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GLEES AND XIIS

David Hill, MBE, Adjudicator, 22 October, Speech Room and elsewhere

Marking the culmination of many weeks of rehearsals, this year's Glee's and Twelve's competition maintained its impressive reputation and proved to be an invigorating display of talent across the School. The event provided a welcome tonic for the Harrow community, a comforting reminder of normality. For this pivotal moment in the School calendar, the expectations were extraordinarily high, and the presence of esteemed adjudicator David Hill MBE, Musical Director of the Bach Choir, made it all the more prestigious. In his opening remarks, he recalled Leo Tolstoy's supposition that 'music is the short hand of emotion', a statement which the evening certainly embodied and communicated.



Glees

The evening opened with The Head Master's singing *The Sound of Silence*. It is always a hard task to start an evening like this, let alone when Speech Room is not as buzzing as it usually is. Nevertheless, they gave an exciting performance, with the adjudicator commenting on their strong sense of rhythm and their intonation.

Rendalls followed, singing *If Ye Love Me*, which was a nice interpretation of Tallis, a break from the usually pop style which most glees engage with. They sang the well-known Renaissance piece with a competent sound. This was a fine performance, bringing a creative performance of 16th-century music to the evening.

Up next, Lyon's sang *Yesterday*. They had a very nice blend to their sound, and they told the story very well. The piece was nicely presented and did not lack emotion. The performers were not fazed by the classic Beatles work, doing the song justice.

After this, West Acre sang *Light in the Hallway*. The performance grew remarkably in confidence. The singers were very much together in their performance and it ended brilliantly, perhaps comparable to the original Pentatonix version.

The second-place performance by Bradbys came next, singing *Beautiful Girls*. They really engaged the audience as if they were actors. There was a lot of thought put into the presentation and the solo singing was extremely confident.

Following that, Druries sang *Can't Help Falling in Love*. The singers were very committed to the mood of the song, which came across very strongly. It was clear that the singers enjoyed

the song, portraying the classic love song extremely well.

Following the mandatory change around, Elmfield opened the second group with *Love of My Life*. The vowels and tones blended extremely well, and they performed with a very convincing energy.

Next up, Newlands sang *Piano Man*. This was an exciting performance of the Billy Joel classic, especially given that the singers went up a whole tone, leaving the soloist having to sing a top A – quite an impressive achievement! It was clear, however, that everyone involved with this work was having a great time.

The Park then sang *Colder Weather*, singing with superb energy and with a strong presentation of the melody from the soloist. This rather unknown song had the audience hooked throughout as the singers really engaged with the lyrics.

The third-place performance came from Moretons singing *When the Party's Over*. There was a subtle engagement to this performance as the singers leant into each other, much like the King's Singers. Their sound was engaging and there was a tact to their phrases.

Following this, The Knoll gave their interpretation of <u>*The Sound of Silence*</u>. There was a strong sense of connection amongst the quintet and they pulled of the famous song extremely well. It is always hard to do the same song as another House, but these performers were not put off and sang superbly.

The final (and winning) performance was given by The Grove, singing *I Won't Give Up*. The solo singing was extremely confident, and a huge sound was produced by the group. The presentation was extremely compelling, and the performers had an infectious enthusiasm, perhaps bringing a tear to the eyes of some of the members of the audience.



The Twelves

The Head Master's began the Twelve performances with a brilliant rendition of *Human*, a staple of any Killers fan playlist. They stroke a superb balance between intimacy and robustness, offering a sound the adjudicator claimed to love. The colouring of the text was well executed, the humour understood, and the piano accompaniment extremely complimentary.

Rendalls followed suit with a very spirited vocalisation of *Life on Mars* by David Bowie. They too communicated an extremely strong delivery and maintained a superb amount of terrific energy throughout.

Next was Lyon's, who secured second place after their audacious performance of *Happy Together* by The Turtles. From the very first note they had the entire audience gripped,

and each member lived every moment together as one group, all symbiotically contributing to a well-deserved podium finish.

West Acre eloquently sang *I Want it That Way* by The Back Street Boys. There was an intelligent range of dynamics and impressive creation of atmosphere. Such was their excitement, some singers graced spectators with expressive boogie moves.

Bradbys supplied an engaging rendering of *Take Me to Church*, a truly emotional Hozier masterpiece. They rose to the challenge of a dangerous soft opening, pulling it off meticulously. Clearly a lot of thought had gone into its delivery, and their ability to take risks paid huge dividends.

Druries offered an invigorating showing of *When I was Your Man* by Bruno Mars. It was a truly convincing performance. The music sounded great, with particular skill being recognised for their fantastic 'oo' vowels.

Elmfield provided an accomplished staging of *Luck Be a Lady* by Frank Loesser. Grasping the story with vibrant finesse, they embellished the text with applaudable diction and excellent dynamic contrast.



Met with exuberant glory, Newlands rose to an outstanding victory, unleashing an unparalleled presentation of *Space Oddity* by David Bowie. Seizing the genius, might and gravitas of the momentous song, they engaged a thoroughly thrilling, formidable and evocative exhibition. As a majestic ensemble, they hit every note and had unrivalled gravitas. Commanding such an intense concentration from all in location, their first place was richly deserved.

The Park bestowed a radiantly melodic display of *On the Street Where You Live*, a spectacular track from *My Fair Lady*. A favourite of the adjudicator, they communicated both an articulated and powerful tune. They were sturdy yet equally mellifluous, an entertaining piece.

Moretons proffered a jubilant arrangement of *Don't Rain On My Parade* from the 1960's musical *Funny Girl*. They had clear diction and distinguished adjustments of nuanced dynamics providing a colossal sound.

The Knoll sang *Young and Beautiful* with distinction, a soulstirring Lana del Rey classic. An exquisite demonstration all round, with credit awarded to the lead conductor for his timely caressing of the air. They had altogether well-rounded crystalclear notes, relaying a both energizing and beguiling recital.

Drawing the evening to a close, The Grove bequeathed a quintessential Grovite unveiling of raw enthusiasm, securing further podium praise in third place. The American accents were well versed and indeed talented, as was the extensive attention to detail. A compelling furnishing worthy of admiration.

To conclude, sincere thanks must go to the adjudicator for his thoughtful and kind words, and generous dedication of time. It was an honour and privilege for the School to welcome him back to the Hill for a second time. In addition, thanks must also go to all those that enabled the historic competition to take place this year in such peculiar circumstances. Finally, bountiful congratulations to all boys who took part and indeed beaks involved; it was a magnificent occasion.

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SHELL DRAMA

Ryan Theatre, 18 October

The Head Master's

The Head Master's provided a well-rounded, nuanced performance full of humour, gusto and effective physicalisation. Presenting The Emperor's New Clothes, directors Jack Hedley, Reuben Ackerman and Phoenix Ashworth must be commended for their terrific leadership and instruction of a supremely energetic and committed cohort. Particular credit must be given to Arjun Nanda, who effortlessly charmed the audience with his regal embodiment of the Emperor. Indeed, throughout the performance the aura of a Royal Court was spectacularly communicated. The ensemble provided a fantastic atmosphere, gracing spectators with an impressive array of accents and well executed timing, clearly demonstrating a mature approach to their Ryan Theatre debut. Furthermore, the dynamic duo of Alex Akinluyi and Seun Doherty, Mother and Chamberlain respectively, made superb contributions to the overall piece, though there is no doubt that one and all of the entourage are to be congratulated on this elegant, amusing and grippingly calculated rendition. With The Head Master's providing such an encouraging offering so early in the School calendar, their House play, The Great Gatsby, will unquestionably be an immensely promising event, one surely not to miss.



Bradbys

The bar had been set high, but the Bradbys Shells rose to the challenge with outstanding vigour. Their short but truly sweet performance of The Ugly Duckling, immaculately directed by Sam McGougan, Hugo Bishop and Dominic Smith, gripped those in attendance. The intriguing blink or you miss it ideology of the performance artists was dramatically effective. Indeed, many were on the edge of their seats. Narrators Oliver-Willwong Joshua, Walker Milo and Piranditta Daniyal had tremendous stage presence and delivered their lines with eloquent finesse. Similarly, Tonoki Taka was outstanding in his undertaking of the Ugly Duckling, committing wholeheartedly to the role. The entire ensemble was devout in their concentration, a collective of enthusiastic champions warranting the highest of salutations. Bradbys must be thanked for their enjoyable contribution; we eagerly await their fast-approaching House play A Man of all Seasons.

The Park

Clearly sour from their loss to Newlands in the 2019 Drill Squad, it came as no surprise that The Park directors George Fenwick and Max Wilson were keen to instil military qualities into their Shell year group early on. It must be noted that such attempts were heroic and undeniably commanded the willing attention of both captivated and bewildered onlookers. Their production of *The Tinder Box* was one to savour, jostling for position amongst Parkite thespian giants of old Lucas Marsden-Smedley and Finn Deacon. Such was the excitement of the showing, budding paparazzi jostled in the upper gallery to capture this historic moment. There were terrific performances from the two witches Louis Byrne and Henry Pearson, as well as the Soldiers Hugo Evans and Max Rugge Price. Likewise, narrators Eddie Cook and de la Poer Beresford were equally well poised and rehearsed, providing the foundations for a spectacular scene of entertainment. Special mention goes to the three dogs, Archie Marlow, Tochi Orgji and Jack Shen, who's intimidating barking had the SMT quaking in their loafers. The final frame was one to relish, dominated by humble, yet suitably proud grins. Thank you, The Park, for a brilliant rendition that was both comical and slick. Congratulations.

The Grove

The Grove kicked off the afternoon with an engaging performance of *The Most Incredible Thing*. The House sprang to life and collectively presented a passionate piece with particularly stellar performances from Ralph Lubbe, Hugo Bourne and Rishaad Bhushan. The play had a slick plot and the managed successfully to subvert expectations with a twisted ending that kept the audience captivated all the way through. Credit should be given to the directors, Ben Leonard and Indi Abrams, who led the ensemble to a very successful Ryan Theatre performance.

Rendalls

Not to be outdone, Rendalls continued the high standard with their own performance of *The Tinderbox*. The storytelling was exquisite with several boys narrating the quality performances of Arturo Saville Mascioni and Algy Royle specifically. This performance highlighted the hard work of the directors: Jonny Blake McGrath and Adam Chambers were able to show their own dramatic flair through the boys they directed.

The Knoll

Finally, The Knoll finished the first round with a performance of *The Snow Queen*. With Charlie McDowell and Aaron Patel switching between main roles. The interesting pretence of actors switching roles throughout kept the performance fresh and engaging all the way through. William Wauchope and Daniel Sidhom managed to muster up detailed storytelling and excellent actors to boot.

Elmfield

Elmfield succeeded in capturing the mysterious story of Hans Christian Anderson's *Tinder Box* as well with unparalleled vigour and dynamism, and no one doubted their decision in choosing visual over gustatory entertainment. Through this spectacular storytelling, The Heffer brothers' thespian legacy was evident throughout the performance, with smooth transitions, eloquent and detailed character development, balanced with precise attention to detail. Elmfield were incredibly successful at conjuring up a vivid and colourful landscape, with all the trappings of an engaging performance. In particular, the vivid character acting, specifically in the boys playing the three dogs, was entirely successful. Elmfield certainly set a firm precedent for the remaining Houses, with a thoroughly enjoyable production.

West Acre

After the initial excitement of Elmfield's opening piece, and Toby Deacon's (OH) portrayal of Hans Christian Anderson himself, the stage was there for West Acre, with *The Ugly Duckling*, to seize and prove their theatrical prowess. This was a beautiful, forlorn tale of rejection and hope, and was particularly poignant in light of the current crisis of identity politics. The boys expertly illustrated the sadness in the tale, utilising speaking in chorus to emphasise the alienation and mindless rejection of our eponymous hero, and the use of movement when the Ugly Duckling made his majestic transformation presented a hopeful and optimistic tone, keeping the audience on the edge of their seats throughout. A presentation that certainly would have wowed Hans Christian Anderson himself, West Acre's piece was a remarkable piece of theatre, with a clear dramatic vision evident throughout.

Lyon's

The other two Houses having set a fine precedent, all was riding on Lyon's to deliver a nuanced and intelligent version of The Emperor's New Clothes, a story full of humour and satirical commentary. Of particular note was the characterisation of the Emperor himself, played by Saarvin Cambata-Mistry, with perfect voice acting and posture to suit the character and deliver him precisely to the audience. The humour in the piece came across excellently, with well-timed jokes dispersing the Emperor's despotic tendencies and causing laughter to ripple through the audience. The final moments of the piece were perhaps the most expertly directed, with all the anagnorisis of the Emperor's situation coming across very clearly to an audience held on the edge of their seat. Another entirely successful, amusing and well thought out piece, that rose perfectly to the standard set by both the other performances, and finished the evening with a memorable presentation of the satirical tale.



Newlands

By the time the last of the four Shell Drama rounds kicked off in the evening, the wintery set aptly complemented the chilly temperature outside. In his icy cabin, we see a tranquil Toby Deacon OH snuggled up in furry clothing, chiselling away at a piece of wood. An inquisitive young boy enters the cabin, and as they exchange pleasantries, he picks up a bow and arrow and shoots the old man, who soon after begins warbling a romantic tune while plucking his guitar.

The boy stealthily exits and is replaced by Newlands, who recount the tale of the Ugly Duckling. A mother chicken's eggs all hatch on time, except for one that delays significantly. When it does eventually hatch, the duckling is ostracised by his siblings as he looks and sounds different. He is considered so undesirable that a dog even decides against eating him, sending his self-esteem plummeting. However, he finally finds his place when he runs into a flock of swans who welcome him as part of the group in which he belongs.

Druries

Newlands were followed by Druries, who performed the classic tale of the *Little Tin Soldier*. We are taken into a boy's living room on Christmas day, where he is unwrapping his gifts, one of which is a set of tin soldiers. One of these soldiers is missing a leg, and is resultingly placed on the windowsill, the unwanted runt of the litter. A gust of wind blows him off into the street, where two boys find him and place him in a paper boat which they then let sail down a stream. The stream eventually takes the boat and soldier into a drain, where a fish arrives and gobbles him up. As fortune would have it, the fish is caught, sold and taken back to the boy's home, where he is found when the fish's belly is sliced open. Druries' performance was enjoyably light-hearted in spirit, including subtle jokes the more eagle-eared in the audience would have enjoyed.

Moretons

The final show of this year's Shell Drama Festival was *The Beetle Who Went On His Travels*. This humorous fable tells the story of a conceited beetle who decides to go out into the world to seek his fortune. He encounters ladybirds, frogs and scholars, as well as visiting a dung heap before returning home. What stood about Moretons' performance was their fantastic use of choreography, moving about the stage to create formations that really brought the tale to life.

We then return to the snowy cabin, where the boy has returned to visit the old man, who asks him who he is. Grabbing his bow and striking a pose reminiscent of the statue in the centre of Piccadilly Circus, he asks 'What do you think?' before vanishing into the icy night.

Many congratulations go to all of the performers and their Sixth Form directors for putting on a highly enjoyable day of performances, and many thanks go to APC and the Ryan Theatre team for organising the event so expertly, despite the challenges of the moment.

MATHEMATICS SOCIETY

Oscar Wickham, The Head Master's, "Public Key Encryption and the Future of Cryptography", MS2, 14 October

On Wednesday 14 October, the Mathematics Society gathered in Maths Schools 2 to hear a lecture on 'Public Key Encryption and the Future of Cryptography', given by Oscar Wickham, *The Head Master's*. Wickham began by explaining the reasons why he had given this talk to the Maths Society and not to the Computer Science society. This is because programs are binary and hexadecimal, but encryption is purely mathematical.

He then led us on to single key encryption, used since Roman times (Caesar's cipher is a good example of this) and all the way up to World War II, in the Enigma code. This is when one algorithm is used to encode, and the recpient simply reverses the algorithm to decode. However, this method of encryption is insecure, and a code breaker can break this form of code, no matter how complex.

This problem was exacerbated by the arrival of the computer. This allowed for much faster code breaking. In fact, as Wickham went on to explain, the computer was used at Bletchley Park to help coders break the Enigma code, a code which the Germans at the time deemed impossible to solve.

Single key encryption was rendered useless by the creation of the internet. With the internet, it would be possible for eavesdropping on communications between anyone, anywhere, and since single key encryption can be easily broken, it was made redundant. RSA is now widely used across the world. WhatsApp's "end-to-end encryption" is an example of RSA.

Wickham then went on to talk about RSA code, which is the code that is now used across the internet. This utilises the fact that it is easy to multiply together two prime numbers, but it is difficult to factorise their product. The product of these two numbers would be the public message that is sent across and the two factors would be the keys. The key point here is that the key to encode it and the key to decode it are asymmetric, making it difficult for a codebreaker to break the code.

Wickham demonstrated the maths behind this on the whiteboard, using techniques such as Euler's totient function. He then used some examples in a Python program that he had made earlier to demonstrate RSA in action.

Wickham then went on to explain that with the advent of quantum computers, which can compute incredibly large numbers even faster, and with the assistance of what is known as 'Shor's algorithm', RSA may be breakable. This could prove to be 928

highly problematic, as even cryptocurrencies such as bitcoin could be broken. In fact, Google claims to have already solved a prime factor problem with quantum computing. Fortunately, there may be quantum-secure encryption, such as lattice-based encryption – which involves the mathematics of spaces with hundreds of spatial dimensions – code-based encryption, and multivariate encryption. Overall, as Wickham summarised, quantum computing is just the next step in the encryption arms race and, as he put it, "There's always a bigger fish".

PIGOU SOCIETY DAE, "Introduction to Game Theory", OMS, 20 October

On Tuesday, the Pigou Society gathered in the OH Room for an entertaining and informative lecture from DAE on 'Introduction to Game Theory', an always fascinating part of studying Economics. For anyone who wants the technical definition for game theory, it is the 'study of the ways in which interacting choices of economic agents produce outcomes with respect to the preferences (or utilities) of those agents, where the outcomes in question might have been intended by none of the agents'. A very convoluted definition, but in simpler terms, game theory is 'the analysis of how the players of a game react to changing circumstances' as proposed by none other than CTP himself. The study of game theory can be used to model a variety of scenarios involving two players and definitive payoffs.



The classic example of this is the risoner's dilemma. The prisoner's dilemma presents a situation where two parties, separated and unable to communicate, must each choose between co-operating with the other or not. The highest reward for each party occurs when both parties choose to co-operate.

The prisoner's dilemma goes like this: two members of a gang of bank robbers (John and Michael) have been arrested and are being interrogated in separate rooms. The authorities have no other witnesses and can only prove the case against them if they can convince at least one of the robbers to betray his accomplice and testify to the crime. Each bank robber is faced with the choice to co-operate with his accomplice and remain silent or to confess and testify for the prosecution. If they both co-operate and remain silent, then the authorities will only be able to convict them on a small charge of loitering i.e. one year in jail each. If one testifies and the other does not, then the one who testifies will go free and the other will get ten years. However, if both testify against the other, each will get five years in jail for being partly responsible for the robbery.

In this case, each robber always has an incentive to confess, regardless of the choice the other makes. From John's point of view, if Michael remains silent, then he can either co-operate with Michael and do one year in jail, or confess and go free. Obviously, he would be better off betraying B in this case. On the other hand, if Michael confessess and testifies against John, then John's choice becomes either to remain silent and do ten years or to talk and do five years in jail. Again, obviously, he would prefer to do the two years over three. Now, since Michael faces the exact same set of choices, he also will always be better off confessing as well. The paradox of the prisoner's dilemma is, therefore, that both robbers can minimize the total jail time if they both co-operate (2 years total), but the incentives that they each face separately will coerce them each to confess and end up doing the maximum total jail time between them (10 years total)– this is known as the Nash Equilbrium, which can be labelled in a payoff matrix.

The Nash Equilibrium is 'a concept of game theory where the optimal outcome of a game is one where no player has an incentive to deviate from his chosen strategy after considering an opponent's choice'. This concept can be applied in real-life scenarios, including the arms' race, where countries are given a choice to build or not to build nuclear weapons. Each country's most preferred outcome is to gain advantage over the other country, and this can only be done by building weapons. Since this game is symmetrical, the other country would also build, leading to the arms' race. However, in the long run, the world may be at risk from nuclear war, so it may be advisable for the two countries to refrain from building. This equilibrium can only be achieved by assurance strategies to ensure one country doesn't deviate to building weapons.

This concept can also be applied in the Chicken Game. In this game, each player drives head-on towards each other and have the choice to either swerve (the risk being you may be shamed for being a quitter) or continue driving straight. When one player swerves, the conflict is avoided, and the game is over. However, if both drivers drive head-on there would be a collision and would most likely result in death. Therefore, it is in the best interest of drivers to swerve.

The final, and arguably most interesting, application is in the TV show Golden Balls in the final challenge. Here, players are given a choice to either split (with the risk of losing your share of the prize money if the other steals) or steal (with the risk of losing everyone's share if the other also steals). When drawing the payoff matrix, it is obvious that it is in the best interest for the players to steal (and so the Nash Equilibrium is that they both leave with nothing). However, in one of the most entertaining Golden Balls battle, one of the participants revealed that he was going to steal. Although bizarre at first, the other person is now presented the option of losing everyone's share (steal) or just losing his own share for the other player (split). As a rational man, he splits, and so does the initiator. Although labelled as "stupid", he should really be labelled a genius for breaking the game (and the show not long after).

Accompanied with suspenseful videos and funny gifs, DAE's presentation enacted as a perfect introduction to game theory for aspiring Economists. Huge thanks must go to DAE for delivering such a riveting talk, which will surely inspire boys to explore game theory further.

METROPOLITAN

JOHN LOCKE ESSAY

Neil Kumar, West Acre, "What is the socially efficient level of crime?"

To answer this question, we must first establish the definition of social efficiency. Social efficiency has been achieved when there is an optimal distribution of resources in society, considering all external costs and benefits as well as the internal costs and benefits. Social efficiency is closely related to the concept of Pareto efficiency – the point where it is impossible to make any person better off without making some other person worse off. Marginal Social Cost is the total cost society pays for the production of another unit of a good and Marginal Social Benefit is the total benefit society receives from the production of another unit of a good. Put into graphical terms, social efficiency should occur at an output where the Marginal Social Benefit (MSB) curve intersects the Marginal Social Cost (MSC)curve. This is demonstrated in Figure 1.



Figure 1: Determining Social Efficiency

There exists a controversy over what criteria to use when determining the social efficiency of crime. In my view, the current criteria are best explained in "The Economic Theory of Public Enforcement of Law" (Polinsky and Shavell, 2000). The controversy lies in the fact that their welfare function, a function that ranks social states as less desirable, more desirable, or indifferent for every possible pair of social states, incorporates the social benefit criminals receive from committing illegal activities. While the distaste towards this variable is unsurprising (e.g. does society really care about the pleasure a murderer gets from killing someone?), if one truly believes in a utilitarian welfare function, it is hard to reject. For this reason, modern economic models of crime consider the social benefit criminals receive from undertaking illegal activities. We therefore have a situation where we will aim to identify the point where the marginal social benefit criminals receive by committing crimes equals the marginal social cost endured by the victims of that crime. The graph below depicts the equilibrium point between the Marginal Social Benefit criminals receive when they commit crimes and the Marginal Social Cost victims and non-criminals experience when crimes are committed. The point of social efficiency on this graph is where these two curves intersect.



Figure 2: Determining Social Efficiency of Crime

On the flip side, we could attempt to determine the optimal rate of crime deterrence. The graph below demonstrates how to find the balance between the net cost of the harm caused by crime and the cost of preventing it.



Figure 3: The Efficient Level of Deterrence

In Figure 3 the x-axis measures the amount of reduction of criminal activity, ranging from 0% reduction to 100% reduction. The net cost of crime, which includes the opportunity cost of time lost to criminal activities, incarceration, crime prevention, and recovery after victimization[1], is measured in pounds on the y-axis. The curve MSC represents the marginal social costs of achieving a certain level of crime reduction. The MSC curve slopes upward because law enforcement agencies generally tend to undertake easier forms of deterrence before undertaking harder forms of deterrence. Consequently, achieving additional reductions in crime becomes increasingly costly for the society. For instance, reducing crime by an additional 1% is easier when crime has only been reduced by 5% as opposed to when crime has already been reduced by 95%, such is the law of diminishing marginal returns. The curve labelled MSB measures the marginal social benefit of achieving various levels of crime reduction. The MSB curve slopes downward because the benefit to society of a reduction in the level of crime declines as the total amount of crime declines. For example, the reduction from 3% to 5% benefits society more than the reduction from 97% to 99%. Socially optimal deterrence, and therefore social efficiency, would occur at the point where the marginal social cost of reducing crime further equals the marginal social benefit of reducing crime further. In the graph above, social efficiency is achieved at the level of deterrence marked D*. Notice that for any level of reduction in crime less than D* the marginal social benefit of a further reduction in the level of crime exceeds the marginal social cost, so society should reduce crime further in search for greater social efficiency. Similarly, for any level of reduction in crime more than D* the marginal social costs of a further reduction exceed the marginal social benefit, so society should allow more crime to go undeterred. It also must be recognized that changes in MSC and MSB can change the optimal level of deterrence. For example, suppose that the opportunity cost of resources devoted to deterring crime falls and the marginal social benefit of deterrence remains the same. In this case, MSC would fall to MSC2 and the optimal level of deterrence would increase to D**. As long as deterrence is costly, the optimal amount of crime is positive. Costly deterrence prevents a rational society from completely eliminating crime, and if deterrence costs rise, the optimal amount of crime rises. However, if the net harm from crime rises, the optimal amount of crime falls.

However, I believe there is a slight limitation to this model which originates from the fact that we are taking the viewpoint of Nobel laureate Gary Becker (Becker, 1992), who initiated modern economic analysis of criminal law. Let us assume that criminals are rational and respond significantly to the deterring incentives by the criminal justice system. They compare the gain from committing a crime with the expected cost, including the risk of punishment and the possibility of stigma. Becker's model used to derive social welfare and the benefits to crime considers a "market approach" in which the "supply" of an offense is determined by the sanction and probability of conviction and the "demand" (D)is determined by the net social harm caused by the activities. Specifically, Becker considered the total gain to criminals, G, and the harm to society, H, as functions of the number of offenses, O, so that D(O) = H(O) - G(O). He assumed that D' = H' - G' > 0 so that net social harm would be increasing in the number of offenses. Thus, Becker's welfare calculus included social benefit to criminals. However, if we were to go by Becker's model, we must recognize that his differentiated equation effectively states that the social harm caused by crime would always outweigh the resulting social benefit, saying that H' - G' > 0. We can therefore conclude that based on Becker's model, and therefore based on current models of criminal activity, the socially efficient level of crime would be to have no crime at all. But what this model does not consider are the instances where crime may result in more social benefit than harm. This leads us to the question: are there certain instances where crime makes a society more socially efficient?

To answer this question, we must consider the fact that crime is a subjective word. Many things that were considered criminal at one point in history were eventually revised with an evolving understanding of morality and social structures. For example, LBGTQ rights. It took sustained efforts from this community of "criminals" to make society more socially efficient today. Certain things like murder and rape will likely always remain criminal offences, almost always reducing social efficiency. On the other hand, certain things that we consider criminal today may be considered entirely legal a few centuries of even decades from now. Our justice system is inevitably flawed and will likely never be perfect. For example, at one point in American history time slavery was considered legal, and at another alcohol was considered illegal. The concept of what is criminal and what is not is constantly evolving in accordance to our changing views on what is socially acceptable and what is not. In some cases, certain activities considered criminal will actually have social benefits that outweigh the social costs, essentially meaning they ought to be legal rather than illegal. In this instance, a certain level of crime would offer greater social efficiency than none.

Another factor in answering this question is how necessary is crime in bringing about social reform? On one hand, sometimes crime is indeed required to shake society to the core to trigger much needed social reform and conversations. Take the recent Black Lives Matter movements that all started with the unfortunate incident involving George Floyd. There are two ways to look at this incident. Firstly, a violent crime was committed by Derek Chauvin to spark this conflict. Without this violent example of the racial prejudice that still exists in the world today, perhaps the uproar against racism from society would not be as extreme and therefore leave the issue to be unaddressed. In this scenario, a violent crime committed with the wrong intentions provided evidence to the world that the world needed social reform. This crime has led to millions of people worldwide being exposed to the racial inequality that still exists in America today, leading to a worldwide campaign against this. Peaceful protests and millions of dollars of funds have been raised to correct this social injustice, and therefore providing greater social efficiency. Of course, social efficiency was lost in the crime of killing George Floyd itself, but a greater amount of social efficiency was gained from this incident through raising awareness for this movement throughout society. So therefore, the crime Derek Chauvin committed by murdering George Floyd may have provided society with a greater sum of utility, and therefore may have brought about greater social

efficiency, however strange that may sound. Secondly, certain crimes in protest of this racist behaviour have been carried out to the benefit of society. Without the looting and burning of buildings, however horrible and unjust these things are out of this context, perhaps this movement would have gotten a lot less publicity and therefore less support. In some cases, it was the shocking videos of burning buildings and riots which garnered the attention of more and more people, contributing to the support this movement has received. In this case, these crimes, although directly lowering social efficiency by a certain amount, have arguably indirectly raised social efficiency to a greater extent. Once again, in both instances a certain level of crime would offer greater social efficiency than none.

On the other hand, society does not always need criminals to remind itself of its responsibility to achieve the highest level of social efficiency. For example, the constitution of India states: "With evolving understanding of the societal fabric and newfound definitions of personal and collective freedoms and acceptance, laws and amendments to the constitution can be accepted." My point is a society's collective understanding of social efficiency, what is right and what is wrong, can influence the laws by themselves thanks to provisions like these. Crime and violence are not always needed to remind you when something is unjust. The LGBTQ+ community did not need to burn down buildings to legalize gay marriage in 37 states. The Civil Rights Movement, one of the most famous and successful examples of social reform, was carried out with the mindset "Violence is never the answer". Mahatma Gandhi, who led a social reform of arguably even greater magnitude, carried out his movement with the message "An eye for an eye only ends up making the whole world blind." In these cases, violence and crime was not necessary to carry out social reform on a massive scale. What this leaves us to determine is the optimal trade-off between reliance on crime to bring about societal change and having a strong enough societal structure to bring about this change without depending on crime.

In conclusion, the socially efficient level of crime cannot be attributed to a single number. As the criteria of criminal activity is constantly being adjusted and will continue to be in the future, so will the socially efficient level of crime. Ultimately, the socially efficient level of crime will be reliant on a combination of several factors: the socially efficient equilibrium of the marginal social cost victims and the public endure from crimes and the marginal social benefit criminals receive from committing crimes, and the socially efficient equilibrium of the level of crime and the net cost of reducing it. As the variables affecting these factors are constantly changing, so too is the socially efficient level of crime.

HERE AND THERE

Congratulations to Krish Nigam, *Moretons*, on his solutions to the very tough Student Problems in Mathematical Gazette which earned him 2nd prize. The Editor of the gazette commented on Krish's talent and perseverance.

OPINION

CORRESPONDENCE

DEAR SIRS,

Just before half-term, I had a strange encounter with a fellow Harrovian. I was en route back to my House, out and out knackered by the incessant trigonometry. As I was about to cross the street, a boy who was no taller than 5'6" and had a not-so-friendly attitude – presumably a Fifth Former – snatched

my hat which was atop my head. For all intents and purposes, he executed that rather deftly. He eventually gave the hat back to me and said apathetically, "You don't need to wear it." I looked at him in a complete state of confusion, but before I could give a proper response to such abrupt intervention, the intruder pulled off a Zinedine Zidane roulette turn and disappeared in the sea of Harrovians.

The correspondence, however, is not a whodunnit mystery, nor is it a criticism of the act of 'hat-snatching'. I have no intention of castigating the boy in question. In fact, this anecdote merely serves to foreshadow a severe issue that affects all of us, precisely a crisis that needs to be addressed as soon as possible, and that is the ostensible demise of the Harrow hat tradition.

Recently, there have been fewer hats visible on the High Street. It has become apparent that rather than wearing their hat, pupils are now more inclined to carry it between classes. I understand that sometimes hats might be a nuisance, for instance, it might mess up your delicately combed hair. At the same time, the hardened brim of the Harrow hat can just feel uncomfortable, such that having it on your head feels like someone grasping your skull. There are myriad reasons one can give for not wearing a hat, but I feel that this two are the prevailing ones.

Rules are nevertheless rules – and please do not pull a hackneyed "rules are meant to be broken" rebuttal on me, for we all know that, deep down, rules are called rules for a reason)and unless someone with a vehement loathing towards the Harrow hat instigates a revolution (which I sincerely hope there isn't), we are all expected and obliged to follow the rules. The School's Existing Customs states explicitly that 'Hats should be worn when going to and from lessons, Speech Room and Chapel, except after 4.15pm during the winter timetable and when the boys are walking to lunch.' Whether you like it or not, it goes without saying that the hat epitomises Harrow School. It symbolises the School's exceptional teaching ethos and the School's formidable reputation. In essence, Harrow will never be Harrow without its hat.

To have the opportunity to study at Harrow School is a privilege that not many can enjoy. Therefore, we Harrovians are obliged to cultivate a sense of pride and belonging and further the Harrow traditions so as to make sure that future generations can know about the excellence and prestige of this School.

> Wear your hats, JUSTIN CHAN, DRURIES

DEAR SIRS,

Composed, during my return cab journey from one of many dental appointments:

Many trees, all look the same. Which tree is my tree. So much grass, blade after blade. Which blades are my blades. Turns, so many twists and turns. Which twist and which turn is my twist and my turn. Road after road, all drive the same. Which road is my road. Lost, I am lost, no recognition. Hope this lost, is not my lost. Taxis, so many taxis, this car is not my car. Which car is my car. Human driving, not my human, So many humans all look the same. Which human is my human. Teeth, so many teeth, these teeth are not my teeth. These teeth are my teeth now.

Your sincerely, NEIL PORTER 931

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Ways to contact *The Harrovian* Articles, opinions and letters are always appreciated. Email the Master-in-Charge <u>smk@harrowschool.org.uk</u> Read the latest issues of The Harrovian online at <u>harrowschool.org.uk/Harrovian</u>

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