with Henry at Woodstock, he was inspired to defend the English church against the “tyrants”. This displeased the king and he could not forgive the man he had “raised from dust” and piled with honours and riches for returning the favour in this way. Henry aimed at becket's humiliation and destruction, the archbishop was not in the mind of backing down.

1 [https://en.wikipedia.org/wiki/Becket\\_controversy#Exile](https://en.wikipedia.org/wiki/Becket_controversy#Exile)

2 A. Duggan, Thomas Becket (London 2004)

3 W. L. Warren, Henry II (London 1973)

4 A. Duggan, Thomas Becket (London 2004)

5 D. Knowles, The Episcopal Colleagues of Archbishop Thomas Becket (Cambridge 1951)

6 <https://www.bbc.com/bitesize/guides/zw3wxnb/revision/1>

7 F. Barlow, Thomas Becket (2nd edition London 2000)

8 F. Barlow, Thomas Becket (2nd edition London 2000)

## English

### Should Music and Poetry Be Considered Equal?

In this essay I will be covering why I believe that music and poetry should be classes as the same in most cases. I think this because they are both forms of art that people put passion into and they shouldn't be considered different based on the way they present it. To help backup my points I will be talking about two different songs; 'Dear Mama' by Tupac and 'Ghost Assassin' by Maduk and Veela. I chose these because they both come from genres of music that have stereotypes of being relatively meaningless and made for just sound, rap and electronic.

The song 'Dear Mama' is about the new found respect that Tupac has for his Mother after realising all the hard work and sacrifice she put in to be a great Mother. When Tupac was

younger he didn't appreciate things his Mum did for him and blamed her for a lot, he wants to say sorry for the things he did and thank you for being there. The second song I chose 'Ghost Assassin' is about someone who feels like she is trapped in her own head and is being controlled by someone else. She is slowly being broken down by this concept and doesn't want to accept that her mind and body are different people. In 'Dear Mama' one line that portrays this point the most is 'Ain't a woman alive that could take my Mama's place.' This shows he believes that no is as good as her, he wouldn't want anyone else. In 'Ghost Assassin' one line that portrays this view the most is 'Hey commander, can you unplug me?' This suggests that she feels there is someone above her controlling her thoughts and how she acts, she wants to be released from those ties for once. 'Dear Mama' has quite a simple yet poetic message which could easily be made into a poem, one poem that is similar is 'My Grandmother' by Elizabeth Jennings. This poem is about how she has memories of her Grandmother and how she 'once refused to go out with her'. She never thought about her decision then, it wasn't until her Grandmother had passed she felt guilty about not spending more time with her and appreciating her, similar to Tupac, but she realised too late. This makes me think music is like poetry as two things with very different styles convey such a similar message and meaning in different ways. 'Ghost Assassin' could also be a poem in my opinion as it has lyrics reminiscent to the mental health. One poem that has ties with mental health is 'Suicide in the Trenches' by Siegfried Sassoon. This is about a soldier who feels trapped in war with no way out, he dies by putting 'a bullet through his brain'. This is similar to 'Ghost Assassin' as they both feel trapped in different ways, the speaker in 'Ghost Assassin' feels trapped in their own head, whilst the soldier feels literally trapped at war.

In the song 'Dear Mama' it portrays the way he was raised through using colloquial language with words like 'ya' instead of 'you' and 'Mama' instead of 'Mum'. This demonstrates the real way he would speak to make his message sound natural, from the heart and not forced. One poem that uses some incidences of colloquial language is 'Remains' by Simon Armitage. Although these poems have very different messages, it uses words like 'mates' and says 'and I swear' which are both natural words or phrases to show that this poem is based on an interview with a war survivor with PTSD. It makes it feel more real, like a proper conversation, him telling his story. In 'Ghost Assassin' there is a use of rhyming couplets in an A.B,A.B pattern throughout the song. This is also done in 'Suicide in the Trenches' by Siegfried Sassoon with rhyming couplets in every line. This makes me think that music is like poetry as both music and poetry use the same techniques to create an impact on the reader/listener.

In the song 'Ghost Assassin' it uses interesting language through symbolism. For example it says about the speakers 'armor getting rusty' to symbolise the effects of her life slowly tearing her down. The word 'rusty' also implies that this is a process that has beaten them down slowly over a long period of time as rusting a material is a very long process. In 'Ghost Assassin' it also says 'Hey

commander, can you unplug me?' This refers to the fact she feels trapped in her own head and his control by someone else, someone higher than them. In 'Dear Mama' he describes his feelings for his father very well by saying 'I wouldn't let me feel for a stranger'. This is a very emotional and powerful line as he compares someone who is meant to love you and care for you to a stranger. Another interesting line is 'even though they sold drugs, they showed a young brother love.' This shows that even people who sell drugs have more heart than his father despite, typically having a negative stigma, they gave him love and help when the father didn't.

In the song 'Dear Mama' there is one line that has emphasis on how it is said rather than the music and can potentially sound better without music in the background. 'And even as a crack fiend, Mama. You always were a black queen, Mama.' A lot of the sounds in these words are quite a sudden and abrupt sound to them, making the way they are said more important than music. In 'Ghost Assassin' one line that can sound better without music is 'The air was so dusty, her armor getting rusty.' This sounds better without music because of the rhyming couplets and sharp sounds at the end of each line, putting more emphasis on how it is said, rather than the background.

I agree with a secondary criticism written by Adam Bradley as he states 'Despite their vast differences in tone, however, both songs are poetry.' He covers multiple genres of music, yet they all have elements of poetry and suggests in his writing he believes that music is just a more up to date version of poetry and have 'left pop stars to give people the poetry they really want.'

In my opinion I think that music should be considered poetry even though the term 'music' covers a vast spectrum. Nearly all songs that include lyrics will use poetic techniques to make the song sound better to the ear, or have deeper metaphorical meanings to be uncovered. Some people may disagree as music stereotypically comes under a lower class than poetry, so it is less complex in some people's minds. I think the more important points made are about genre as people tend to look down upon certain genres of music as less superior or meaningless such as rap. People often take one listen to the colloquial or slang language and deem it worse than other songs or poetry, but that isn't that case. Same with 'Ghost Assassin' it's an electronic song, people instinctively hear the loud sounds and disregard any important or interesting lyrics with meanings put into them.

# Philosophy

## Justifying Punishment: Retribution, Consequentialism or a compromise?

### Abstract:

In this essay I will be discussing and justifying why punishment is necessary and morally acceptable due to its positive benefits on individuals and humanity collectively. Punishment can be justified by consequentialism, the reasoning behind this will be in the discussion section of this essay. I will also be writing of the advantages and disadvantages of teleological/deontological theories.

### Introduction:

Punishment is a negative consequence inflicted upon someone for retribution as a result of doing something wrong. What people consider 'wrong' or 'right' varies from person to person however subjective views are influenced by many different factors such as the environment and situation.

Objective views are the complete opposite of subjective views, some actions can never be justified regardless of certain details, judgement depends on the action and nothing else.

Normative theories are a moral compass to shape what we believe is right or wrong. Utilitarianism/Consequentialism (divisions of teleological theories) is when an action is judged by the outcome, if the consequences are positive then the action is good. Certain persons determine that the action must benefit a greater number of people than it harms to be a 'good consequence' nonetheless, this definition varies from individual to individual. In contrast, deontological theories disregard the consequences and fixate more on objective views for example, killing is always wrong.

Deterrence is influencing people to comply through the use of a discouraging action such as the threat of imprisonment.

Rehabilitation is the recuperation of an individual's life with the purpose of re-adjusting them to society; in this essay the rehabilitation mentioned refers to imprisonment.

Retribution is penalising someone for a wrong deed by imposing upon them the offense they committed. For example, if a person killed, according to retributive justice, they would deserve death and be executed.

Restoration is returning something into its original form. In the context of punishment, it is reconciling with the community (community service) with the intention of compensating for a minor crime committed.

Incapacitation is a specialised punishment given to prevent the assailant from committing a crime identical to their previous one. An unadulterated example of incapacitation took place in Saudi Arabia: a thief had his hands cut off to terminate his ability to steal again.

Societal Protection is a method of making a community completely secure from any harm. Punishment is a form of this, it discourages people from committing a crime resulting in a guarded environment of trust.

Cultural relativism is the view that people's normative ethics are dependent on what their culture believes for example one society may say that killing is wrong and another may accept it; the people within each society should supposedly assume the same attitude however this is generally not the case as a large amount of people belong to more than one society causing their morals to have multiple influences.

Supernaturalism is when a person's ethics are based on religion and their morals follow God's wishes; if God wishes it then it is good. According to supernaturalism, atheists having the ability to judge what is right and wrong seems to be beyond the boundary of possibility because they do not believe in God and therefore have no moral compass.

Moral subjectivism follows the thought that as long as we feel positively towards an action, it is acceptable. This would tell people to follow their feelings but not logically and instead impulsively, this presents many problems as it could promote illegal behaviours (discriminatory crimes, killing etc.)

Moral Hedonism is when someone values pleasure over normative ethics. Actions and judgements correspond with pleasure seeking.

Moral rationalism is when normative ethics are determined by the exercise of reason.

### **Discussion:**

Is punishment justifiable?

Some justifications of punishment are deterrence, rehabilitation, retribution, restoration, incapacitation and societal protection.

Deterrence is a strong justification of punishment as, in theory, it could reduce offense rates and convince everyone to conform to laws. Deterrence is successful in stopping people from committing crimes due to 'bad' consequences. This also helps people feel reassured as crimes are being prevented. In a utilitarian society, this would be extremely successful as punishments aiming to achieve deterrence would likely be extremely severe for example, authorities would likely give an apple thief twenty years in prison for the greater good of the population, for deterrence.

Rehabilitation benefits the criminal in that they will not commit another offence and their feelings towards the act will be remorse (they will be able to become a part of society.)

Restoration helps redeem the criminal by compensating or correcting their offense through community service.

Retribution satisfies those who wish for vengeance humanely and counteracts the need for vigilantism. It restores stability and impartiality of power (that someone may have received through the act, for example, power over someone's life.) Commonly referred to as 'an eye for an eye' in some situations, literally. Retribution is seen daily in minor and major cases however a controversial topic, capital punishment, is in many countries unacceptable. This in turn triggers vigilantes to dismiss the judicial system and take it upon themselves to restore justice. This type of punishment is often seen as pointless because nobody gains anything (except for satisfaction, possibly) but the criminal loses something. Some argue that this is unfair and makes the executor of punishment as guilty as the offender, it is contradictory, and nothing is gained from it. A case where this conflicting justice can be seen is in the case of Alfred Boirgeois, who murdered his daughter. He was sentenced to death, this may be a clear example of retributive justice but despite that, this punishment causes the executor to become a murderer therefore requiring them to be punished equally for their crime; this creates an endless cycle of crime, justice and death.

Societal protection comforts citizens.

Incapacitation is also another method of stopping a criminal from committing another offense however some find it too anachronistic and immoral as limbs may be removed or a life taken.

In certain situations, punishment is undoubtedly unjustifiable. Being judged and sentenced without taking motives into account is inevitably going to result in a miscarriage of justice. For instance, a man and a woman are both on trial for killing six people (individually) however their motives are

different: the woman killed them for pleasure, the man killed them for his son being held hostage. Considering this, the punishment that each would receive would not depend on the law but rather the judge's values. To justify the man killing six people, the judge would have to believe that the child's life is more valuable than the six who died.

One who follows deontological theories would give the man and woman the same punishment because they regard killing as always 'wrong.' One who follows teleological theories would give the man a lighter sentence because killing, subjectively, under certain circumstances, is not always morally incorrect.

A naturalistic explanation as to why humans drive towards justice and punishment is the "instinct of self-defence and the feeling of sympathy. It is natural for us to resent those who hurt us and retaliate against those who hurt others that we sympathise with." Mill, J.S, (1868/2001), 'Utilitarianism', Hackett publishing company. Another reason to explain why punishment occurs is, the enjoyment of power over another human being and their distress. The desideratum for safety urges society, through fear, to accept punishment and form a compromise of legal and illegal actions, this further establishes the power of institutions over society.

Natural law is also perceived by some as an unalterable cause for our principles. Thomas Aquinas (the creator of the natural law theory) claims that our morals are inherent in our minds and that they are established by nature: God or a 'transcendent source.'

Deontology and teleology are fundamentally different in that deontology is objective and teleology, subjective. These two theories judge the same actions very differently, as stated previously. I believe that teleology is the better theory of the two because, judgement of teleological authority would deliver equal, proportionate justice and punish those who demonstrate inherently 'incorrect morals' (according to society.) On the other hand, deontology would cause society's collective dissatisfaction and ruin many lives.

To decide if punishment is justified, we must first judge who is deserving of punishment. To answer this question, we must review our own personal normative ethics and the law. Society has the power to regulate citizens by ruling certain actions as deplorable and appointing a sentence. What those actions are is determined by someone's belief of what is right and wrong, for example, killing is against the law because it is seen as wrong. Human beliefs are shaped heavily through our religions, communities and laws therefore developing an Earth of moral discord. This would, in theory, make it extremely hard to collectively settle on acceptable and unacceptable deeds, however, the lands have compromised, and the law has been birthed. Regardless of what our normative ethics are and the behaviour we believe should have consequences, punishment is still in place. The law is generally influenced by society and not one person (democracies not dictatorships) and a factor that plays into law passing is what the majority of people want, this in a way can be seen as a utilitarian system as the act of passing a law only occurs if the predominance of the population benefits from it.

Teleological theories have many advantages, one being, it influences people's actions in a positive manner that will result in beneficial outcomes (individual consequentialism benefits themselves, collective consequentialism or utilitarianism benefits a greater number of people) for example a society following a utilitarian scheme would function and produce general satisfaction throughout its community. There are however, a few disadvantages of utilitarianism, one would be that, independent beliefs of the definition of a 'good' consequence could possibly cause disarray as well as a lack of distribution. Another being that, some occupants of the society may find it unethical to mistreat a small part of the population in favour to the majority. A short story where this flaw is mentioned is the 'The ones who walk away from Omelas.' In this story, a society's prosperity depends on one child's perdurable agony.

Deontological theories also have a positive effect in that certain actions will be ruled, by everyone, as immoral leading to no arguments as to what an immoral action is. Another advantage is that the actions of someone who follows deontology will not depend on the consequence, making their judgement of the situation very quick compared to a consequentialist. A complication that may arise for deontologists is the conflict of two moral 'duties.' The question 'which duty is more important?' is contradictory to their values and difficult to answer. This theory also does not take into account what a 'good' action is, there are only forbidden and incorrect actions. This prevents them from forming a goal and alternatively prompts them to avoid certain actions instead of actively pursuing good actions.

I agree with teleological theories because the advantages of it overpower deontological theories in positive outcomes for humanity. The theory regards society's best interests and distributes punishment in a way that profits the majority. Through the eyes of a utilitarian, one person is worth sacrificing for twenty others, I agree with this attitude as it is logical to value the lives of the majority for there is more overall satisfaction. Punishment may not be proportionate however it still renders practical consequences through impractical actions.

### **Conclusion:**

According to the reasoning of the benefits of punishment, the results obtained through a teleological judicial system and the positive consequences of subjective judgement that were discussed previously in the discussion section, I conclude that subjective utilitarianism is the best moral compass as the effect it would have on society would produce a majorly satisfied and functioning living system. Delivering retribution would not be an inconvenience and criminals would be correctly prosecuted for their crimes excluding punishment with the intention to deter others. A teleological society would thrive in many departments, one being satisfaction of the greatest degree felt by citizens

### **Reference section:**

Mill, J.S, (1868/2001), 'Utilitarianism'

## Politics/ Social Sciences

**“Given the social and political context in the UK do you think it is a good times to stand up for human rights? Do you still think they matter today?”**

To begin, human rights are rights we all have just because we were born and because we are human. They are basic rights and freedoms that belong to every person till death. No one can take them off you. And exploited someone's rights is illegal.

There have been many political and social changes in the world around us, changing our lives, and our very existence, rocking our country to the core. Changes that are making us think that there is no need for human rights anymore. That in a few years they may have lost most all their power. Many political mistakes and social mishaps have led to this situation to where it is today. Where a lot of people do not even believe in the power of human rights as they do not seem to protect them.

Firstly, Brexit is a big part of our political view at the moment and it is causing a lot of controversy in the UK today. It is considered for many that leaving the EU will cause problems for our human rights, that many of our rights will not be carried on after we leave the EU. [1] But it has been said that by leaving the EU, it does not affect our rights under the ECHR, as it comes from the council of Europe not the EU. It will all depend on the new laws that are passed down after we leave, by politicians to deal with the laws and rights that we do not have anymore. Even though we will have basic human rights for example 'the right to an education' there are still rights that involve children's rights and some basic rights about non discrimination that are not in the Charter of Fundamental rights. This could mean that we could be exploited by politicians or those who run our country as they may not replace the rights we have lost with ones of our own so every factor of our lives are protected. Due to this perhaps it is not the best time to stand up for human rights. We should concentrate on protecting the ones we have now. And protect them.

Also, if Brexit happens so will article 13,[2] a contentious piece of EU copyright law that opponents claim, could destroy the internet as we know it. It has been referred to as the 'meme ban' as well as censorship. However its supporters say that it is necessary to support creators online. It also restricts our right to the internet, due to the copyright law which means that authorities will need to take down copyright material which may restrict the stuff we can read or see on the internet. It says that it will help creators online but it will also restrict them. Only the soul creator of a piece of music or writing will be able to use that piece of writing or music. Any other creators that use it will have their video or web page will have to be taken down. This is in a way blocking our right of freedom of expression as we won't be allowed to express ourselves as much as we would like. It isn't really freedom of expression as it has restrictions. With these restrictions in employed people who rely mainly on YouTube or the internet for income, with copyright material not being able to be used it will restrict the content we are able to use. Making the content on YouTube and the internet not very original and not that many things to watch or use for information. It may also restrict the information allowed to be used for homework and schools work. It may also lead to our privacy being breached as they will also have to check if any social media posts have any copyright information in and this is breaching our right to privacy. As they are searching through our private social media posts.

On the other hand we should fight for human rights as they are important to us. As without them anyone can do anything to us. We need to start standing up to everyone to stand up for our rights. There are many things that have happened socially that have restricted our human rights.[3] For example the right to protest. The right to protest is a vital part of our democracy, and Liberty will continue campaigning to protect it. It is a right and a way to practice our freedom of expression. But it is restrained by police. Only if protests get violent can police intervene. Many laws have been put in place for if we protest, like in the terrorism act article 44 it says 'which allows for stop and search

without suspicion and has been used disproportionately on peaceful protestors. The court of human rights has ruled that section 44 breaches human rights and we will be pressing the new government to urgently amend this broadly drafted power.' It breaches protesters right yon privacy as they are searching you without a warrant. There is no. Reason for them to search you but they are. This is a big time for protestors and strikes and I believe that we should be standing up for our rights and for protests in general, and we should be standing up for our rights to get the politician's attention so they can help us get our confidence and rights back. More especially when Brexit is getting rid of and restricting certain human rights. It is time to stand up for what we believe in.

In conclusion, I believe that no matter what the social or political circumstance we should stand up for our rights. They are important and make up who we are. They protect us and without them we have nothing. From birth till death we have rules that help us in everyday life that protect us in every day life. No matter how many referendums or votes our rights should be stood up for as they are the most important thing that we have. Human rights areb our most valuable assets and it is up to us to protect them.

[1]- <http://www.equalityhumanrights.com/en/our-human-rights-work/whatdoes-brexite-mean-quality-and-huamn-rights-uk>

[2]-<https://www.YouTube.com/watch?v=TRYDxIYHSOw>

[3]-

<https://www.theguardian.com/commentisfree/libertycentral/2010/jun/02/state-powers-pervent-protest-brian-haw>

## Life Sciences

### Why don't some drugs make good medicines?

#### Distaval Disaster

Distaval (also known as thalidomide) was a sleeping pill and day-time sedative that was very effective in doing its job. The drug was withdrawn due to birth defects such as babies being born with malformed limbs after pregnant women has taken the sedative. This drug was widely used within the late 1950's into the early 1960's as a treatment for morning sickness in pregnant women.<sup>3</sup> Distaval was said to be safe for children who had already been born, however had an extreme impact on the foetus and embryo when taken by women, who was carrying a child during the first trimester – between one and three months. Since the drug had very large effects on people's children, there was a very large pay-out. Distillers (a quite large Scottish drinks and pharmaceutical company) had to pay for the damages to around 60 of the children affected by thalidomide. A final settlement of £20 million was agreed upon in 1972. This gave the company a very bad reputation and cause a huge loss in profit since their drug was no longer available for them to make money from. The Thalidomide Trust was established soon after. They provide support and assistance to the survivors. <sup>4</sup>

Many babies born after the mother had taken Distaval had defects to either their arms and legs or all four of the limbs. The most severe impairment is phocomelia which is where the long bones of all or some of the limbs are misshapen and also where hands and feet can either be mostly fully-formed, malformed or rudimentary. Some children had other limb disabilities including shortening of the limbs, entire limb lessness and fused fingers. Distaval also affected eyes, ears and the cardiovascular system as well as the gastrointestinal tract and kidneys. The UK Ministry of Health Report 112 states that the children could, "suffer reduction deficiencies of the limbs, malformations of the eyes, ears and deafness, defects of the heart and kidneys and malformations of the alimentary system." Alongside this, Distaval has also caused genetic conditions such as TAR syndrome which is when the radius bone in the forearm is absent (TAR syndrome can be passed down through generations even though it is a recessive gene) and Holt-Oram syndrome (which causes abnormalities in the skeleton of the arms and hands and can cause heart problems). These both affect the upper limbs of the body of the sufferer. <sup>4</sup> Thalidomide babies could be born with these conditions. This meant the families of children with the birth defects caused by thalidomide had to take extreme care of their children so that they could live the best that they could.

Thalidomide was withdrawn after an Australian scientist William McBride published a letter in The Lancet, connecting thalidomide to the malformation of the babies. When he made this public information there was outrage and many questions were asked such as, why they were taking the drug in the first place and how the effects weren't discovered before it was released to the public. The answers were simple, Chemie Grunenthal had not tested the drug properly in animals, almost skipping a phase of the clinical trial in which it had to go through before it was released to the general public. It was later discovered that Chemie Grunenthal had ignored the connections between their drug and the birth defects. After all the reports of malformed babies, Chemie Grunenthal quickly withdrew the drug from the market, knowing that there will be uproar from the public. Then Distillers followed by withdrawing it a month later due to an increase in reports of malformed babies linked to the drug. This shows that the evidence found by William McBride was correct the entire time and Chemie Grunenthal should not have carried on testing the drug without evidence of the effects that it had on animals. However, the drug was not withdrawn in the UK until 1962. Since it wasn't withdrawn earlier, about 20 more children were born with the abnormalities linked to the mothers taking thalidomide. The reason that it took longer for the drug to be withdrawn was because Distillers weren't aware of the evidence that McBride had that linked the two things

together. Finally, after the drug was withdrawn, a study from Leeds University showed that there was a large decline in the deformities caused by the drug within a year of the withdrawal of the drug. Currently there are around 450-500 people that are alive today that have the malformations caused by thalidomide.<sup>4</sup>

Alternatives to thalidomide are still being made and will someday be available for the public to use. These will not have the same side effects as Distaval but will be quite similar to one another. There are drugs that have been made that are already similar to Distaval that are used to cure other things like cancers and skin conditions. These drugs are very effective in doing this, making them suitable for use. There also aren't many side effects too, making the drugs even better.

Since cancer and leprosy have life threatening effects on people, they have to make a choice, if normal treatments like chemotherapy don't work, whether or not they want to take thalidomide even though it has some really bad side effects. We believe that it is safe to use this drug as a way to help cure these illnesses and seeing that it is very efficient and effective in doing so, we continue to use it and will in the future.

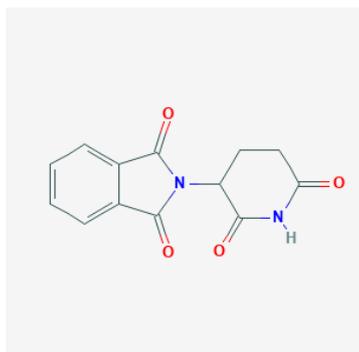
Even though Distaval was a very effective sedative and hypnotic, it caused massive, life changing birth defects to many children around the world. This led to its eventual withdrawal and even though it is still being used to treat cancer and leprosy, it is still very harmful to developing foetuses.

#### **Thalidomide's horrific past and how it is used now.**

Thalidomide was a night-time hypnotic and a day-time sedative and could also be used to alleviate the symptoms of morning sickness in pregnant women that was shown to be non-toxic.<sup>2</sup> However, it was soon discovered that the drug caused birth defects to pregnant women who took the drug.

#### **Why it was withdrawn**

The drug thalidomide (Distaval) was withdrawn from the market in 1961 as it caused birth defects to the children of pregnant women who took the drug. The drug contained a very weak Michael acceptor (as there is a ring connected to it) along with a stereocentre. See **figure 1**.



**Figure 1** – the structure of thalidomide

The stereocentre in the drug changes the effects of the drug. One structure has the sleeping pill effects whereas the other structure can cause birth defects. Thalidomide caused many birth defects as it was usually taken by women who were 1-3 months into pregnancy as they would normally suffer from morning sickness. Overall, there were about 10,000 birth defects and thousands of deaths of children. The structure of thalidomide is C<sub>13</sub>H<sub>10</sub>N<sub>2</sub>O<sub>4</sub> and at first, there were no signs of problems since there were no noticeable side effects after testing on animals. This made tests unreliable because they didn't discover the effects that it would have earlier, so they didn't have any documentation of how it would affect different things. In addition, there was already data from testing on animals, so this made it more available for doctors. Thalidomide had passed tests in

animals with no side effects and doses almost 600 times the amount used in a human had no effects on animals like rodents.

Even though thalidomide was very useful at its job, the stereocentre meant it can interact with the body and change the compound, this was what caused thalidomide babies as it interacted with the placenta. No clinical trial was done with women so there was no study on the affects it would have on the babies of pregnant women. W.G. McBride discovered the effects it had on the babies. He discovered this when he noticed a large number of birth defects in the children of women who had been taking thalidomide. When this was released to the public there were a lot of questions that were asked such as why it was put on the market in the first place. The reason it was originally put onto the market was because it was deemed to be safe to be taken by everyone.

### **What has changed since then**

After all of this occurred, the ways that drugs were tested have changed for the better. Also, instead of being used as a sedative or hypnotic, it is now used in Brazil as a way to treat cancer or leprosy. It is only being used as a last resort drug, but it is very effective in curing these illnesses. However, it caused a rise in thalidomide babies. Doctors recommended that people should not share the drug as it has multiple uses (as a sleeping pill and a cure for cancer and leprosy). Even though the drug is extremely dangerous, it is very good at curing leprosy and cancer. The drug is still used as it only caused birth defects in pregnant women, so it could still be used in curing leprosy and cancer in other people. This is because the side effects it had on non-pregnant people weren't as harmful (apart from blood clots and peripheral neuropathy,<sup>5</sup> which are the conditions that are caused by nerves sending signals to the brain and to damaged parts of the body.<sup>6</sup>) therefore we still think that it is a viable option to use as a last resort drug. In addition to curing these diseases, scientists are still studying the effect of the drug in curing other diseases. Along with cancer and leprosy, thalidomide can also cure mouth and throat ulcers related to HIV and many different inflammatory diseases.<sup>5</sup> The people who were suffering with these life-threatening illnesses were willing to take the drug even though they were aware of the side effects that it had. They had to make the choice between fighting off these diseases by taking the drug and suffering the side effects or trying to fight it without the help of the drug. The drug is useful in curing cancer because it prevents the growth of new blood vessels that can quote on quote starve tumours, eventually causing them to shrink. Even though it is very effective in shrinking tumours, there are still other alternatives to using thalidomide in curing cancer however, they are a lot more expensive and have a lot more side effects than thalidomide does. This is why we use thalidomide instead of these alternatives.

Alternatives to thalidomide are currently being developed to be similar to thalidomide but to have fewer side effects. These drugs are not available but hopefully will be in later years.<sup>5</sup> Some drugs are already available such as lenalidomide (that is used to cure myelodysplastic syndrome which is a group of diseases that cause either mass production or less production of normal blood cells in bone marrow.<sup>7</sup>) and pomalidomide which can treat multiple types of myeloma. These don't have the same side effects as thalidomide itself since they are chemically different to thalidomide so aren't as harmful as it.

### **A patient's story**

G.E age 39 was diagnosed with mantle cell lymphoma. After undergoing chemotherapy, his doctor prescribed him thalidomide. After taking the drug, his tumours began to shrink. Although it caused his hands and feet to become numb, it still holds back the disease.<sup>1</sup>

This is just one way that thalidomide has helped people suffering from cancer however, the drug is still very harmful to developing foetuses, so it still should not be taken by pregnant women.

### **To Conclude...**

Overall, thalidomide had huge, life changing effects on many people around the world. Even though it had these side effects, it is still very useful in curing different diseases. It is really effective with curing diseases like cancer since it can shrink tumours. Alternatives to thalidomide are still in the workings and in future years these drugs should be available.

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## Physical Sciences

### Final assignment – Should my child have an MRI scan?

A case study

MRI is a complex tool that comes with both multiple positives and negatives as well as benefits and dangers. Thus in this essay the two sides and consequential alternatives will be explored thoroughly and an overall conclusion, determining if your child should have an MRI, will be devised based on these facts.

MRI (Magnetic Resonance Imaging) is a form of scan used for a plethora of different health and medical inquiries and conditions, such as cancer research and identifying progression of and identifying tumours. This form of scan is completely safe; it uses a magnetic field ( $b_0$ ) and radio waves to consequently produce either a structural image (a qualitative piece of data) or a functional MRI where a patient is for example thinking or blinking. These scan results are both clear and detailed. These images can be taken from multiple angles: such as transverse where for example, a bird's eye view of the brain is portrayed. Additionally, a coronal view hypothetically slices the body front to back and sagittal does similarly but left to right through the torso. The physical aspects of the machinery are fairly large, however the spherical tubing area where the scan itself is conducted is rather confined. Machinery of this kind is located in hospitals and radiology centres.

Prior to the procedure, while the patient's body is in a state of normality, the seven billion billion hydrogen atoms, that the body consists of, are moving and rotating randomly. Then, once the patient has been positioned horizontally into the MRI, a large external magnetic force is applied (the whole extent of this machinery is run by magnets, hence the "magnetic" aspect of the acronym). Due to this field, the hydrogen atoms consequently flow in a vertical direction, either traveling up or down; the vast majority of these protons cancel each other out by having approximately half and half flowing in each direction. However, some miscellaneous protons are not cancelled out. Therefore, next a radio frequency (RF) pulse is applied, this is specifying in the hydrogen atoms. The MRI system is able to direct the pulse to the area of need, and thus the hydrogen protons are able to absorb the energy transferred through it. From this energy, the protons alternate  $180^\circ$ , thus causing there to be an even flow of protons, from the foot of the patient to the head and vice versa. Once this has happened, the Radio Frequency Pulse is turned off, thus meaning the hydrogen atoms protons gradually return to their previous and natural alignment. By creating this movement of the atoms, the energy that was once absorbed by the atoms from the RF pulse is released once again within the magnetic field. When this occurs, it emits a signal that the coils that the MRI pick up and subsequently sends to the computer. From this information that the computer system is receiving, it integrates this quantitative data and creates a qualitative piece of data. The MRI image (the "imaging" aspect of MRI) is formed using the mathematical formula, Fourier Transform. Once this conversion from quantitative numerical data to qualitative imagery has been conducted, the MRI is complete and the image can then be used for further medical means and intention.

To begin, although being a complex tool, MRI is a safe one. As stated hitherto, MRI functions using a magnetic field and radio waves, hence it does not require radiation, unlike one of the alternative imaging options such as CT (Computed Tomography) like an alternative, CT, does. Radiation, particularly large quantities of it, can be hazardous to the body due to the fact that it damages the cells that make up the human anatomy. Despite that low levels of the radiation are not harmful, when the amount of scans that one is having increases, this high amount of radiation becomes detrimental to the patients' health. In addition, in some cases, high levels of radiation can cause cancer<sup>1</sup>, however, only 1 in 2000 patients are diagnosed with cancer as a result of one

abdominal CT2. Therefore, by receiving a medical procedure that does not use radiation, patients are able to receive a scan that will not potentially not cause health issues in the future. them to have health issues in the future.

Furthermore, Magnetic Resonance Imaging is a sufficient option in which to operate a scan of the brain and further organs and potentially detect tumours. MRI can use uses Diffusion Weighted Magnetic Resonance Imaging (DWI). The fact that the weight of the human body is formed primarily by a great quantity of water, that flows freely and miscellaneously; this process is known as Brownian Motion. This percentage of water is a composition of intra and extra cellular fluids<sup>3</sup>. While the intracellular fluids flow within the cells and the extracellular flow around the cells and are not contained<sup>4</sup>, the water molecules within tissues, follow a set direction depending on the structure of the tissue. However, if a patient were to have a suffer with a tumour, the pattern in which the molecules were originally flowing in would be disturbed, causing the route of diffusion to alter. Through identifying this change, abnormalities can also be identified and this is achieved through DWI. The exploitation of the water molecules causes the internal organs and potential tumours to be visualised<sup>3</sup>.

Subsequently, Apparent Diffusion Coefficient (ADC), a tool that provides both a quantitative numerical value and a qualitative ADC map, then uses the quantitative DWI to potentially map the lesions and characterize them as benign or malignant. The severity of the tumour is generally detected by the value of the ADC and consequential tone of the imagery. A low ADC displays the mass as a dark area and indicates that water cannot move within it. Tumours of this nature include Wilms tumour and Neuroblastoma, both of which are located in the abdominals, the area in need to focus on, and are able to spread throughout the body and grow at a quicker rate than non-cancerous tumours. On the other hand, a visually bright area may suggest a benign tumour, also, like cancerous tissue, formulated of necrotic, dead tissue. This form of tumour is not cancerous, grows by dividing slowly and does not spread. Despite this, by using the colour of a tumour to detect the severity, it means that only a general rationale can be given and will thus usually mean further testing. Since, a dark area always means that there is less flow of water, not necessarily a tumour. Additionally, a benign tumour may also be dense and display a dark colour.

Although due the previously stated points, one should not have cause for concern when it comes to MRI, the following risks and dangers of MRI must be addressed. Compared to other potential options, such as CT, due to the fact that MRI operates on magnets, the magnetic field will have a perilous consequence to patients who have metal implants or fragments or tattoos which contain have been done with ink that contains traces of metal<sup>5</sup>. An example of the extremity that metal within the area of the MRI scan, is a recent case in India. Rajesh Maruti Maru, a thirty to year old male, was thrust in the machinery, thus meaning an oxygen tank ruptured and leaked. Unfortunately, the man subsequently died from both inhaling large quantities of oxygen and heavy blood loss from the incident<sup>6</sup>. Although rare, further accidents of this nature are possible due to the strength of the magnetic force. Examples like the incident stated, highlight even more the importance of the safety precautions within radiology centres. However, it must be stressed how extremely rare these cases are.

Furthermore, one beneficial, but also potentially hazardous tool regarding MRI, is the usage of contrast agents. Gadolinium is a chemical substance commonly used within the scanning process of MRI; once injected/vaccinated into the body, the element creates a contrast between the internal body structures. This contrast then enhances and improves the visibility of the overall image<sup>7</sup>. Generally, most patients who receive the contrast medium have successfully functioning kidneys and therefore are able to easily flush out the gadolinium through their excretory system. Minor side

effects of the vaccination include nausea, vomiting, headaches, and/or pruritus, all of which will last only in the short term.

If in the case that gadolinium had been used with a patient whose renal functioning is insufficient, depending on the level of that function, the patients' is poor, they may consequently suffer with Nephrogenic Systemic Fibrosis. Although still remaining difficult for the medical world to fully comprehend, Nephrogenic Systemic Fibrosis is a condition that causes sufferers to develop tightening of the skin; this can be externally or internally around organs. Common restrictions from this condition include disability and in some extreme cases death<sup>8</sup>. For instance, in June of 2017, Gena Norris, wife of actor Chuck Norris, reported of burning sensations on her skin and a persistent 'foggy' mind, all being indications of gadolinium poisoning<sup>9</sup>. Despite the danger, Nephrogenic Systemic Fibrosis is rare and specific to kidney failure; as of 2011, 335 cases have been diagnosed<sup>10</sup> and although this is a reliable source, each patient will react of varying degrees.

Regarding the ethical aspects of MRI, incidental findings within the medical profession are of main priority. If a tumour were to be identified, it opens several hypothetical questions that must be acknowledged prior to the MRI procedure: would one wish to know if there was no available treatment for their stage of cancer? What are the following actions of a misdiagnosis? (Misdiagnosis commonly causes extreme mental trauma with both patient and doctor). In the case of a cancerous tumour being identified, following treatment includes chemotherapy and radiotherapy, both of which have a relatively high success rate. Just over fifty years ago, the survival rate of an infant suffering with cancer, was just 10%, however now with MRI being able to clearly and successfully diagnose problems early, that statistic has increased to 90% in 2018. Despite the fact that 43 children every day are diagnosed with cancer, with the reliability of MRI and subsequent treatment, the survival rate had increased incredibly<sup>11</sup>.

Finally, if MRI is not an appealing option for yourself or your child, a CT scan is a viable option. Firstly, a CT scan is quicker than MRI. CT is a faster version of scan, taking a minimum of five minutes. This would mean for a quick consultation in addition to the scan and an overall quick diagnosis, allowing for potential treatment to take action as quickly as possible. Moreover, due to the fact that the physical scanning process has a shorter time period, this consequently means that claustrophobia is less likely to occur. Whether your child is prone to claustrophobia or not, both items of medical equipment operate using a similar spherical tube area. Thus being in this environment for a shorter period will decrease this preventable state of suffering for the patient. If patients are less anxious and consequently move less, artefacts are less likely to occur (an artefact is a blurry appearance in the final image as a result of a patient's movement), which are common issues in MRI. Unlike MRI, computed tomography does not use the usage of magnetics; therefore this enables CT to be a viable option for multiple patients who do have metal implants, such as pacemakers, prosthetic metal heart valves or artificial joints<sup>5</sup>. However, computed tomography scans do involve radiation and emits a quantity of it, in some cases equivalent to seven years of natural radiation from the sun<sup>12</sup>, which over a long period of time and multiple scans can cause various cancers, such as cancer of the skin. In addition, yet again unlike Magnetic Resonance Imaging which operates of three planes of imaging (transverse, coronal and sagittal), CT is limited to the transverse (also known as axial) plane.

In conclusion, MRI is a preferable option for your child. As stated previously, it is safe and comes with minimal health threats to your child. Not only this, like all medical procedures, any possible, unlikely risks that may come as a consequence with undoubtedly be dealt with the best possible care.

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## Mathematics/ Computing

### Does Facebook Control The World?

Part B:

Facebook can be modelled as a network with everyone being connected to those they are friends with. The nodes would be the people and the connections would be who each person is friends with. People's names and ages and other small details about them has been disregarded. This is okay because these things are not really needed in a simple models. However, if you are trying to create a model that was investigating if people of different ages use Facebook in different ways, this would be a major weakness.

The degree is the number of neighbours a node has. The degree distribution summaries the amount of nodes with a certain degree in the network. The degree distribution of Facebook cuts off at 5000. This is due to a limit imposed by Facebook. In the degree distribution, there is a kink at 20 friends. This is due to Facebook trying to get people with under 20 friends to get to 20 friends or above. There are very few people with less than 20 friends however there are a lot of people with exactly 20 friends. It is a fat tailed distribution. This is because most people have an average of under 200 friends, while a very small amount have hundreds and thousands. If something was to reach these hubs, it is much more likely to reach a larger proportion of people. If this was something that was not supposed to be spread around, it would be seen by many people quite quickly. Especially compared to someone with around 200 friends.

The path length, is how many nodes it must go to, to get from one node to another. The path lengths in Facebook are rather short due to someone most likely being friends with someone that is friends with the person they are trying to reach.

The clustering coefficient is the amount of mutual friends of a person. A larger clustering coefficient would indicate a group of people who are close. A tight knit group possibly. On Facebook, it's shown that the clustering coefficient drop a large amount for users with close to 5000 friends. This is because very few friend groups or families would be made up of over 5000 people. Influencers would be the main people with this amount of friends and they wouldn't have very tight knit groups. It's more likely to be their fans.

Mixing patterns are when the nodes that are linked together are similar in some way. On Facebook this is shown with people being more likely to be friends with others their age. It's also shown that most people are friends with others in their country. As many people would be into the same things as the people they're friends with, it's likely that they will begin to believe that the whole world thinks like them. It begins to get hard for people to see why others don't have the same opinion. This can badly effect politics.

Facebook can be positive in many ways. Such as the ability to communicate with people from all over the world. It also allows us to talk to family members/friends that we are not close to or may not see often. If you need to contact someone but don't have their number, it's more than likely that you'll be able to search them up on Facebook and find them. However, it has negative parts to it as well. Having so many people on a certain social media makes it much easier for things to be spread. Even things we may not want going around.

If Facebook was to make people use their passports to make an account as verification, there would be less accounts. This is because many people have multiple accounts, many of which are fake. This would also lead to fake accounts not being made. Overall making meeting people on Facebook much safer than it currently is. If Facebook was to remove the 5000 friend limit, there would be a few people with even more friends, however this would be a very limited amount of

people. The average amount of friends would most likely stay the same as very few people would have more than 5000 friends. If Facebook didn't push people to have at least 20 friends, there would not be a kink in the graph. It would more even until the average number of friends was reached and then it would begin to decline. There would also be a decline in the amount of people active on Facebook. Anyone with under 20 friends would most likely get bored of the website and stop using it.