WEMBLEY HIGH TECHNOLOGY COLLEGE

Newsletter

Spring 1 - 2026

A CELEBRATION OF STUDENT WORK

CEO's Message

Dear Parents and Carers,

This term has been defined by extraordinary opportunities and inspiring achievements across our whole community at Wembley High Technology College. It is a very proud moment when sharing these magical opportunities that have been created and delivered to all of our school community.

Our students have developed confidence and courage through Public Speaking, Debating and the Spelling Bee, while we were proud to host our IB Verification Visit earlier this half term, showcasing the strength of our provision. We also completed a full audit of our Inclusion Quality Mark Centre of Excellence, affirming our deep commitment to inclusive practice. Our House charity work demonstrated compassion in action, with students bringing food to support the local food bank.

Subject enrichment has flourished, from the vibrant Spanish Culture Club to the creativity of Choir and Guitar Club, including participation in the Brent Big Sing event. Students have also represented us with pride at the Pentathlon Event, embraced the transformative residential trip to Jamie's Farm, and benefited from the exceptional visit of the Confucius Institute. Together, these experiences reflect a school community rich in opportunity, character and excellence.

Thank you for your continued support in ensuring that we continue to deliver our mission statement of '*Achievement for All, One Child at a Time*'.

Beth Ragheb
CEO

Headteacher's Message

Dear Parents and Carers

What an extraordinary half term it has been at WHTC.

When we look back at the past six weeks, the scale and quality of what our community has achieved is truly remarkable. We welcomed an **IQM Centre of Excellence visit**, hosted **Assessment Week 3**, held **two Parents' Evenings**, successfully navigated our **IB Final Verification Visit**, and enjoyed a stunning **Confucius Institute** cultural performance that reminded us of the richness and global outlook that defines our school. These milestones reflect not only academic rigour, but also the strength of partnership between staff, students and parents.

Alongside this, students experienced the transformative power of **Jamie's Farm**, took to the stage in our inspiring House Drama event, and lifted the roof with **The Big Sing**. These are the moments that shape character, confidence and belonging. They are the experiences that help our young people grow in courage and self-belief, and the memories they will carry with them long after they leave WHTC.

As we look ahead to Spring 2, our focus sharpens. This is a critical phase for our examination cohorts. It is now about going pedal to the metal - leaving nothing in the tank. Every intervention, every lesson and every conversation will matter as we prepare students for the summer ahead. We do so with precision, urgency and absolute belief in their potential. Our students deserve our very best, and together we will ensure they receive it.

The House competition remains fiercely contested as we reach the halfway point of the year. Current standings are: Confucius leading on 148 points; Leonardo and Al-Khwarizmi tied on 121; Boudicca close behind on 120; Aryabhata on 103; Hypatia on 102; and Angelou on 99. With margins this tight, there is still everything to play for. The energy, pride and participation across the Houses continue to be a real strength of our culture.

Thank you, as always, for your continued support and partnership. I wish all our families a restful and restorative half term.

Tom Best
Headteacher

Wembley Multi-Academy Trust
ACHIEVEMENT FOR ALL

House Events Round-Up

What a half term it has been for House Events!

We began with House Spelling Bee for Years 7 and 8, followed by House Debating with Sixth Form, then House Public Speaking by Years 9 to 11.

Not content with those events, we rounded off the half term with our House Foodbank Collection, collecting an amazing 213 items of food and drink, followed by House Drama Competition in the final week of half term.

Our House system has something for all students - please encourage your child to get involved if they haven't already.

House Public Speaking

The next round of the House Cup took place this term.

This time, Years 9, 10, and 11 were pitted against each other in House Public Speaking. Pupils were tasked with delivering a speech arguing that something of their choosing should be "banished" to Room 101 forever. The proposed banishments ranged greatly from alarm clocks and holiday homework on one end, all the way to animal testing and even humanity itself on the other. Corruption was also a particular highlight.

All pupils spoke very well, using a range of rhetorical devices to argue their points persuasively.

In the end there was a clear winner in **Aryabhata** with three excellent speeches from Mikolaj, Sahaana and Fabergé. **Confucius** and **Hypatia** brought up 2nd and 3rd respectively.

Mr Lowthian

House Debating for KS5

The House Debating competition saw two teams of Sixth Form students go head-to-head in a thought-provoking debate on the motion *"Social media does more harm than good."*

Both groups presented well-structured arguments, demonstrating strong critical thinking, confident public speaking and the ability to respond effectively to opposing viewpoints.

Although it is a topic with a seemingly obvious answer, our brilliant students came up with some excellent rebuttals including the thought that, if social media is so bad, why is it one of the first aspects in our society that is suppressed and censored in countries with weaker democracies? What would we have done without social media during the COVID pandemic?

The debate was closely contested, with students engaging thoughtfully with the complexities of the topic and delivering persuasive contributions throughout. After careful consideration, **Leonardo House, Confucius House**, and **Hypatia House** emerged as the top-performing Houses.

Special mention must go to **Benice** from **Leonardo House** and **Vrinda** from **Hypatia House**, whose stand-out performances impressed both the audience and judges with their clarity, confidence and depth of insight.

A huge thank you goes to our wonderful judges, **Ms Allen** and **Mr Garden from the RS team**, for giving their time, expertise, and sound judgement, which helped make the event such a success.

House Spelling Bee for KS3

The Years 7 and 8 House Spelling Bee was a lively and competitive event, bringing together students from all Houses to test their spelling skills. The competition began with accessible vocabulary to build confidence, followed by mixed levels of difficulty as the rounds progressed. As words became more complex, students demonstrated impressive focus, resilience and a strong command of language.

Representatives from different Houses rose to the challenge, spelling accurately under pressure and cheering each other on in true House spirit. After an exciting final round, **Aryabhata House** claimed first place, followed closely by **Confucius House** in second and **Boudicca House** in third. Congratulations to all participants for their enthusiasm and effort in making the Spelling Bee such a successful and enjoyable event.

Calendar

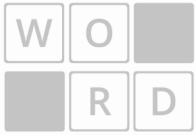
Uncharacteristically

Onomatopoeia

Bureaucracy

Business

Separate



House Charity: House Foodbank Collection

WHTC has spent the last two weeks collecting items for our charity Foodbank collection, with each House collecting a specific item:

Hypatia	Tinned tomatoes
Al-Khwarizmi	Long-life milk
Leonardo	Tinned veg / beans
Angelou	Rice
Boudicca	Long-life juice
Aryabhata	Multipacks of crisps
Confucius	Pasta / noodles

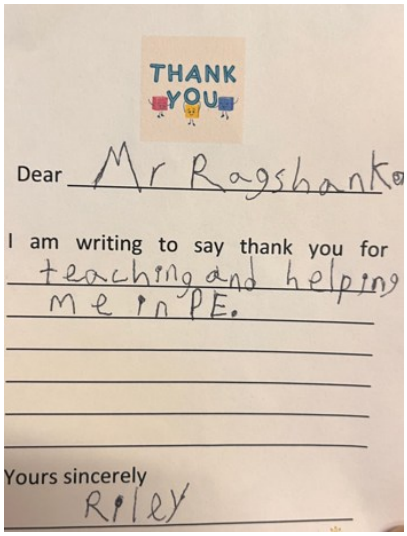
We are so grateful to parents and carers for their support for this collection – we were overwhelmed with the items collected, supporting our school value of 'Helping Others'.

We filled a whole room with our collection of items from Brent Foodbank's Shopping List of most-needed items - a significant contribution to help those in need in our local community.

Thank You Cards for Staff

The week beginning 2nd February, our school's focus was Well-being and in form time and in assembly, our Year 7 and Year 8 wrote thank you cards to staff they are grateful to, while in Tutor Time students read examples of what our staff are grateful for.

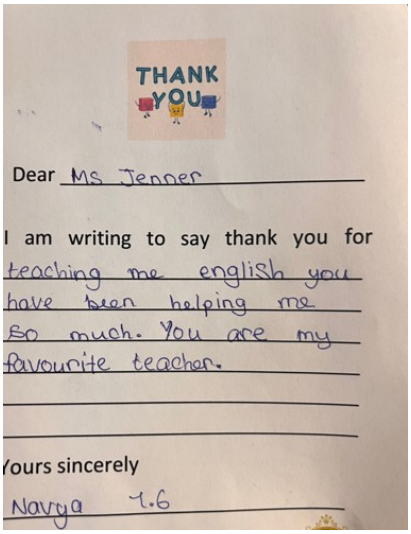
Here are some lovely examples of our students' thoughtfulness:


THANK YOU

Dear Mr Ragshank

I am writing to say thank you for teaching and helping me in PE.

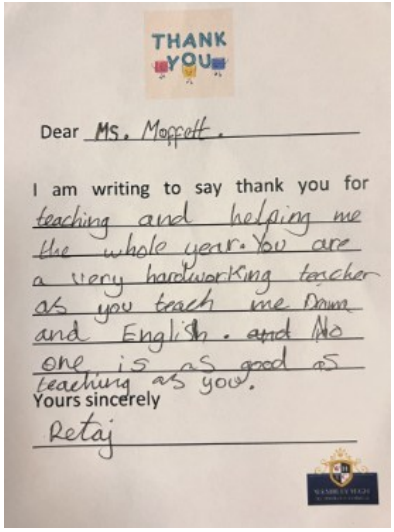
Yours sincerely
Riley


THANK YOU

Dear Ms Jenner

I am writing to say thank you for teaching me english you have been helping me so much. You are my favourite teacher.

Yours sincerely
Navya 7.6


THANK YOU

Dear Ms. Moffett.

I am writing to say thank you for teaching and helping me the whole year. You are a very hardworking teacher as you teach me Drama and English. and No one is as good as teaching as you.

Yours sincerely
Retaj

Spanish Cultural Club

Just before we broke up for the holiday, the Spanish Cultural Club were busy getting creative in the kitchen with Ms Romero and Ms El Kharroubi!

Most recently, they have been playing games in Spanish.

In Spanish, students have been developing their writing skills ahead of the next assessment, responding to feedback.

Spanish

En mi opinión, deberías visitar el prado y sacar fotos del palacio de cristal porque son muy bonitos. Además, hay que comer en el mercado san miguel porque es muy delicioso. Sin embargo no es posible ir de paseo y ir de compras en Gran Vía porque hay muchas personas y es muy caro.

Jueves cinco de febrero.

~~Where you live~~

1. El banco - The bank
2. El bosque - The forest
3. El museo - The museum
4. La iglesia - The church
5. El castillo - The castle
6. El mercado - The market
7. La mezquita - The mosque
8. La fábricas - The factories
9. Las tiendas - The shops
10. El puerto - The ports
11. Las montañas - The mountains
12. Los campos - The fields / countryside

To memorise

1. There is - Hay
2. City - Ciudad
3. Town - Pueblo
4. Neighbourhood - barrio
5. Outskirts - afueras
6. Village - aldea

Short Descriptions:

1. En mi pueblo hay una iglesia.
2. El museo es bastante grande.
3. En mi barrio, hay cinco tiendas.
4. Las montañas son bonitas.
5. Hay un mercado pequeño en la aldea.

Jdyn (Year 11)

Para el futuro, me interesaría vivir en Nueva York y conocer a muchas personas en la ciudad. Si pudiera, me encantaría dominar un idioma y viajar el mundo dado que sería genial. También, me gustaría conseguir un título y después, empezar mi propia carrera para ayudar a los niños sin casa y comida. Para tener éxito, me interesaría ganar mucho dinero y donar ese dinero a las organizaciones benéficas y mejorar el mundo.

Las ventajas de mi barrio son que hay muchos espacios verdes donde se puede pasar tiempo y mis amigos viven al lado de mi casa, así que vamos al cine todo el tiempo. Las desventajas son que hay mucho ruido y los vecinos son maleducados. Prefiero viajar al extranjero y visitar a mi hermana en Madrid.

Me encanta Shakira porque es graciosa y simpática también. Es importante ganar mucho dinero y tener éxito en la vida así que donaré dinero a las organizaciones benéficas y ayudaré a los niños sin casa y comida.

Excellent piece of writing!

→ Cuando tenga quince años, me encantaría ir al extranjero con mis hermanas porque sería increíble. Si pudiera, disfrutaría de alojarme en un hotel de cinco estrellas y tomar el sol todos los días porque me permitiría relajarme. Por la mañana, me gustaría comer un pastel para mis cumpleaños en la habitación dado que sería genial. Me interesaría comer un helado en un restaurante después de almorzar con mis hermanas ya que sería agradable. ¡Qué bueno!

¡Perfecto!

AW! Feedback - writing paper — Miércoles tres de diciembre

1. quite expensive = bastante caro ✓
2. a little bit boring = un poco aburrido ✓
3. too slow = demasiado lento ✓
4. faster = rapidamente / más rápido ✓
5. very pretty = muy bonita ✓
6. a lot of noise = mucho ruido ✓
7. too much food = demasiada comida ✓

Review 3

Word order

In Spanish, there is no possessive -'s. When translating these phrases, you must change the word order in the sentence.

Example 1: I am going to go to **my aunt's house**.
Voy a ir a **la casa de mi tía**.

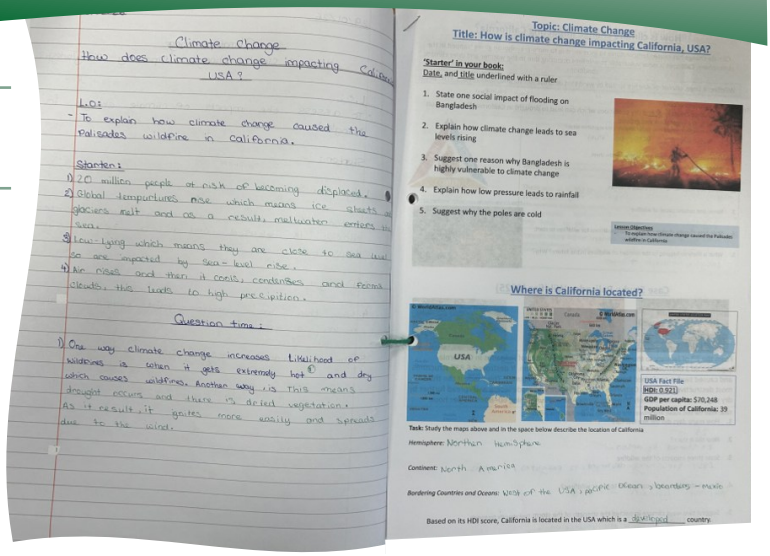
Example 2: **My teacher's lessons** are boring.
Las clases de mi profesor son aburridas.

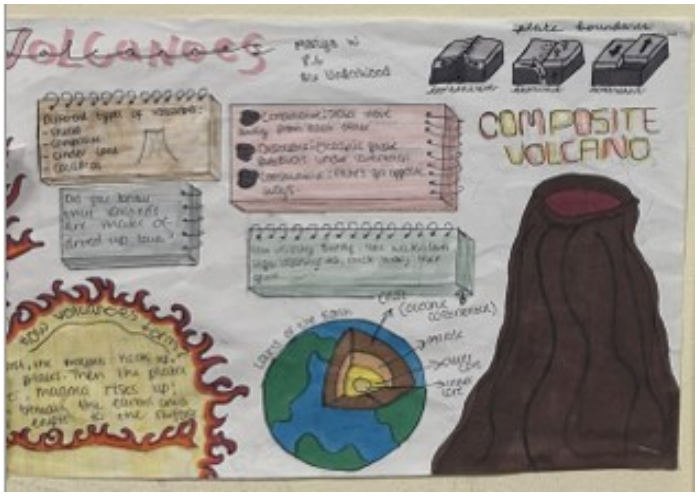
Dia (Year 11)

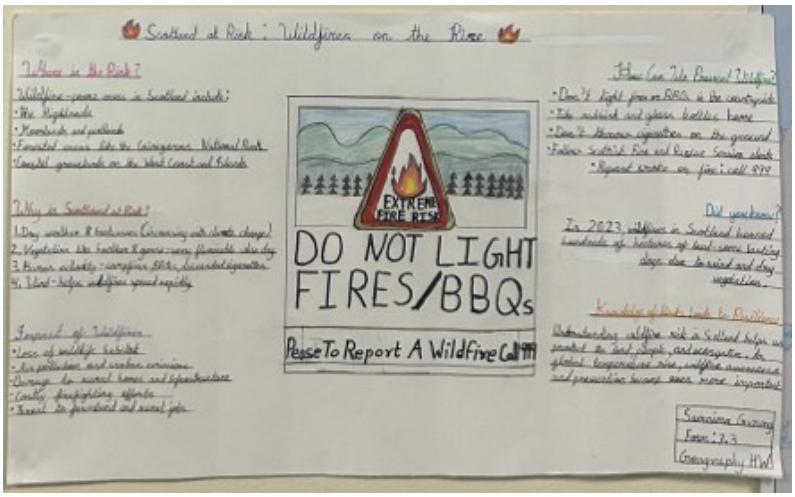
Geography

Our Year 7 Geographers are looking at climate change, its impacts and how different groups are responding to it.

Here is our lesson on the California wildfires that occurred last year and how they link to climate change.



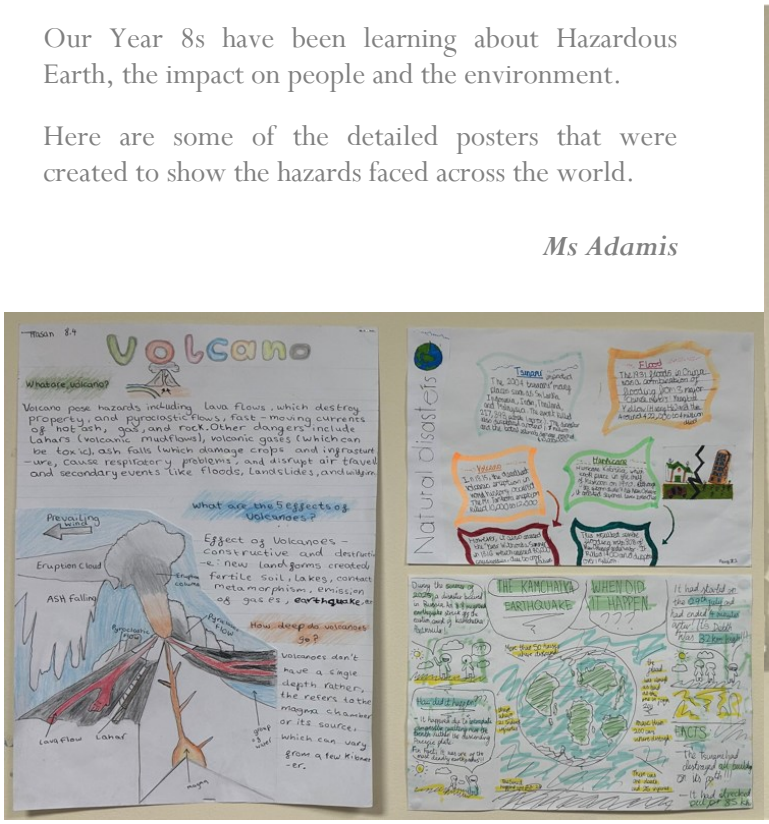


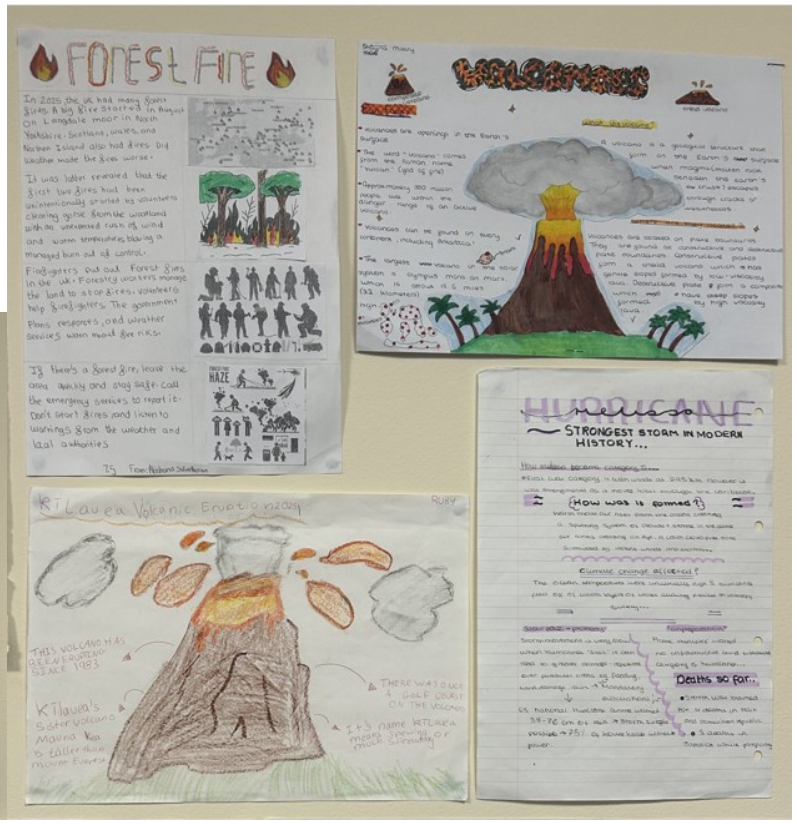


Our Year 8s have been learning about Hazardous Earth, the impact on people and the environment.

Here are some of the detailed posters that were created to show the hazards faced across the world.

Ms Adamis

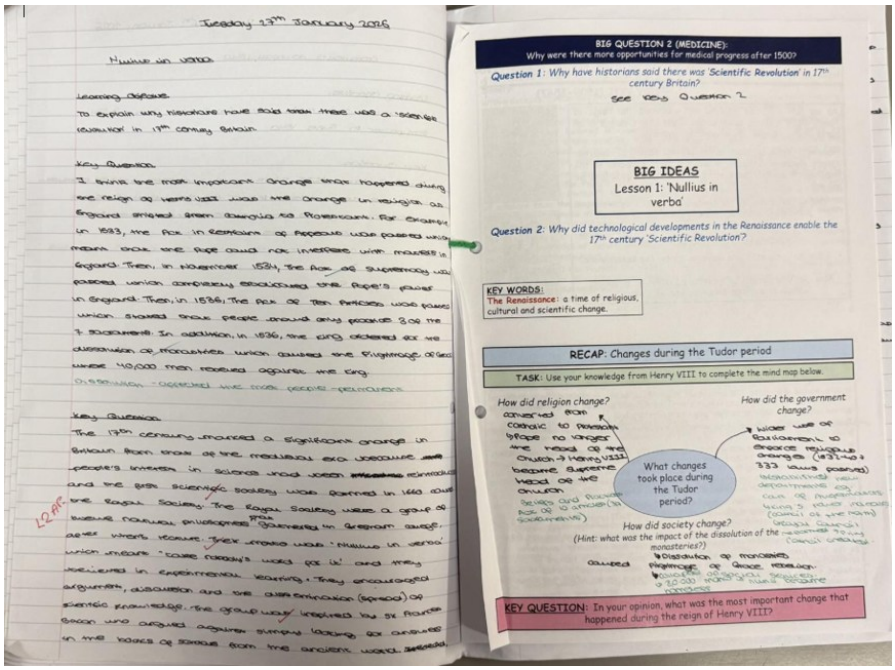


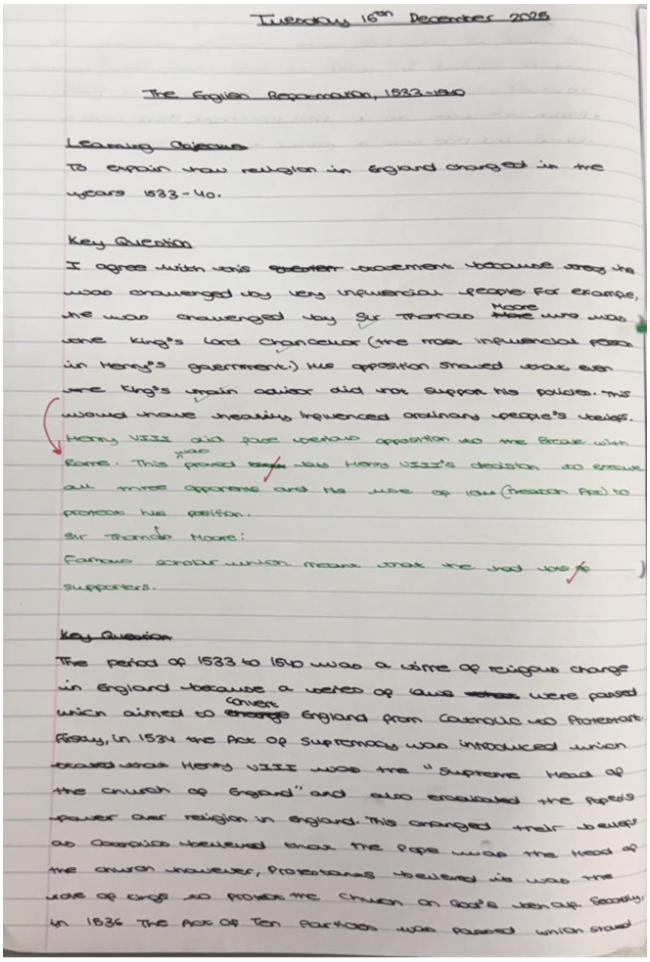


History

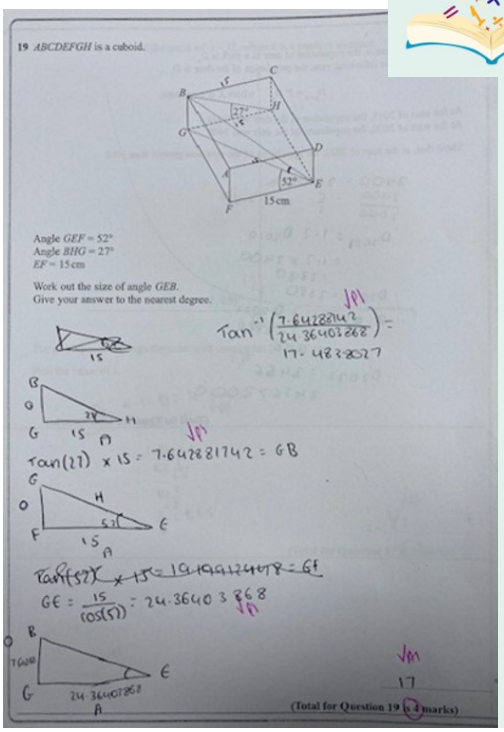
We would like to celebrate the work of **Aarna T. in 9.3**.
Aarna's engagement with independent practice in lessons demonstrates her strong understanding of the subject and her ability to engage confidently with wider disciplinary questions. She responds thoughtfully to feedback and consistently strives to refine the quality of her written work.

Mr Pratt





Maths

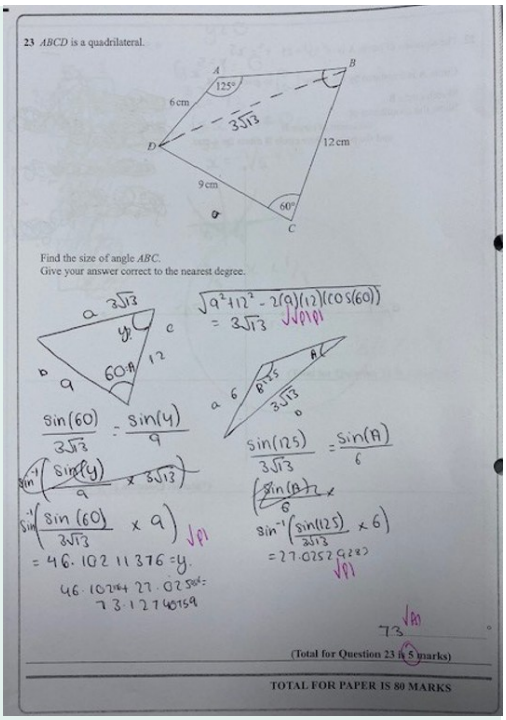


We would like to celebrate the work of **Sanchi J**.

Sanchi's mock was completed at the start of the half term. She is in 9Ma1 and is preparing to sit her GCSE at the end of the academic year.

Here we can see that Sanchi has very clearly and accurately showed her working out to answer these questions.

We have practised these individual skills in trigonometry such as use of sohcahtoa, sine and cosine rule in class. Sanchi has then been able to combine these skills together to answer multi-step problems. She labels her work clearly and shows all steps making it very easy to follow.



It has been impressive seeing how much 9Ma1 has learnt in such a short space of time and how they have been able make progress in each mock they have done this half term.

Arabic Club

During Spring 1, Arabic Club was full of exciting, hands-on learning and joyful moments.

Students learned how to describe fruits and vegetables in Arabic through a fun classroom experiment. Everyone brought in their own fruit and took turns describing it in front of the class, using new vocabulary for colour, size, and taste.

This activity helped students build confidence in speaking Arabic while making learning interactive and memorable.

Students also learned the days of the week in Arabic through a lively song. Singing together made pronunciation easier and helped everyone remember the words while enjoying the rhythm and teamwork. The classroom was filled with energy, laughter, and enthusiastic voices.

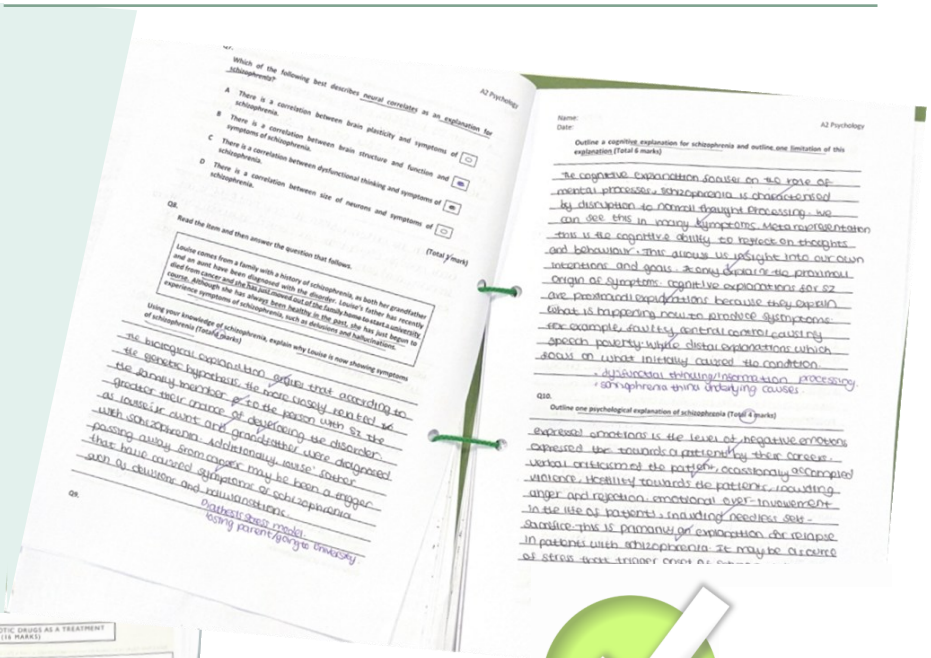
Spring 1 was a fantastic term for building language skills, confidence, and a love for learning Arabic - and the club can't wait to continue the journey!

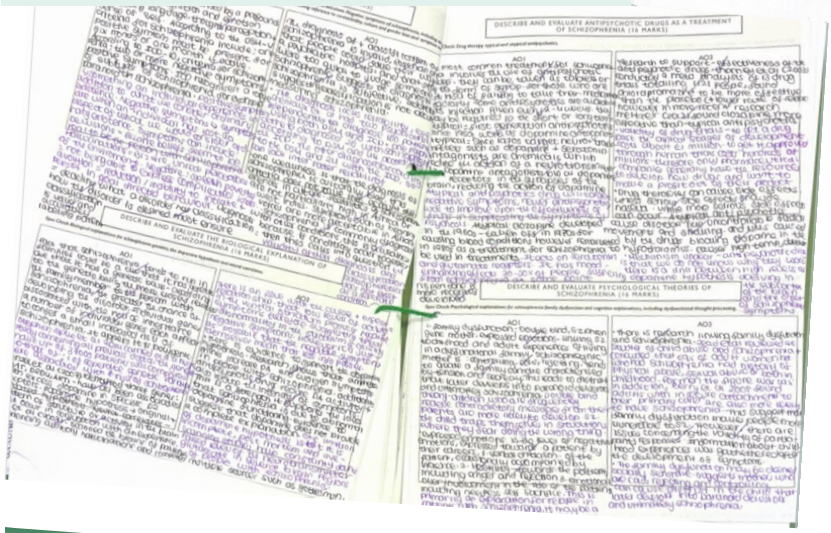
Psychology

Year 13 Psychology students have begun their revision in preparation for the summer examinations.

The images below illustrate the high level of diligence demonstrated through their homework, which comprises an essay planning pack and examination-style questions.

Students are also actively engaging in retrieval practice to consolidate their understanding and strengthen long-term memory.





Well done in particular **Diya** for her fantastic revision seen here.

Sociology

Well done to the five Year 13 sociology students who submitted an essay to the British Sociological Association as part of the essay writing competition.

Students explored the theme; '*What are the most significant social challenges facing your generation?*'

Students conducted independent research to write a university style essay by exploring themes beyond the A level sociology curriculum.

Good luck to all who have taken part!

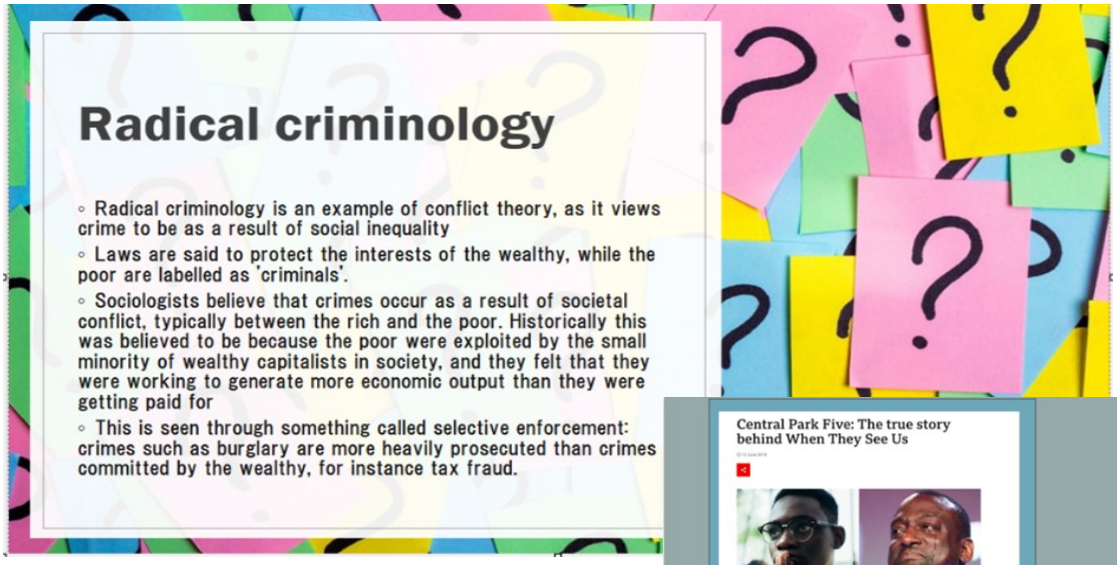
What are the most significant social challenges facing your generation?

The increasing dependency on social media is one of the most complex challenges that this generation faces and, by extension, generations to come. Its complexity lies in the fact that social media cannot be ruled as inherently harmful or entirely helpful. Unlike something such as drugs, which society can easily categorise as illegal and damaging, yet both concepts share an addictive pull. Social media sits in a grey area, as it can connect, educate, and inspire, yet it also fuels comparison, distraction, and online hostility. These platforms evolve every day, creating algorithms that feed our entertainment and keep us scrolling endlessly, and as a result, we can often overlook not only the effects of these platforms but also how deeply we have come to depend on them. This essay will explore the most significant impacts of this dependency, including its influence on mental health, the rise of performative activism, and the way open discussion online can escalate into discriminatory attitudes.

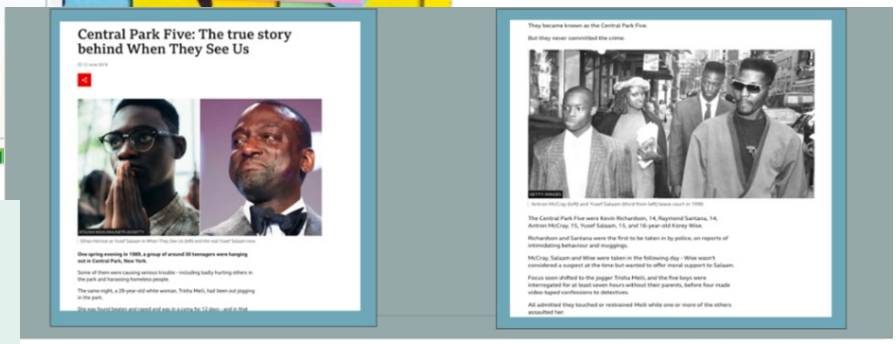
Exsiba (Year 13.6)

Man is by nature, a social animal." Aristotle wrote over two thousand years ago, yet in the twenty - first century, my generation finds itself lonelier than ever. Despite being surrounded by endless digital connection, socialising through posts & curated feeds, we have never been more connected - and yet never more alone. This paradox of modern loneliness has become a profound social challenge for my generation. It is visible in the rise in mental health struggles, in the decline in traditional communities, and in the replacement of genuine relationships with digital performance. To acknowledge this, is to confront the hidden cost of modern life; a society where connection has never been easier, but belonging has never been harder.

Kalyani (Year 13.7)



Well done to **Isra** and **Moxa** in Year 12 for creating and delivering an exceptional presentation on conflict theories and crime for the sociology society.



The students facilitated an engaging task whereby the society members applied what they had learnt about radical criminology to the case of the Central Park Five. This challenged the students to apply their understanding to a real life example.

READ THE FOLLOWING ARTICLE, AND IDENTIFY HOW THIS FITS CONVENTIONS OF CONFLICT THEORY AND RADICAL CRIMINOLOGY

Science - Our WonderLab Club

Ms Panchani

Lemon Volcano:
By mixing lemon juice with baking soda, students created a fizzing reaction similar to a volcano eruption.

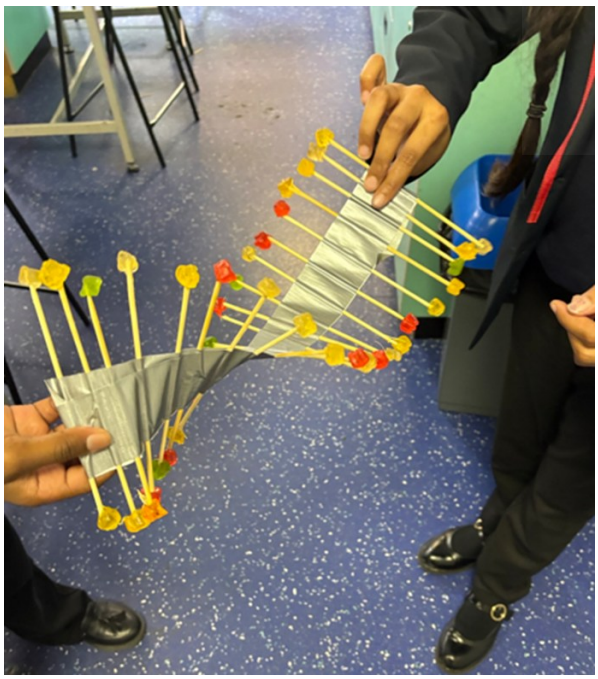
This showed how acids and bases react to produce gas.

Dancing Popcorn:
Students observed popcorn kernels "dance" as bubbles of gas attached and lifted them up before popping at the surface.

This experiment demonstrated how gas can cause movement.

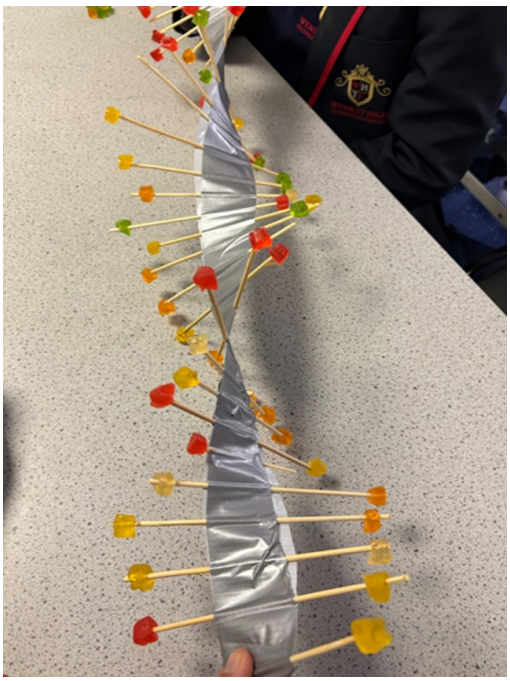
Fizzing Lava:
Students created a bubbling, lava-lamp effect using liquids and tablets.

This experiment demonstrated chemical reactions and differences in density.



Gummy Wave:
Students added sweets to the ends of skewers and moved them to model how a wave travels.

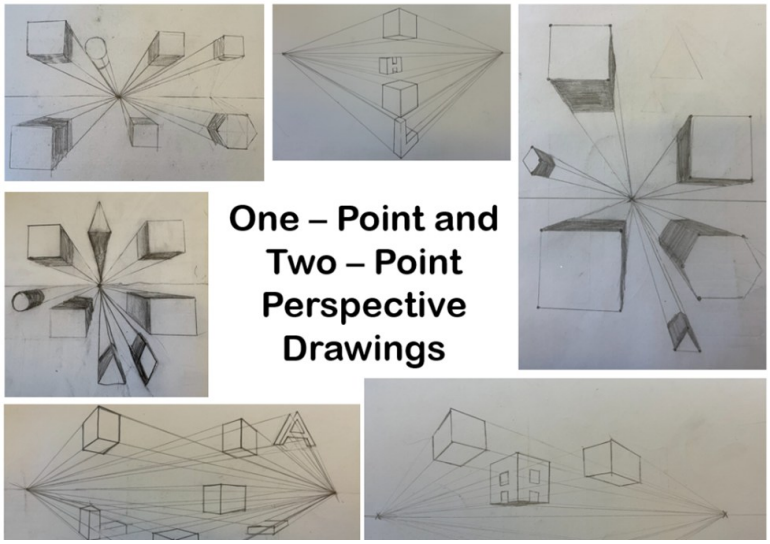
The experiment showed that energy moves through a wave while the objects stay in place.



A CELEBRATION OF STUDENT WORK

Art

Year 7 have been working hard on their Tiny House project, developing their technical drawing skills and demonstrating their understanding of one and two-point perspective.

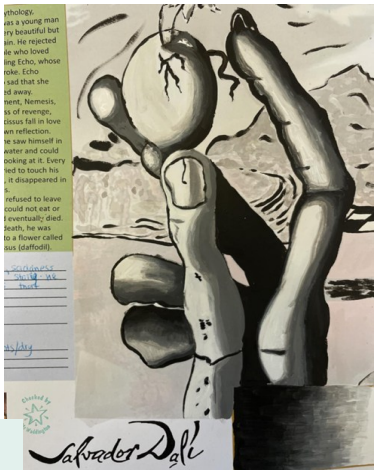


Dhriya's task was to create an advertisement for her funny ugly monster.
She has shown great attention to detail and takes so much care and pride in her work! Dhriya always goes the extra mile

Dhriya (8.2)

Emily's acrylic painting uses strong tonal contrast and expressive, surreal imagery to reinterpret Greek mythology in a bold, confident way that immediately draws the viewer in. Well done, Emily.

Emily (9.5)



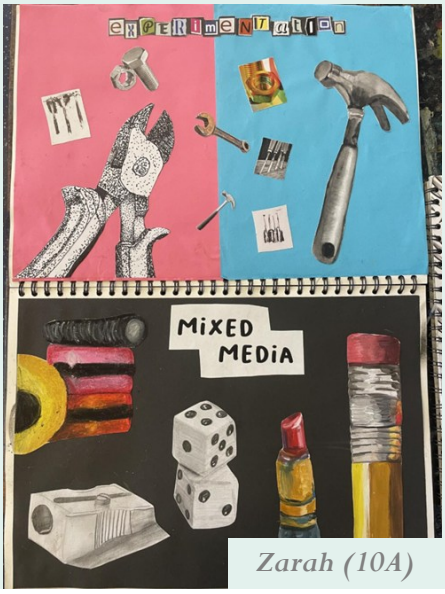
Year 11 Photos of the Week:

11PT2 have made a promising start to their exam project, producing highly developed outcomes based artists who explore the theme 'Reflection' and 'Nature'.

Mr Waddington

Zarah has made a fantastic start to GCSE Art and Design. She is developing her technical skills well and always comes to lesson with a positive attitude, reflected in the impressive outcomes she is producing.

Keep up the great work, Zarah.



Zarah (10A)

Drama

This term in Drama, Year 7 students have been exploring process drama through an imaginative unit called A Night at the Museum.

Process drama is a collaborative form of drama where students explore ideas, stories, and situations through improvisation and role-play rather than working toward a final performance. It encourages creativity, empathy, and problem-solving as students learn by doing and reflecting together.

Students have brought museum exhibits to life by creating characters in tableaux, using body language, facial expression, and levels to tell a group improvised story.

Students are seen here in still exhibition form! We then brought the characters to life through four weeks of scene work, unpicking how characters evolve in storytelling.

Through collaboration and creative problem-solving, students have been developing confidence, focus, and expressive performance skills while discovering how characters can communicate powerful ideas.

Ms Noble

Daniyal and Prajwal

Computer Science

Students have been learning to code in Python using **Python Turtle**, a visual programming tool that works like a giant coordinate grid. By directing their turtle to move, turn, and draw, students create shapes and images on the screen. This activity helps develop computational thinking, as students break complex images down into simple shapes and precise steps. Along the way, they use commands such as '*pen up*', '*pen down*', and '*go to*' to control their turtle's movement and bring their ideas to life.

```
for i in range(50):
  t.circle(75)
  t.left(10)
t.color("purple")
for i in range(50):
  t.circle(50)
  t.left(10)
t.color("green")
for i in range(50):
  t.circle(40)
  t.left(10)
t.color("yellow")
for i in range(50):
  t.circle(30)
  t.left(10)
t.color("orange")
for i in range(50):
  t.circle(25)
  t.left(10)
t.color("orange")
for i in range(50):
  t.circle(200000000000)
  t.left(10)
t.color("blue")
for i in range(50):
  t.circle(200000000000)
  t.left(8)

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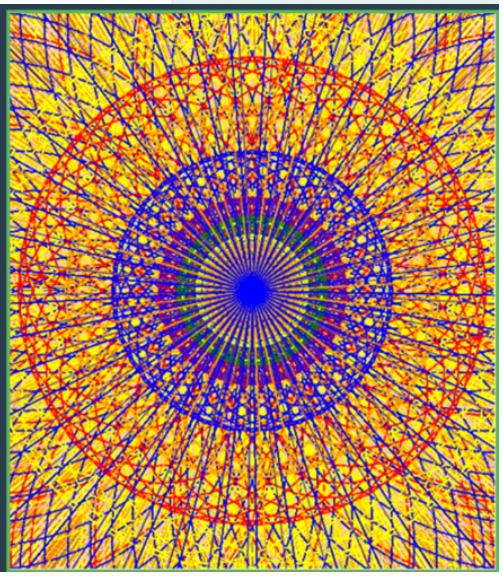


This activity helps develop computational thinking, as students break complex images down into simple shapes and precise steps. Along the way, they use commands such as pen up, pen down, and go to to control their turtle's movement and bring their ideas to life.

What have students been doing in Choir

Choir this half-term has been all about learning the classics!

Students have been learning music by Adele and Elton John, as well as working on singing in harmony and having several opportunities to solo/duet during pieces.

We look forward to growing our repertoire and hopefully performing for others by the end of half term 4.

Ms. Traynor

Music Production Club

In Music Production club, I get to use Logic Pro and a MIDI keyboard to build my own tracks from scratch. I love that I can make a single keyboard sound like any instrument, which makes arranging my own music way more fun. It's definitely my favourite way to be creative with technology after school.

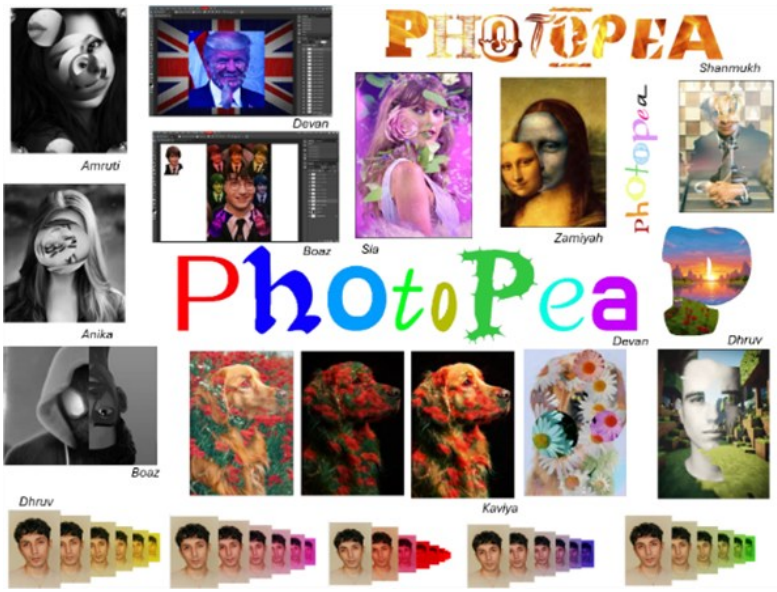
Matilda (Year 9)

The Guitar Club

Guitar Club has been going strong in Spring 1!
Our members have been practising everything from maintaining correct posture and hand positions to playing chords to practicing strumming patterns - we have now learnt four chords (E minor, G, D and A) and are on track to using them to learn our first song: *Wonderwall* by Oasis!
Most of our members are complete beginners however the progress has been incredible to witness, especially with some students who only joined us in January.

Three of our members, Krishi, Kashvi and Dhruvi, got to perform with the Rock Band at the Christmas Showcase and the Guitar Club as a whole will be seizing the next opportunity to perform live.

Mr Pillai



Photopea Club

In Photopea Club, students explored a range of keyboard shortcuts and tools to work more efficiently while editing images.

Each week they focused on a different skill, such as adjusting images, cutting out subjects, and creating overlays.

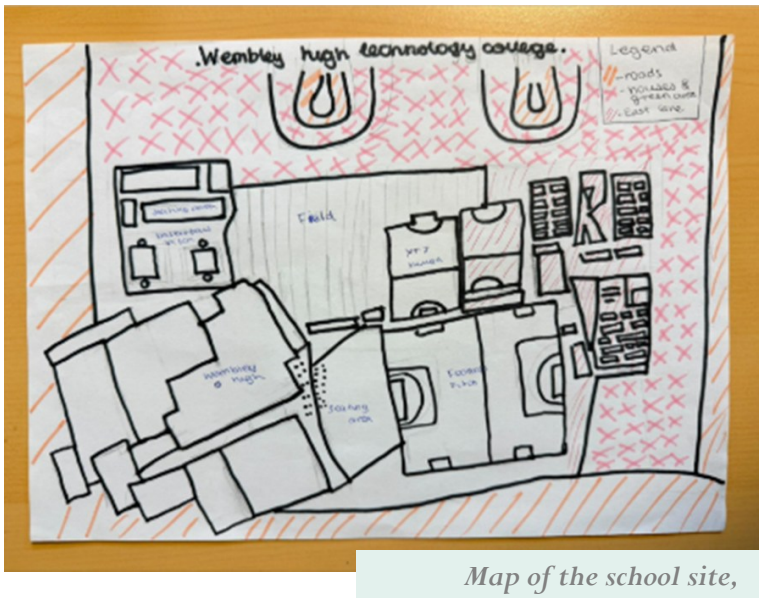
Through these weekly edits, students built confidence using Photopea and developed their creative digital editing skills.

Ms Hussiani

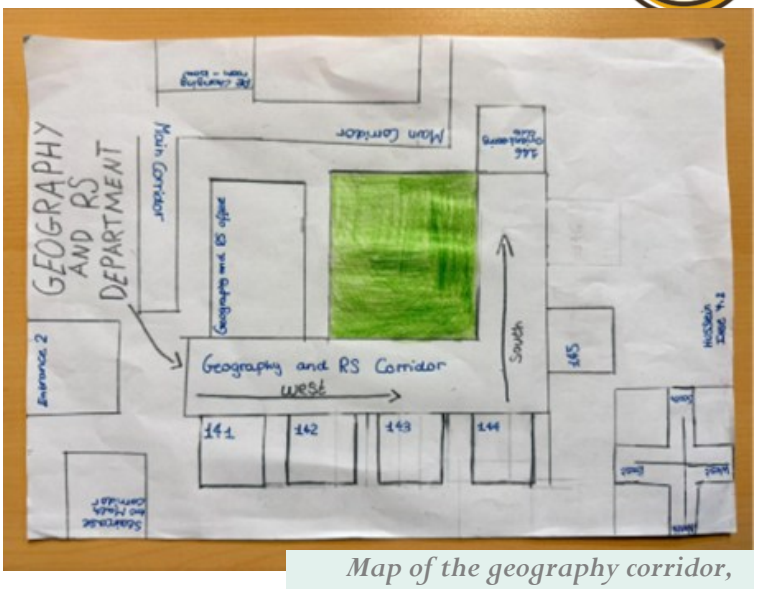
We've been learning all about maps this half term in Orienteering Club, and the students were tasked with making their own maps of familiar school sites. Here are some wonderful examples of the maps that students in Year 7 and Year 8 have made.

Mr Underwood

Orienteering Club



Map of the school site, made by Zamiyah in Year 8



Map of the geography corridor, made by Hussein in Year 7

At Chess Club this week, three of our Year 8 players Vinayaka, Megh, and Prajwal played some excellent matches while testing a new challenge format.

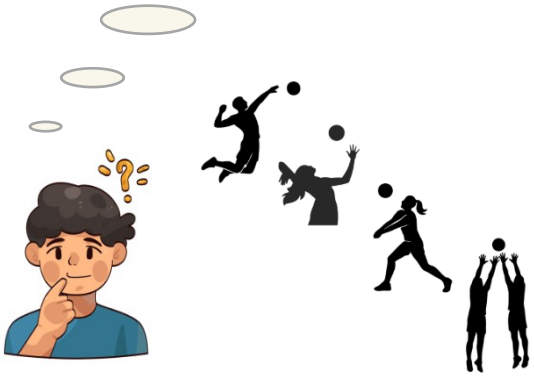
Chess Club

They have been experimenting with our chess clock by giving one player 10 minutes and the other just 5. This format encourages players to think carefully about how they use their time, stay calm under pressure, and make good decisions even when the clock is against them. It also helps them reflect on planning, patience, and learning from mistakes.

Overall, it was a strong example of the enthusiasm and effort Vinayaka, Megh and Prajwal bring to chess club. Their willingness to try new formats and challenge themselves is already helping them develop as players, and it was good to see that progress in action.

Physical Education

Have you ever wondered what techniques you need to develop for volleyball?



Volleyball looks easy, but takes practice and skill:

- **Passing (Bump)** – Using your forearms to receive serves or attacks. This is the backbone of good volleyball.
- **Setting** – Using your fingertips to place the ball accurately for an attacker.
- **Serving** – Starting the rally. Common types:
  - Underhand
  - Overhand
  - Float serve
  - Jump serve (more advanced)
- **Hitting / Spiking** – Jumping and striking the ball to score.
- **Blocking** – Jumping at the net to stop or deflect an opponent's attack.
- **Digging** – Defending against spikes or hard-driven balls.

Here, our students are modelling the skills of setting, serving and spiking: well done, girls!

Ms Degirmen

Middlesex Cross Country Championship

Our brilliant athletes Szymon, Fahad, Dahlia, Safi and Mahaveer all participated in the Middlesex Cross Country Championship – well done to these students for representing our school and coping with the inclement weather!

Panathlon Event

A group of WHTC students recently represented the school at the Panathlon event, achieving an excellent second place in the borough. The competition involved six different activities, with teams earning points for their school based on performance and teamwork.

Throughout the event, our students demonstrated outstanding cooperation, communication and determination, supporting one another and working together to maximise their scores in each activity.

3,928
SCHOOLS INVOLVED

Their positive attitude and commitment were clear in every challenge they took part in. This fantastic result is a credit to the students' teamwork and they should be extremely proud of their achievement and the way they represented the school.

74,383
TOTAL PARTICIPANTS

Year 7 boys vs Ark Academy and Claremont

The Year 7 football team recently completed their final fixtures of the season against Ark Academy and Claremont, putting in two competitive and spirited performances. Against Ark Academy, the team showed excellent character and determination.

After going 3-1 down, the group demonstrated outstanding teamwork and resilience to fight back and earn a well-deserved 3-3 draw. Their refusal to give up and commitment to working together was a real highlight of the match. In the second fixture against Claremont, the team were involved in another closely contested game. Despite a strong performance, they narrowly lost 3-2, with Claremont scoring with the last kick of the game. The effort and attitude shown throughout the match were commendable and reflected how much the team has developed over the season. With the season now complete, the Year 7s can be proud of their progress, effort, and sportsmanship. We look forward to seeing them build on this experience and achieve even more success next year.

Year 11 boys vs Ark Elvin and Ark Academy

The Year 11 football team put in a strong and disciplined performance against Ark Elvin, earning a well-fought 2-2 draw. The team showed good organisation and resilience throughout the match, competing well against tough opposition and finishing the game with a positive result to reflect their effort and commitment. The following week the group played Ark Academy where they ran out 4-2 winners. Excellent defending and goalkeeping kept us in the game during the first half before some impressive attacking displays earned Wembley 3 points.

Year 8 boys vs Newman CC

The Year 8 boys enjoyed an excellent performance against Newman Catholic College, securing an impressive 5-2 victory.

The team played with confidence and energy, showing good teamwork and attacking intent which led to a deserved win.

Brent Big Sing

On Tuesday, 3rd February, we had the amazing opportunity to take 30 students in Key Stage 3 to Brent Big Sing, an event facilitated by Brent Music Service at the North Brent School. Students had a blast learning songs in many different styles, including opera, pop, percussive, and cultural Punjabi and Hindi language music.

Year 9 student Fabergé's favourite part about the day was "how the staff were there to help and support us, and how their hospitality and friendliness helped us to improve on the pieces. I had lots of fun and learned how to add in actions and emotions when performing, which helps to direct emotion and intention to the audience."

We are proud of our growing group of enthusiastic singers for their energy, talent and bravery shown on the day, which culminated in a 4-school-wide sing-along! We look forward to continuing to involve students in music-related activities, including through choir, guitar club and rock band, next half term.

Ms. Traynor

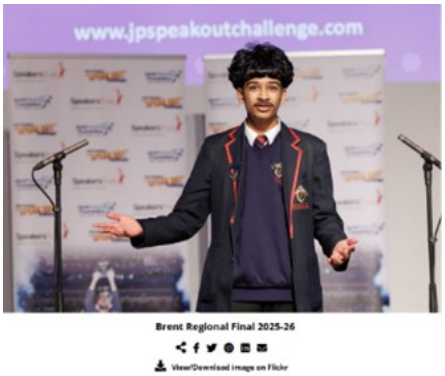
Jack Petchey Speak Out Regional Final

We are so proud of our students who represented our school at the Brent Jack Petchey Regional final on Thursday 22nd January, competing against the top public speakers from the borough: [Album Display - Jack Petchey's Speak Out Challenge.]

Students attended workshops run by public speaking experts before students delivered their speeches.

Well done to Aashi, Alok and Osis who took part.

Here is WHTC student Osis' account of the event:



When we arrived at Queens Park Community School, Aashi, Alok and I were led into a room filled with speakers from other schools, where we took part in a workshop run by the Jack Petchey public speaking instructors. We then paired up and practised our speeches, and we were also given the opportunity to rehearse on stage using the microphone, which definitely helped to calm our nerves. From around 6pm, our friends and family began to take their seats and the speeches started. I delivered my speech on challenging negative stereotypes of immigrants, while Alok spoke about the importance of embracing your identity. After the speeches, we were all awarded certificates and had our photographs taken with the Mayor of Brent. It was an unforgettable evening.

Visit to Jamie's Farm

[Jamie's Farm - Equipping young people to thrive - Home]

This half term a group of Year 9 and Year 10 pupils took part in a residential trip to Jamie's Farm, where they were fully immersed in farm life.

Pupils began each day early, taking responsibility for feeding animals including chickens, bulls and cows. They worked hard to build a new fence for the cattle and spent time working one-to-one with horses, developing trust, patience and confidence. The week was a significant challenge for many pupils, pushing them beyond their comfort zones both physically and emotionally. However, it proved to be an immensely rewarding experience, helping pupils to develop resilience, teamwork and self-belief.

The Jamie's Farm experience strongly reflects our school motto, '*Achievement for All*', by giving every pupil the opportunity to succeed, grow and discover their strengths in a supportive yet demanding environment. Thank you so much to all staff who supported with this, and especially Ms Blake, Mr Jones and Mr Hepburn.

Mr Jones

Pupils themselves reflected powerfully on the impact of the trip.

Jamie's Farm has been an amazing experience. I am very happy that school invited me to come, and it has made me realise I can push myself more than I thought before.

Thomas, Year 9

This trip taught me about hard work and the importance of respect and manners. Jamie's Farm was challenging but really fun.

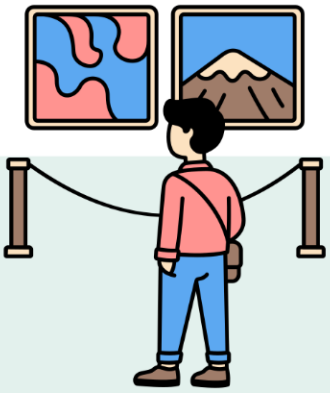
Adem, Year 10

This trip made me realise I can be more respectful, work hard, push myself and follow instructions first time. It was tough, but I really enjoyed it.

Shaniya, Year 10

Jamie's Farm showed me that I can push myself to my limit and still achieve. Overall, I really enjoyed it and would love to do it again in the future.

Roda, Year 10



The Year 13 trip to the National Portrait Gallery

The Year 13 trip to the National Portrait Gallery was a valuable and engaging experience.

Students explored a range of Tudor portraits spanning the reigns of Henry VII through to Elizabeth I, allowing them to visually contextualise key themes such as power, propaganda and changing royal image.

Our students also had the opportunity to enjoy a guided tour of 18th century portraiture and how art was used to reflect status and secure fame. Overall, the visit deepened students' understanding of how portraiture was used as a symbol of authority and legitimacy.

Trip to Oxford University by Year 11

On Monday 2nd February, 26 Year 11 pupils visited the dreaming spires of Oxford University for a day learning all about the University and its admissions process. They were treated to a tour of Magdalen College and its grounds by current students, deer park and all. The pupils got a taste of College life which even included a formal lunch served in Magdalen College hall.

Following this, the students were taken on a guided tour of the city featuring the Bodleian Library, the Radcliffe Camera and the Bridge of Sighs.

Finally, pupils were treated to a private talk given by an academic in the Natural History Museum on biology. Pupils were shown how to handle objects that ranged from elephant teeth to live cockroaches.

Our pupils were deeply impressed by the beauty of the city and the academic environment. Many pupils were inspired to apply in the future.

Mr Lowthian

Trip to Stamford Bridge Station for the Standing Together Programme

This half term, we were pleased to take part in the ***Standing Together*** programme delivered in partnership with the Chelsea Foundation.

The programme involved 25 Year 8 students and provided a valuable opportunity to explore key issues relating to equality, diversity and inclusion through a well-structured series of workshops and learning experiences.

The programme began with an immersion event at Stamford Bridge, followed by a series of in-school workshops delivered by the Chelsea Foundation in collaboration with specialist organisations including Kick It Out, ShoutOut UK, Stand Up Education, Be Lads and the Metropolitan Police.

Across these sessions, students engaged with themes such as anti-discrimination, anti-racism, misogyny, media literacy and positive behaviour, while being encouraged to think critically, challenge prejudice appropriately and make informed decisions.

The sessions were carefully planned and age-appropriate, allowing students to engage thoughtfully with complex and sensitive topics. Students responded positively throughout, demonstrating increased awareness and confidence when discussing issues of identity, respect and fairness. Those who participated, and who continue to participate, have shown a growing willingness to challenge discriminatory language and behaviour and to promote inclusion within the school community.

The follow-up workshops built effectively on the initial immersion experience, reinforcing key messages and supporting students to apply their learning in practical and meaningful ways both within school and beyond. We value our involvement in the *Standing Together* programme and are proud to work alongside the Chelsea Foundation in supporting a culture of respect and inclusion.

Dr Mahmood

'Outstanding' Standing Together programme returns | News | Official Site | Chelsea Football Club

When we were offered a visit by the Confucius Institute for performances and workshops, we jumped at the chance.

Our school has been working with the Confucius Institute for many years, so we were proud to be selected for this opportunity.

On Wednesday 4th February, our Years 7, 8 and 9 were treated to performances to celebrate Lunar New Year!

Visit from the Confucius Institute

In the afternoon, 80 of our Year 7 and Year 8 were selected to participate in four different workshops, including painting, martial arts, musical instruments and calligraphy.

Ms Feng, our Mandarin teacher here at WHTC, commented, 'Students showed great enthusiasm for the performances, and participation in the afternoon workshops was also very high.'

We are proud of how our students make the most of these opportunities, how they listened attentively, and got stuck into the activities in the afternoon.

A CELEBRATION OF STUDENT WORK

This edition of our newsletter is a celebration of student work, inspired by the magazine our PD Team has assembled of the best essays from our Year 12 in Personal Development lessons.

Each student in Year 12 carried out a research project based on a topic that interests them, linked to their future career. Guided step-by-step by their PD teachers, students researched, drafted and wrote up their projects, learning along the way how to research effectively and how to reference correctly - a skill that most students learn at university. Students also presented their findings to each other, developing their confidence and oracy. Topics include: Investigating How Behavioural Economics Principles Are Incorporated into Artificial Intelligence, How the concept of a "Straight Line" differs across Euclidean, Spherical, and Hyperbolic Geometries, and how this affects the angle sum of triangles in different spaces and The fundamental power of the relationship between History and Economics. - Abuse, Manipulation and Greed.

We think you will agree that the calibre is high for each research project - well done to all students, and especially those whose essays were chosen to be part of our magazine: Hetiv, Divya, Sam L, Nusaybah, Sepan, Christopher, Umaiza, Meryem, Sanjana, Miedhurshika, Vanshika, Sita, Nishana, Mubarak, Tia, Dia, Pranshu and Molly.

2025/26 Year 12 Research Projects Magazine

Students in Year 12 undertook a five-week independent research project on a topic of their choice, developing their skills in academic writing and the delivery of professional presentations to communicate their findings. To celebrate their hard work, this magazine showcases the top essays from each class.

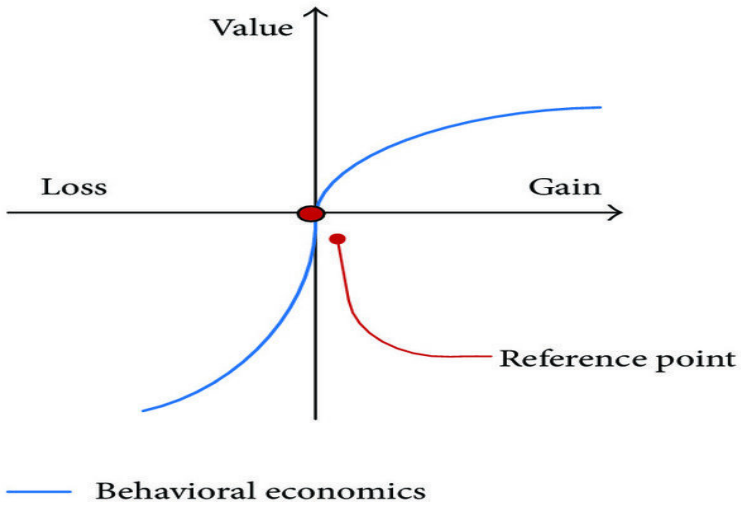
Contents

Investigating How Behavioural Economics Principles Are Incorporated into Artificial Intelligence

By Hetvi K 12.1

Artificial intelligence (AI) has become an integral part of everyday life. It influences everything from the news and product recommendations we see to the algorithms deciding on loans, scheduling medical appointments, and creating study plans. However, human decisions are not simply rational in calculations as traditional economics suggests. They are influenced by heuristics, biases, emotions, and context. Behavioural economics, which studies how people often deviate from rational decision-making, provides important insights for creating AI systems that can understand and influence human behaviour responsibly. This paper explores how principles from behavioural economics are being used in AI, covering the methods employed, various applications, benefits gained, ethical risks involved, and future research directions. The purpose is not just technical; it aims to bring a human perspective to the discussion, highlighting how design choices reflect values and impact people's experiences.

At its heart, behavioural economics reveals predictable ways that human decisions stray from ideal rationality. Prospect theory, created by Daniel Kahneman and Amos Tversky, demonstrates that people assess gains and losses unevenly, showing a tendency to avoid losses. Tversky and Kahneman also outlined cognitive shortcuts like anchoring, availability, and representativeness that can affect judgment. Richard Thaler and Cass Sunstein popularized the idea of choice architecture and nudges, which are design choices that make certain options more attractive or easier without removing personal freedom. These concepts are not just theories for engineers; they highlight the cognitive processes that AI systems need to interpret. When designed with intention, these concepts can help achieve better outcomes.



The existing incentive mechanisms of crowdsourcing construct the expected utility function based on the assumption of rational people in traditional economics. Many studies in behavioural economics have demonstrated the defects of the traditional utility function and introduced a new parameter called loss aversion coefficient to calculate individual utility when it suffers a loss

A direct way to integrate behavioural insights into AI is through feature engineering and model design. Machine learning models depend on how well they represent user behaviour. Including variables that capture behavioural tendencies—like features that indicate impulsive choices, responses to different phrasing, or reactions to social cues—models can better reflect real-world decision-making. More specifically, computational decision-making models from behavioural economics, such as utility functions based on prospect theory, can be incorporated into predictive systems. For example, financial robo-advisors can use loss-aversion parameters to adjust risk communication and portfolio recommendations, thus helping clients stick to sound strategies during market dips.

Reinforcement learning (RL) is another key area in AI that offers rich opportunities. RL algorithms learn to maximize overall rewards, making them suitable for modelling and influencing behaviour. When human decisions diverge from maximizing rewards—such as choosing instant gratification over larger future gains—AI systems can adjust by changing reward signals or proposing commitment strategies. Human-in-the-loop RL approaches go further by incorporating human feedback into the environment, allowing systems to learn from both observed choices and expressed preferences. Inverse reinforcement learning (IRL) techniques can deduce underlying motivations from behaviours, revealing human drives that standard metrics might overlook. However, IRL assumes that observed behaviour provides useful insights and reflects stable preferences. Behavioural economics shows that this assumption is frequently incorrect, necessitating mixed methods that combine statistical learning with psychological insights.

Natural language processing (NLP) is a practical area where behavioural signals can be clearly identified. Language can express emotions, uncertainties, preferences, and attitudes toward risk. Conversational agents designed for healthcare, financial guidance, or education can analyse speech for emotional cues and respond in ways that respect individuals' mental states. For instance, a digital therapist might use gentle rephrasing to counter loss aversion when discussing health changes. Similarly, a budgeting chatbot could break long-term financial goals into smaller, emotionally relevant milestones to reduce impulsive decisions. It is crucial to apply behavioural insights through NLP with care—recognizing vulnerability creates ethical duties to protect privacy and avoid manipulation.

Choice architecture is a method of organizing decision contexts that connects behavioural economics with UI/UX design, allowing AI to scale and personalize. Simple adjustments to default settings, the arrangement of choices, or how information is presented can greatly influence behaviour. AI can customize these nudges in real-time by adapting defaults based on an individual's past decisions or cognitive biases. For example, health apps can time exercise reminders for when users are most receptive, while donation platforms can highlight options that relate to a donor's previous interests. However, personalization amplifies the impact: a helpful nudge for one person could feel manipulative to another, so it is crucial to ensure transparency about the nudges and provide users with real control.

Examples across different fields show both the benefits and risks of these approaches. In healthcare, AI using insights from behavioural economics can enhance medication adherence, boost appointment attendance, and encourage preventive care. Research on implementation intentions, which prompts people by specifying when, where, and how tasks will be done, has effectively increased vaccination rates and similar behaviours. AI systems can automatically create and schedule such prompts for individuals. In education, intelligent tutoring systems utilize strategies based on cognitive load theory and motivation research, helping to break down tasks and frame failures as opportunities for growth to lessen loss-averse reactions. In public policy, AI-driven "digital nudges" can simplify benefit applications and reduce bureaucratic hurdles, enhancing access to underserved communities.

However, commercial applications—especially in advertising and e-commerce—have embraced behavioural principles with varied results for society. Recommendation systems exploit social influence and scarcity tactics to increase sales. While these strategies can raise revenue, they might also promote impulsive behaviour. For example, Meta (Facebook) now uses conversational data from its Meta AI chatbot to personalize ads, combining AI-driven user modelling with behavioural-economics insights to target people based on their motivations and emotional cues. And Amazon similarly applies predictive algorithms grounded in behavioural principles—such as loss of aversion and social proof—to tailor product recommendations and nudge users toward quicker purchasing decisions.

Political microtargeting uses psychological insights to create compelling messages, sometimes worsening divisions. The same techniques that support responsible saving can also encourage addictive engagement with certain platforms. The double-edged nature of behavioural design in AI presents a significant ethical challenge that requires careful governance.

The ethical landscape involves several related issues: personal freedom, clarity, fairness, and privacy. Personal freedom is compromised when nudges operate secretly or apply pressure. Fairness can be undermined if behavioural models reinforce societal inequalities. For instance, algorithms trained on data from disadvantaged groups may mistake frequent short-term choices for true preference, rather than a reaction to limited options, thus perpetuating disadvantages in automated recommendations. Privacy issues increase when personalization is based on psychological profiling, as inferring traits like impulsivity from behaviour encroaches on personal identity and raises the stakes for data misuse.

To tackle these issues requires a blend of technical, organizational, and regulatory measures. On a technical level, research into explainable AI is vital; users should understand why a system recommends certain actions. Offering ways for users to contest or adjust nudges will restore their autonomy. Algorithm audits and fairness testing must be conducted to uncover any unequal impacts across different demographic and socioeconomic groups. At an organizational level, companies should integrate ethical practices into their design processes, bringing in behavioural scientists, ethicists, and affected communities early on. Regulators can support these efforts by setting limits on acceptable influence, mandating disclosures for specific types of psychological profiling, and ensuring the protection of sensitive behavioural data.

A critical issue remains on how to evaluate behavioural AI interventions objectively. Traditional metrics like click-through rates or conversions might not always capture the long-term benefits of such systems. Randomized controlled trials are still the best method for establishing causal relationships in social interventions and should be used more widely to assess AI-driven nudges. Incorporating qualitative research—such as interviews, ethnography, and participatory design—adds context to understanding user experiences. Furthermore, metrics should focus on long-term outcomes like sustained behavioural changes, indicators of well-being, and impacts on equity, instead of just short-term engagement.

Looking ahead, several areas of research are promising. One is to create hybrid models that merge behavioural theories with data-driven learning, using insights from psychology to guide and clarify statistical patterns. Another is cross-cultural behavioural modelling; much of the existing behavioural research comes from Western contexts, so AI systems should not assume findings apply universally without validation in various populations. Innovations in privacy-preserving techniques, like federated learning and differential privacy, can help customize nudges while minimizing centralized data profiling. Lastly, frameworks for collaborative education and governance are essential; developing human-centered AI that integrates behavioural economics must involve more than just technologists.

Humanizing technological progress involves acknowledging the values embedded in design choices. When AI encourages someone to exercise, it is not just optimizing outcomes; it is forming a relationship of influence. Designers and policymakers should approach AI's role in behaviours with care, questioning who benefits, how consent is achieved, and how potential harms are mitigated. Real-world applications should feature clear explanations, options to opt out, and ways to seek redress. People deserve systems that foster their well-being rather than exploit vulnerabilities for profit.

In summary, behavioural economics provides a vital set of tools for making AI systems better at predicting, persuading, and supporting human goals. Techniques vary from feature engineering and prospect-theory-inspired models to reinforcement learning with human input, as well as tailored choice architecture. Applications in healthcare, education, finance, and public policy show clear benefits, while commercial uses highlight the risks of manipulation and inequality. To harness the potential while minimizing harm will require thorough evaluation, robust safeguards, interdisciplinary collaboration, and ethical oversight. Incorporating behavioural economics into AI involves moral considerations as much as technical ones; the choices we embed in our systems will influence how people live, decide, and trust in the future.

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How the concept of a "Straight Line" differs across Euclidean, Spherical, and Hyperbolic Geometries, and how this affects the angle sum of triangles in different spaces

By Divya P 12.2

Geometry is a part of Maths that studies shapes, distances and the properties of space. In classical, flat geometry, developed by an ancient Greek mathematician Euclid, a straight line was defined as the shortest distance between two points and an object that lies evenly with the points on itself. This idea works in a flat two-dimensional plane where Euclid assumed his postulates were true.

However, not all spaces are flat. Some spaces can be curved which means that they might bend either inwards or outwards. When the plane of space is curved, Euclid's definition of a straight line doesn't apply in the same way and this causes different versions of geometry such as spherical or hyperbolic geometry, In these curved spaces, the equivalent of a straight line is called a geodesic, which means the straightest possible path within that particular surface.

Geodesics in spherical and hyperbolic geometry are very different from straight lines in Euclidean geometry, especially with shapes like triangles. This leads to my research question of how the concept of a straight line differs across Euclidean, Spherical and Hyperbolic geometry and how it affects the sum of angles in a triangle?

This essay argues that Euclidean triangles always have a sum of 180°, spherical triangles have angles with sums greater than 180° and hyperbolic triangles have sums less than 180°. All of these are due to the curvature of the space that they lie in.

In Euclidean geometry, there is no curvature of space. This is often called flat space. In Euclidean space, the parallel postulate says that through any point that is not on a given line, there is exactly one line which is parallel to the original. This assumption helps back many other geometric results, including the sum of all the angles in a triangle. The sum of the angles in a triangle in Euclidean geometry can be shown by imagining a triangle and drawing a line through one vertex of the triangle that is parallel to the opposite side. Due to Euclid's parallel postulate, this parallel line exists and behaves consistently. Both base angles of the triangle then cause alternate interior angles with the new parallel line. This means that they are equal to angles at the top of the triangle. Both these angles, and the original angle at the vertex lie on a straight line. Angles on a straight line add to 180 degrees so this means that the three interior angles of the triangle also must add to 180 degrees. Therefore, the idea that all the angles in a triangle add to 180 degrees depends on the fact that Euclidean space has zero curvature. Zero curvature means that straight lines are straight and that parallel lines do not converge or diverge.

In Spherical geometry, there is a positive curvature of space. This means that the space curves outwards like a sphere. Due to the positive curvature, Euclid's definition of a straight line will not work. The version of a straight line in spherical geometry is called a geodesic. A geodesic is the shortest path between two points on a curved surface. On a sphere geodesics are sections of great circles. The equator or the tropics are examples of great circles. In Euclidean geometry parallel straight lines never meet but in Spherical geometry great circles eventually will always intersect. This means that the parallel postulate will not work in spherical geometry. When three geodesics intersect, they form a triangle on the sphere. However, the interior angles of the triangle will not add to 180 degrees but will always be greater. The exact value will always depend on the size or the triangle. For example, the equator and 2 lines or longitude meeting at the north pole create a triangle which has three right angles, so the sum of the angles inside the triangle would be 270 degrees. The increase in sum of interior angles of the triangle is because there is more positive curvature of the sphere which leads the geodesics to curve towards each other and that shows how the concept of a straight line proportionally changes the geometry of triangles.

In Hyperbolic geometry, there is a negative curvature of space. This means that space curves inwards like a saddle. Like spherical space, in hyperbolic space Euclid's definition of a straight line won't work either and straight lines in hyperbolic space are also called geodesics. For example, in the Poincaré disk model, hyperbolic geodesics are seen as arcs of circles that meet the boundary of the disk at right angles. In hyperbolic geometry on a point not on a given line, there are an infinite number of lines that don't intersect with the original line. This means that there are infinitely many parallels, and the parallel postulate doesn't work. When three hyperbolic geodesics form a triangle, the sum of the interior angles will always be less than 180 degrees. The difference between 180 degrees and the actual angle sum is called the angle defect. As the triangle increases in size, the defect also increases. The total interior angle sum is less than 180 degrees because geodesics diverge away from each other. This shows that because straight lines in hyperbolic geometry diverge, the triangles formed from them have smaller interior angles.

The sum of the interior angles of a triangle is dependent on the curvature of the space that the triangle is in. If the space has positive curvature like spherical geometry, the geodesics will converge towards each other, and this will cause the interior angles in the triangle to be larger so the total interior angles will be bigger than 180 degrees. In contrast, if the space has negative curvature like hyperbolic geometry, then the geodesics will diverge away from each other and will cause the interior angles of a triangle to be less than 180 degrees. In flat space there is no curvature, and geodesics are straight lines, and parallel lines never meet which means that interior angles of a triangle will always add to 180 degrees. The difference between the sum of the interior angles and 180 degrees shows the total curvature enclosed within the triangle. The difference will be proportional to the product of the curvature of the space and area of the triangle, showing a direct link between geometry and curvature.

In conclusion, the concept of a straight line is not universal, but changes based on the space that the line is within. Euclidean straight lines, spherical great circles, and hyperbolic geodesics all represent the straightest possible path in their respective spaces, but all behave in different ways. These differences influence the sum of the interior angles in triangles and prove that it doesn't always add to 180 degrees but only in flat space. Using this idea, we can see how geometry is dependent on the space that it's in. Geometry has countless real life uses like navigation or map projections.

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The potential of harnessing the water and waves for renewable energy production

By Samuel L 12.3

Estimates suggest that global tidal power generation currently totals to 90GWh, which is dwarfed by the total power demand of the whole world which lies around 18PWh (0.0005%). [5] This is a very unfair comparison but highlights the very early stage that tidal power is currently at. This is forecasted to increase to 120GWh in 2030, [5] which is impressive given the starvation of large-scale funding. I believe that despite the current low capacity for tidal energy generation, there is both need and potential for the technology to develop and grow into a more mainstream and widely implemented energy generation source. We know from experience that it is vital to have a diversified energy mix and this is no different for renewable energy, with solar energy only being generated during daylight hours (not a strongpoint of the UK), and wind energy generation being weather dependant. Fear not however, despite having mildly intermittent generation periods affected by tidal levels, tidal power can generate energy 24 hours a day, 7 days a week if implemented in a suitable location. Ultimately, there will always be drawbacks of every solution with some including the great expense of installing and maintaining the infrastructure, potential disruptions to marine life and the limited availability of installation sites. Tidal power may not be the revolutionary solution to all our climate change issues, but with some investment into developing the technology and an open mind to new solutions, tidal power can be a step towards our sustainability goals.

Modern tidal power generation methods usually act on a similar system to an underwater windmill where the tide turns a rotating shaft, which is connected to a gearbox which in turn drives a turbine of large slow-moving blades. [4] The electricity generation then acts in the same way as wind turbines or fossil fuel power of powering a generator.

One large tidal power project proposed in 2015 was the Swansea Bay tidal lagoon, with the premise of generating 320MW to power roughly 155,000 homes in Wales and surrounding areas. [6] It received an initial promise of funding from the government around £1.3 billion given the lagoon needed to be man-made and then the construction of all the necessary equipment totally to an eyewatering figure. [6] Despite this, there was much intrigue and attention paid to the project since it was an ambitious and innovative project which had the possibility to both provide the area with many jobs and economic benefits as well as pave the way to inspire future tidal power projects after the world leading project in southern Wales. Unfortunately, these hopes and ambitions were cut short when the government retracted their funding for the project, leaving the project still lingering in its planning phases. The future of the Swansea Bay tidal project is unclear but very much on hold for the moment until new investors join the project or it restarts at a different location in the future. For example, a large tidal power project is being discussed and planned in Liverpool along the river Mersey where its concept would generate 700MW from 28 turbines, totalling 2TWh annually. [5] This would be a slightly different approach to tidal power as a two-way generation system with water sluicing between gates and being pumped out would drive the turbine rather than simply driving an underwater turbine. [3]

While the Swansea Bay tidal lagoon project seems a rather distant failure now and the project in Liverpool seems a long way off, there is still optimism to be had in this sector of renewable energy in the UK. The technology for tidal power has made progress since 2016 and with experience of current projects, there is undeniably a lot of potential for the technology to develop and become a powerful tool for the UK to meet its sustainable energy goals as well as make energy cheaper for consumers. The efficiency of current wave energy converters is typically in the range of 20-30%, however this is forecasted to improve in the future which will make tidal power generation more efficient. [2]

Examples of tidal power projects that are currently live or have been granted contracts and are on course for construction include: [1] [3]

- HydroWing (up to 20MW in Morlais, Wales)
- MeyGen (between 6-50MW in Pentland Firth, Scotland)
- SeaStar (4MW in Orkney, Scotland)
- Magallenes (2MW in Wales)
- Ocean Star Tidal (up to 10MW in Orkney, Scotland)

These current/ near future projects are a positive step for the tidal power sector as they prove the ability to carry out these projects, encouraging more influential investors to support their projects to be bigger or develop their own project to generate tidal power on the UK coastline and indeed across the whole globe. Places like the UK have lots of potential for this technology since we are an island with a subsequent very large coastline to house these projects. By providing opportunities to develop this sector, it opens up thousands of job prospects for university students looking for a job or anyone interested in working on projects that create a force for good.

One final thing to consider is the possibility of utilising the water and waves for renewable energy generation in other ways, like floating solar farms. Future innovations will surely uncover more of the sea's best kept secrets and how humans can work in conjunction with nature to be more sustainable inhabitants of this planet.

While the current levels of tidal power generation and technology is slightly lagging behind that of wind energy, there is much room for development and innovation in this sector if sufficient funding is granted and committed in the long term. The current ocean energy estimates range from 20,000 to 80,000 TWh of electricity per year, accounting for 100-400% of existing global power demand, making the ocean a vital tool which we must understand and utilise more efficiently. [5] Therefore, tidal power may or may not be the miraculous solution to overcome climate change, but it is undeniably a powerful tool to contribute to existing efforts.

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How is AI reshaping business industries and is it ethical to allow AI to completely turn the tables in these industries?

By Nusaybah A 12.3

Artificial intelligence (AI) is an intelligent companion, tool and support system that has become integrated in our everyday lives, from burning questions to complex math problems, AI can provide solutions for it all. These days, it's so prevalent that many people are not even be aware that they are using it. Take digital assistants like Alexa or Siri, or even Google with an AI algorithm that enables the auto-complete feature [1] allowing the search engine to pre-populate responses when you research something. Nowadays people often claim that "AI is the future", this certainty has likely come about because of the impacts AI has on industries, particularly in businesses. Over the past decades, AI has reshaped businesses in ways that would have been unimaginable 30 years ago, offering us countless benefits in terms of making strenuous tasks more efficient and innovative however there are also countless underlying drawbacks such as the 92 million jobs expected to be displaced by 2030 [2]. Whether it's platforms like ChatGPT or GauthAI—platforms that both students and teachers and many others frequently use— In fact it's availability makes it so common that it's hard not to interact with these platforms. This leads to questions surrounding whether AI will truly have such a large impact as people presume and whether it's ethical to allow AI to have such a widespread influence.

How exactly has AI altered business industries? Generative AI (AI that is capable of producing text, images, files and much more) has been quickly transforming business industries, such as automating certain processes and overall, just enabling more efficient and cost-effective ways for businesses to operate. For instance, customer support nowadays is often AI powered, such as Verint IVA [3], allowing for fast responses to common questions and redirection if further support is needed. It's also predicted to have immense economic potential, The Oliver Wyman Forum has assumed significant potential of AI, suggesting that generative AI could add up to $20 trillion to global GDP by 2030 and save 300 billion work hours a year [4]. Further highlighted by a 2023 report, where McKinsey claims AI to have permeated into our lives suggesting that generative AI could add the equivalent of $2.6 trillion to $4.4 trillion annually across the 63 use cases analysed [5]. It's apparent that AI has a major effect on the business world, but what we are interested in is how it concerns or benefits different people, the primary question is surrounding its ethical implications. For instance, one of the main concerns is the job market, AI could displace 85 million jobs globally by 2025 [4]. Although AI is presumed to make lives easier, it's also taking the jobs of many, proposing challenges to many young people who are soon to be exposed to the job market, this may be one of countless reasons why people may deem AI unethical.

However aside from job displacement, there are also countless perks and opportunities that AI presents. For instance, AI has enhanced customers' experiences and services, generative AI can power chatbots that answer customers' questions day and night [6]. AI can also make areas like education more accessible, the Oliver Wyman Forum, suggests 100 million could gain access to education through generative AI by 2030 due to its ability to provide universal access and personalised tutoring [4]. Although not all AI platforms are free of charge, this can benefit businesses by encouraging a more educated younger generation that makes up the future workforce, however this ease of access can raise doubts as to whether education is taken seriously, it's easy to misuse such platforms and end up with a workforce that hasn't actually put any work in but has relied on AI to do it all [7]. As things stand, AI is likely to continue to reshape industries, but apart from just effecting efficiency of operation and the workforce, to truly understand the impact of AI on industries, we must take into account the environmental impacts. Barclays suggest that AI requires vast amounts of electricity to power huge data centres and a lot of water to cool countless racks of servers.8 This clearly shows that whilst AI is efficient and has immense productive potential, it may negatively impact the environment and pose ethical concerns, perhaps even leading to customers doubting a business' morality. However, Barclays then continues to address the situation suggesting that the mining of raw minerals required in the process are actually not as harmful as it appears and tends to create jobs in various fields [8]. So, whilst AI appears to pose a risk to many and can be deemed detrimental in the long-term with its

environmental implications, AI is also creating jobs despite displacing some and boosting the productive potential for businesses.

Ultimately, AI has had significant influence on various business industries. For instance, looking at case studies in America; Target uses Google cloud to implement AI services on the Target app and website, Alaska Airlines uses generative AI to provide customers with a chatbot that offers travel agent services [6]. AI has integrated itself into business, or rather humans have allowed AI to leave its trace in almost everything and this has had numerous effects. AI has enhanced operative capability making firms eager to enter the market and providing a route for countries to experience economic growth. Although, it's acknowledged that AI proposes certain harms to the environment and significant risks to certain groups of people, but it compensates for it by providing several other roles in industries surrounding AI: Artificial intelligence engineers, Data engineer , AI research scientist and more [9], all these jobs directed primarily to the highly skilled population, mitigating issues to businesses such as brain drain as the skilled workforce is incentivised to stay in the UK and work in AI fields. The ethicality of AI remains ambiguous as whilst it harms thousand, it provides for thousands, but it's clear that AI has incredible potential and will continue to frame businesses providing new and improved opportunities year after year to look forward to.

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The fundamental power of the relationship between History and Economics. – Abuse, Manipulation and Greed

By Sepan P 12.4

The British Empire- the most powerful empire in the history of the world. The most dominant, ruthless and brilliant but manipulative empire the world will ever see. At their peak, they ruled over 25% of the planet, motivated by economic gain and motivation to have wealth far beyond imaginable. Their abuse of history cannot be forgotten about either; their use of rewriting history portrays a shadow over their empire which cannot be overlooked in the slightest (Elkins, C. 2022). This one example is one in many ways that societies, communities, governments, kingdoms of wealth have over abused their power and manipulated history (Macmillan, M (2010) to suit their own financial benefits for their legacy over history. As Johns (1921) says History and Economics are both very powerful subjects that can betray one another but can indeed go hand in hand and work together to benefit each other as Schweitzer (1965) says. These common theories are both considered to be drastically contrasting while people fail to recognise how they both are more chained than people think. Many cases across more recent History have found how history gets manipulated and misused for financial and personal gain without considering the impact it would have on others. Macmillan M. (2010).

Manipulation Of History

As Gellner (1983) describes, 'History is defined as a process of transitions between different types of societies driven by 3 distinct transformations: 'Economies, Power and Knowledge'. This can be interpreted in many ways as History can provide societies with these 3 mechanisms. The book History and Memory by Lowenthal (1997) shows how rulers and emperors manipulate the past to gain authority. He mentions Milan in 1162, when Emperor Frederick Barbossa rewarded Rainald of Cologne by allowing him to 'ransack' the city. The destruction of the city was not only physical but can be put up for interpretation: whilst some writers think it's fair and justified, some others see it as tyranny. This highlights how the same interpretation of a certain event in History can be reshaped and moulded differently exacerbating its vulnerability to manipulation Ranum (2000). History is a tool Nadel (1960). History is the reason why people have strict ideas about certain events, certain political views and certain economic systems. People don't really have a proper understanding of this diverse subject but want to manipulate, exaggerate, over emphasise it and handpick certain events from a certain timeline to aid them. Governments and economic leaders pick historical events or even quotes to make their current system seem 'fair' or 'just' or even 'inevitable.' Ranum (2000).

Greed and Power

In her book, Elkins (2022), she argues how the idea of greatness and the feeling of power acted as a motive to the British Empire to keep pushing for financial gain and a great economic boost. In several events in History, we see coercion and control for financial gain especially from those at the top and those who lead societies. Elkins mentions the term 'archival erasure' – a way of rewriting and reshaping memory of history to prevent the criticism and focus on success and wealth. This power and greed of always 'wanting more' can impact people detrimentally (Morrison. 1987). He goes on to explain how families get torn apart from economic gain and slavery from those in control and then the horrifying nature of this story almost gets burned and buried and forgotten about to focus on the economic gain instead of focusing on the damaging impact of those affected. As mentioned previously History is never neutral and always written in a certain view or aspect reflecting the economic interests and conditions of a Historian and failing to demonstrate the whole portrait and the actual nature of a certain narrative. Ranum (2000). This unwavering power that this diverse and extraordinary subject gives Historian's is unwavering and impossibly hard to control. History is a mechanism that will never stop getting fiddled with, and Historians are the refiners, the polishers, the extractors, going to extreme lengths to persuade others about their view on a certain History. The power that not only Historians have to suit their economic standpoint and reflection about their economy, but also the power that History itself has, must be recognised and not overlooked. Ranum (2000).

The link between Economics and History.

The term fabrication is defined as 'the act of inventing false information to deceive'. This is seen in the British empire Elkins (2022) and during Milan in 1162 (Lowenthal (1997)), both previously mentioned before. The dangers of linking these two very complementary subjects must be mentioned. First, if there's a change in a certain economy or the change of its key principles this will almost guarantee a change in History, eradicating the old and starting a new, more sophisticated history that will change again if this cycle continues. Gellner (1983). Second, Economics can sometimes be over-dependent on History. For instance, the British Empire's economic system depended on systematic violence and therefore they crafted History to hide that fact. Elkins (2022). However, they can also go hand in hand. Schweitzer (1965) argues if people realise that economics can't be isolated, then and only then can both vast specialities and Jobs that these subjects provide can co-exist. A historians Job is to dig into sources and archives and analyse the historical aspect of how it is caused. While an economist provides trends, data and facts to match this claim. Therefore, both these systems are interdependent and link to one another.

To conclude, History is full of interpretation, and interpretation can be depicted as dangerous but also useful. English (2021) argues that fake or manipulated History is often a tool, a mechanism and trigger for economic and political power. As historians, we cannot manipulate such a divine and breathtaking subject but instead learn from our mistakes and challenge and oppose those who misuse it for financial and economic reasons. These subjects are both there to learn and gain knowledge from, not to exploit. Instead of finding and handpicking historical events to benefit some, these scriptures, archives and scrolls are there to take lessons from and value people and Historical movements to drive for a positive change.

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Dave as the Premier Lyricist of Contemporary Music: Social Consciousness and Poetic Mastery

By Christopher K 12.4

The advent of Santan Dave, otherwise known as David Omoregie, has indeed caused a shift in the manner of lyrical possibility that has hitherto been employed in contemporary music. His work transcends entertainment and functions as social commentary through complex rhyme structures, psychological introspection, and politically charged storytelling. His lyrics not only reveal his technical mastery but also position him as an ethical and cultural voice for a generation dealing with inequality, racialized media narratives, and mental health struggles. This essay argues that Dave is the greatest lyricist of his generation in light of his integration of poetic technique, social critique, and emotional vulnerability-a set of qualities that have been widely recognized within both the academic and cultural discourses on modern hip-hop.

Technical Mastery and Poetic Complexity

Adam Krims (2000) maintains that rap lyricism has to be understood in both poetic and performative dimensions, where rhythm, rhyme, and identity combine in meaning. That would be an exact description of what Dave's lyricism does. The complex inner rhyme schemes, layering of meaning, and coherence in his narration express a fully considered poetic art. On Disaster, he raps, "I know people wearing Rollies doing life in can / Isn't that ironic that they couldn't find the time to plan?" The line is replete with wordplay, based on irony, which underlines social observation through linguistic accuracy. This pun on "time" far exceeds the limits of wit-it's a critique of a real tragedy wrought by systemic and personal myopia.

Quantitative analyses of lyrical complexity, like Bansal et al.'s 2025 study "Linguistic Complexity and Socio-cultural Patterns in Hip-Hop Lyrics", provide empirical backing for recognizing artists like Dave as technically sophisticated lyricists. His writing evidences lexical density and semantic depth comparable to literary verse, showing that hip-hop lyricism requires the same analytical respect given to canonical poetry. On a related note, LaVoulle advises in 2016 that rap lyrics should be considered literary texts worthy of close reading and interpretation; a view that supports the academic examination of Dave's lyricism from a perspective informed by poetics and discourse studies.

Race, Identity, and Political Consciousness

In Black, one of Dave's most celebrated songs, he affirms, "A kid dies, the blacker the killer, the sweeter the news / And if he's white you give him a chance, he's ill and confused." This lyric embodies his ability to fuse artistry with activism, resonating with Paul Gilroy's 1987 critique in There Ain't No Black in the Union Jack of racialized nationhood. Deconstructing media bias and the racial double standards upon which British social consciousness is based, Dave's bars translate such critique into musical form.

Tricia Rose defines rap as a cultural site where voices of marginalization articulate resistance and identity. Dave is that resistance, usurping narrative authority for Black British youth. Kathryn O'Connell's 2020 dissertation makes the case that Psychodrama positions Dave as a counter-hegemonic figure who uses narrative and self-reflection to disrupt dominant political and cultural structures. The album's conceptual framework-structured around a session of therapy-allows Dave to grapple with trauma, masculinity, and systemic injustice, turning personal struggle into political statement.

Gender, Safety, and Empathy

Dave's lyrical empathy cuts across racial and class lines, extending even into gendered experiences of danger and precarity: in perhaps his most striking verse, he raps

"But if you ain't a girl, I guess you don't know the feelin' / Of watchin' what you wear 'cause you're worried 'bout makin' it home / Walkin' with your phone to your ear and you ain't on the phone."

These lines epitomize how Dave mobilizes narrative empathy-that is, inhabiting perspectives other than his own-to criticize social conventions. As George Lipsitz (2007) has pointed out, popular music is a repository both of social memory and moral imagination. Dave's decision to speak from women who experience fear in everyday situations locates him within a tradition of artists for whom music is ethical storytelling. For Krims (2000), rap is not an art of fixed identity positions but rather the poetics of identity flux: fluid, empathetic, and reflecting complex realities.

Mental Health, Vulnerability, and Self-Interrogation

A defining feature of Dave's lyricism is the sincerity and candour with which he approaches mental health. On Survivor's Guilt, his lines and delivery articulate inner turmoil and guilt, contributing to a larger movement of openness about mental illness within rap. Smith and Liebrenz (2023) argue in The British Journal of Psychiatry that Dave's work "redefines the cultural representation of psychiatric themes in British hip-hop," presenting emotional vulnerability as strength rather than weakness. This agrees with Kresovich et al. (2020), who found that mental-health discourse in rap music has become an important platform for public health awareness.

Dave reframes self-examination into both aesthetic and political practice by situating Psychodrama around a therapy session. He confesses in one lyric, "I cried about slavery, then went to Dubai with my girl / 'Surely I ain't part of the problem,' I lie to myself." This point of self-criticism dramatizes well the contradictions of modern consciousness-acknowledging complicity even while critiquing. According to O'Connell (2020), this double-edged sentiment forms the very basis of Dave's counter-hegemonic approach: he does not present any moral high ground for himself but instead reveals human complexity.

Social Commentary and Cultural Responsibility

Through his body of work, Dave uses his lyricism as a tool for moral and political illumination. Beyond condemning media bias, systemic injustice, and social apathy, this points toward the "hidden histories" of popular music that Lipsitz (2007) discusses: its articulation of experience. It's in those lines like: "Danger doesn't look like no killer in a mask / It looks like that kid in the group chat that jokes about—" that he shows the insidious normalization of misogyny and violence in digital culture, merging modern critique with poetic subtlety.

This social commentary represents what the OSF preprint (2024) terms as the "junction of social conditions and lyrical expression," where socio-economic realities find their material expressions in creative output. Class and inequality awareness pops up poignantly in Dave's aphoristic observations like "Most of us would sacrifice our soul for the right fees" and "Everybody's makin' content but nobody's content." Lines like these move beyond the local context of rap into articulations of philosophical reflections on materialism and alienation in a digital capitalist society.

Legacy, Influence, and Ethical Lyricism

Dave's artistic integrity places him at the juncture of artistry and activism. He repositioned the place of the lyricist from entertainer to intellectual through narrative voice, moral inquiry, and cultural analysis. His commitment to realism and empathy, combined with technical precision, corresponds to what Rose (1994) and Krims (2000) have stated regarding the functions of poetry and social criticism.

Furthermore, Dave's influence in British and global rap attests to Gilroy's 1987 contention of diasporic creativity, wherein Black British art has the ability to create new cultural idioms speaking simultaneously to both local and global struggles. In this sense, Dave's work can move across national frontiers and articulate shared experiences of marginality, aspiration, and reflection.

Conclusion

Dave's lyricism is exemplary in fusing art and conscience. His technical skill, emotional vulnerability, and socio-political engagement together rewrite the boundaries of contemporary songwriting. Academic frameworks such as those of Krims, Rose, and Gilroy, among others, confirm that lyricism needs to be read as a form of cultural discourse-a space where poetic form and social meaning come together. Through his unflinching introspection, political lucidity, and ethical musicianship, Dave does not stop at being the finest lyrical talent but makes his music a medium of social consciousness and combined empathy. He therefore may well be considered the most important lyricist of his generation-the artist whose words do more than rhyme; they heal, challenge, and transform.

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How does prenatal maternal stress influence childhood neurodevelopment?

By Umaiza S 12.5

Prenatal maternal stress (PMS) refers to the psychological, physiological, or environmental stressors that occur during pregnancy (Talge et al., 2007). This topic has gained significant attention in developmental psychology. Research shows that PMS can have lasting effects on neurodevelopment, impacting cognitive, emotional, and behavioural outcomes in children from infancy to adolescence (Van den Bergh et al., 2018; Lautarescu et al., 2020). With rising rates of maternal stress due to economic insecurity, social pressures, and environmental instability, understanding how prenatal stress affects brain development has become a vital public health issue. Early brain development is particularly sensitive to the conditions inside the womb. Even minor changes in maternal health can influence foetal neural pathways in ways that affect long-term functioning (Schuurmans & Kurrasch, 2013). While the effects of PMS are well established, the connections between maternal stress and childhood neurodevelopmental outcomes are complex and multifaceted.

One of the main ways PMS impacts the foetal brain is through disrupting the maternal hypothalamic-pituitary-adrenal (HPA) axis. Stress activates this system, which increases the release of glucocorticoids like cortisol. This hormone can cross the placenta and change foetal neurobiology (O'Donnell et al., 2009). The placenta usually contains the enzyme 11bhds2, which protects the foetus by deactivating excess cortisol. However, chronic maternal stress reduces the expression and effectiveness of this enzyme (Van den Bergh et al., 2018). As a result, higher levels of maternal cortisol reach the developing foetus, affecting brain areas rich in glucocorticoid receptors, such as the hippocampus, prefrontal cortex, and amygdala. These regions are crucial for memory, emotional control, and executive functioning. Disruptions in their development can increase the risk of long-term cognitive and emotional issues for children.

Besides neuroendocrine pathways, stress-related changes in placental function and maternal immunity also significantly impact neurodevelopment. The placenta actively supports foetal development rather than just acting as a barrier. PMS affects placental gene expression, immune signalling, and the production of inflammatory cytokines, leading to an intrauterine environment that may hinder neural growth and synapse formation (Walsh et al., 2019). Maternal immune activation (MIA), marked by higher levels of inflammatory markers, is linked to altered synaptic development and is strongly associated with autism spectrum disorders (Beversdorf et al., 2018). Inflammatory molecules produced due to stress can cross the placenta and affect foetal neural tissues, impacting microglial activation and the formation of neural circuits during critical developmental phases. These immune and inflammatory processes highlight how maternal health, placental function, and foetal brain development are connected.

Epigenetic mechanisms also play an essential role in connecting PMS to long-term neurodevelopmental outcomes. Changes in gene expression, such as DNA methylation and alterations to histones, can occur due to stress and affect genes that control stress responses, neuronal signalling, and neuroplasticity (Kundakovic & Jaric, 2017). These changes may effectively program the foetus's ability to manage stress, leading to increased sensitivity, altered emotional responses, and a higher risk of later disorders in childhood. Since many epigenetic changes persist through development, they help explain the long-lasting effects of prenatal stress.

The biological changes linked to PMS can lead to measurable differences in brain structure and function. Neuroimaging research has shown that children exposed to high prenatal stress have less grey matter volume, different white matter integrity, and altered functional connectivity in brain areas involved in emotional regulation and executive control (Lautarescu et al., 2020). These structural and functional differences often correlate with the behavioural outcomes seen in children. For example, issues in amygdala development may result in increased emotional reactivity or anxiety, while changes in prefrontal cortex function can create problems with attention, impulse control, and decision-making. Studies consistently link prenatal stress to cognitive delays, poor academic performance, and heightened incidence of emotional issues like anxiety and depression (Talge et al., 2007). In severe

cases, PMS is associated with a higher risk of neurodevelopmental disorders, such as ADHD and ASD, as confirmed by recent meta-analytic studies (Manzari et al., 2019).

It is important to understand that prenatal stress usually occurs alongside other factors. Aspects like maternal nutrition, socioeconomic challenges, and access to healthcare often interact with stress, raising developmental risks. For example, inadequate maternal nutrition can combine with stress-related hormonal and immune changes, worsening their impact on foetal brain development (Marques et al., 2013). Moreover, the postnatal environment plays a crucial role in moderating these effects. Supportive caregiving and stable conditions in early life can protect children from many adverse outcomes linked to prenatal stress. On the other hand, environments marked by ongoing stress or instability can heighten developmental vulnerabilities. These interactions emphasize the need to examine PMS within the broader context of maternal and child development.

Given the strong evidence linking PMS to negative neurodevelopmental outcomes, early identification and intervention are essential. Routine prenatal screening for psychological distress, depression, and anxiety can help healthcare providers identify at-risk mothers and offer timely support (Schuurmans & Kurrasch, 2013). Interventions such as mindfulness training, stress reduction programs, cognitive-behavioural therapy, and increased social support have proven effective in lowering stress during pregnancy and improving outcomes for mothers and infants. On a policy level, including maternal mental health services in standard prenatal care, expanding access to mental health experts, and providing resources to address socioeconomic stressors could lead to significant public health benefits. Ongoing research into biomarkers of stress, placental health, and foetal neural development will enhance early detection and allow for more targeted interventions (Van den Bergh et al., 2018).

In conclusion, prenatal maternal stress has profound and lasting effects on childhood neurodevelopment through interconnected neuroendocrine, immune, and epigenetic pathways. PMS disrupts foetal brain development by altering HPA axis function, placental regulation, inflammatory responses, and gene expression. These biological disruptions increase the risk for cognitive impairments, emotional issues, ADHD, ASD, and anxiety disorders (Manzari et al., 2019). Understanding how PMS affects neurodevelopment emphasizes the importance of supporting maternal mental health as a key aspect of public health. Focusing on the well-being of pregnant people promotes healthier developmental paths and benefits future generations. The prenatal environment is foundational for lifelong brain health, so supporting mothers is crucial for nurturing the developing mind.

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Can animal venom be safely used in medical treatment?

By Meryem B 12.5

What is venom? Venom is a poisonous substance secreted by animals such as snakes, spiders, and scorpions and typically injected into prey or aggressors by biting or stinging which is mainly used as a defence mechanism or as a hunting strategy. For centuries, animal venoms have been associated with danger and toxicity.However, recent scientific advances have reframed venom as more than a lethal weapon. It is now recognized as a rich source of bioactive compounds with significant therapeutic potential. These molecules, shaped by evolution to act with remarkable precision on physiological pathways, offer unique opportunities for drug development in areas such as pain management, infection control, neurological disorders and cancer treatment. This essay discusses whether venom can be safely harnessed for medical purposes by analysing current research, clinical applications, and technological innovations. Evidence from recent studies (Utkin, 2015; Yacoub et al., 2020; Herzig, 2021) indicates that, despite existing challenges, purified venom-derived compounds can be used both safely and effectively in modern medicine.

Experts explain that venoms are complex mixtures of peptides, enzymes, and toxins that act on highly specific molecular targets. Utkin (2015) emphasizes that venom components show strong selectivity for ion channels, receptors and enzymes, enabling the development of medicines with precise mechanisms of action. Herzig (2021) describes venoms as both a curse and a cure, therefore highlighting their dual nature as venom is inherently dangerous yet uniquely advantageous compared to many synthetic drugs. Current research increasingly focuses on isolating beneficial compounds while removing toxic or immunogenic elements, suggesting that purification is key to transforming venom from a natural hazard into a useful therapeutic resource.

Recent technological advances have greatly improved the safety of venom based drug development. An example of this is cone snail venom which has been widely studied for its neurological effects. Research by the National Institute of Standards and Technology (2017) shows that cone snail toxins help scientists understand ion channel behaviour, supporting the development of safer and more effective treatments for chronic pain and neurological disorders. McDermott (2020) describes venom as a wellspring for drug candidates. Noting that modern biotechnological tools are accelerating the discovery of medically used compounds. For example: peptide synthesis, structural biology, and genomic screening. These innovations not only enhance drug stability and effectiveness but also reduce toxicity. This reinforces the argument that venom can be transformed into a controlled and reliable therapeutic resource.

Venom derived therapeutics are already part of clinical medicine which demonstrates the successful transition from toxic molecules to safe pharmaceuticals. For example: Captopril, originally developed from Brazilian pit viper venom, which revolutionised hypertension treatment and ziconotide, derived from cone snail venom, is used for severe chronic pain. Sung et al. (2021) describes the use of purified venom in pharmacopuncture within Korean medicine, where controlled doses are applied to reduce pain and inflammation. Although more clinical trials are still needed, these examples show that venom can be administered safely when standardized. Beyond pain treatment, venom components also exhibit antimicrobial properties. For example, Yacoub et al. (2020) report peptides capable of killing antibiotic resistant bacteria. This offers a promising option against emerging global health threats. Overall, these examples show that venom based therapies are not just theoretical, they are an expanding part of modern medical practice.

Another emerging area of research involves venom derived compounds for cancer therapy. Pal et al. (2015) review evidence that certain venom peptides can inhibit tumour growth, trigger apoptosis in cancer cells and reduce metastasis. More recent studies, such as Kim et al. (2025), show that these peptides often target cancer cell membranes or receptors with greater specificity than many conventional chemotherapeutic drugs, potentially reducing harmful side effects. This precision highlights the broader therapeutic promise of venom based drugs and demonstrates how molecular selectivity, that was once associated with danger can be used to fight one of medicine's most challenging diseases.

Despite its potential, venom derived treatments require strict safety protocols. Raw venom is highly dangerous. However, purified, isolated molecules differ fundamentally from whole venom exposure. Meier and White's Handbook of Clinical Toxicology of Animal Venoms and Poisons (1995) outlines the severe risks of unprocessed venom and emphasizes the need for clinical grade purification. Some safety concerns may include immune reactions such as allergies or anaphylaxis, dose dependent toxicity and natural variation in venom composition. Modern pharmaceutical processes, for example: molecular isolation, peptide engineering, precise dosage control are designed to minimize these risks. When venom derived compounds are purified or synthesized to clinical standards, their safety profile becomes comparable to other biologically derived medicines, which supports the idea that venom can be transformed into a reliable therapeutic resource.

In conclusion, animal venom that was once regarded only as a threat, now represents a valuable resource for modern medicine. Its bioactive compounds demonstrate unbelievable molecular precision. This allows venom derived compounds to be used in targeted treatments for conditions such as pain, infection and even cancer. Thanks to modern technology and rigorous purification techniques, substances that were once dangerous can now be transformed into safe and reliable medicines. This is already evident in established drugs like captopril and ziconotide. Although concerns such as immune reactions or toxicity still exist, these risks are significantly reduced through standardized processing and careful dosage control. Overall, the evidence shows that venom based treatments can be both safe and effective, as long as they are developed and tested under strict clinical standards.

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Mouth cancer. Importance of detecting for cancer early

By Sanjana M 12.6

Mouth cancer. I didn't think that, as a teenager, I would ever end up involved in cancer research. Honestly, it sounded like something adults or scientists would do, not someone still in school. But what sparked me was reading an article related to mouth cancer and a "hydrogel lollipop" treatment for it (Kim et al.,2023). At the same time, I spent a whole month fundraising for cancer research. I didn't raise millions or anything like that, but I tried my hardest, and it felt good knowing that even a small amount could support early detection and treatment (Cancer research UK, 2024).

During that month, I started getting regular emails from the cancer research team. At first, I thought they'd just be basic updates, but they actually opened my eyes to how serious cancer is and how many people it affects (World health Organisation,2024). One thing that really shocked me was learning how common cancer is worldwide. Mouth cancer let alone affects tens of thousands of people every year (NHS,2024), and most people don't realise the signs until it's already advanced (American cancer society, 2024). I remember reading about the symptomsthings like sores that don't heal, lumps in the mouth, or difficulty swallowing and realising that many people ignore these because they think it's something minor. That delay can change everything (MacMillan Cancer support,2023).

Reading those emails made me feel more connected to the people who actually go through cancer. I started feeling genuinely sympathetic, especially towards kids and people my age who have to face something so big so early in life when they have so many things to look forward to but something that's so cruel takes over their lives and stings with them. I kept thinking about how one day someone can feel normal, and then suddenly they're dealing with something that completely changes their life. When you're young, you're supposed to be worrying about school or friendships, not hospitals and treatments. That thought stuck with me a lot.

One thing that really stayed with me during this whole experience was an article I came across about a family living in the middle of a war zone. They were already struggling with everything that comes with conflict, fear, and a lack of resources, all the things people have to face when their home isn't safe. And then, on top of all that, they found out that one of their children had cancer. Reading that made me question why people are not doing as much as they should be doing to raise awareness for this ongoing crisis of cancer. It made me realise how unfair the world can be. It's already hard enough for anyone to deal with cancer, but to have to go through it while surviving a war felt unimaginable. It made me think about how people in different parts of the world are fighting battles we don't even think about. That article motivated me even more to stay involved, because no one should have to deal with two life-changing challenges at once. It also made me appreciate how important cancer research is not to let it slide.

As I continued reading more, I learned properly what mouth cancer actually is. Mouth cancer, or oral cancer, can affect the tongue, gums, cheeks, and other parts of the mouth. It doesn't get talked about as much as other cancers, so many people don't learn the symptoms until it's too late. Common causes include smoking, heavy alcohol use, HPV, and sometimes long-term irritation. But it can also affect people who don't fit any of those categories, which is why early detection matters so much. When mouth cancer is found early, survival rates are way higher. That was part of what made the hydrogel lollipop so interesting to me it felt like such a simple idea with the potential to save lives.

When I first read about the hydrogel lollipop, I honestly thought it sounded almost too simple to be real. But that's exactly what makes it exciting. Instead of using painful or invasive methods which most people with cancer would probably deny to actually get the treatment due to reasons such as not having to undergo even more pain, this device is basically a lollipop shaped stick covered in a soft hydrogel. When it's placed inside the mouth, it can collect cells and biological markers from the inner lining of the cheeks or gums. Those samples can then be examined for early signs of cancer or pre-cancer. What makes it interesting is that it doesn't hurt, it doesn't require any special

equipment, and it only takes a moment. Imagine going to a dentist and getting screened for mouth cancer as easily as getting your teeth checked. For people who might ignore symptoms or avoid hospital appointments because they're scared, something like this could actually encourage them to get checked sooner

The more I learned, the more inspired I felt. I realised that research doesn't always look like big, complicated surgeries. Sometimes it looks like simple, clever tools that anyone could use. And that's what makes early detection so powerful it gives people a chance. It gives families more hope. It saves lives before the cancer becomes deadly.

Being involved in fundraising also taught me a lot about how important community support is. Research needs money, volunteers, time, and awareness. Even though I'm young, I realised that I can still help. I don't need to be a scientist right now to make a difference. Donating, sharing information, encouraging people to pay attention to symptoms those things matter. During the fundraising month, I felt proud of myself. It wasn't just about the money; it was about being part of something that I thought would not be possible at a young age. It made me feel responsible in a good way, like I was contributing to helping people I might never meet.

Looking back at everything I learned, I'm grateful I had the chance to volunteer and raise money for cancer research. It showed me how real and common mouth cancer is, but cancer in general, and how important it is to find new ways to detect it early. The hydrogel lollipop device represents hope, hope for easier testing, quicker results, and a chance for more people to survive. Being involved, even in a small way, made me realise that young people can help more than they think. In a world filled with conflict, stress, and unfairness, choosing to care and take action matters. This experience taught me that when science and compassion come together, real change can happen one discovery, one donation, or even one simple lollipop at a time.

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How do video games influence aggression, empathy, and prosocial behaviour in adolescents?

By Miedhurshika S 12.6

Video gaming has become a core part of adolescent leisure that has engendered much controversy over its psychological and social impacts. Whereas some critics insist that violent video games nurture aggression and diminish empathy, others cite the potential for these and other cooperative and narrative-driven games to build prosocial behavior, emotional involvement, and social skills. Therefore, it is very important to work out these complex and sometimes contradictory influences, particularly as gaming continues to spread across cultures and age groups. Current research indicates that video games are neither inherently deleterious nor uniformly beneficial; rather, their influences rely greatly on content, context, and individual differences.

Aggression and Violent Video Games

A great volume of research has indeed explored the violent video game exposure-aggressive behaviour relation. Meta-analytic reports have continuously revealed a small but significant association. For instance, in their meta-analysis, Anderson et al. (2010) concluded that exposure to violent video games increases aggressive thoughts, feelings, and physical and verbal behaviours in both Eastern and Western countries. In a subsequent study, Greitemeyer and Mügge (2014) reported that violent video game exposure is positively associated with aggression but negatively related to prosocial outcomes.

Longitudinal research supports these findings. For instance, Willoughby, Adachi, and Good (2012) showed that repeated exposure to violent games predicted higher levels of aggression over time among adolescents. Also, Coyne et al. (2018) found long-term links between violent gaming and externalizing behaviours in a five-year study. The mechanism proposed includes desensitization to violence, reinforcement of aggressive scripts, and heightened physiological arousal. For instance, Hasan, Bègue, and Bushman (2013) show that playing violent games increases stress responses, which increase the likelihood of aggressive reactions.

Empathy Reduction

Exposure to violent video games influences feelings of empathy, too. According to Anderson et al. (2010), the repeated experiences of the consequences of violent behaviour desensitize players to the pain of others, reducing empathetic concern. This happens because violent video gameplay habituates aggressive thoughts and reduces emotional sensitivity toward pain.

Not all video games undermine empathy, however. Instead, emerging research has suggested that narrative-driven games, especially those with moral choices, rich storytelling, and emotionally complex characters, may enhance emotional engagement. Well-designed games, say Cho and Bainbridge (2021), have the potential to enhance players' empathic skills in encouraging perspective-taking and emotional reflection. Whether empathy is reduced or enhanced may depend on the degree of player identification with characters, the moral weight of decisions, and the emotional depth of the narrative.

Prosocial and Cooperative Games

A growing body of evidence underlines the positive psychological and social effects of prosocial games. For example, Greitemeyer and Osswald (2010) demonstrated that playing games focused on helping and cooperating increased subsequent real-world prosocial behaviour. Prosocial media use has also been linked with increased empathy and a greater likelihood of helping others over time (Prot et al., 2014). These effects are especially meaningful during the period of adolescence, which is typified by rapid social and emotional development.

Cooperation while playing games is designed to enhance communication among players, negotiation, and agreement in the way leading to success; it could develop teamwork and interpersonal skills. These advantages have been further evidenced by experimental and intervention studies: Boduszek et al. (2019) conducted a randomized controlled trial showing that prosocial video games can reduce aggression and enhance affective empathy among youth. More recently, Wang (2024) reported that exposure to prosocial gaming was associated with improved emotional responses and more prosocial behaviors among adolescents, thus suggesting that the positive influence of such games might generalize across psychological domains.

Moderating Factors No single effect of video gaming on adolescents' behaviour exists. The results are moderated by such factors as gender, the type of game, playing time, and parental interaction. For example, adolescents with lower levels of initial empathy may be influenced especially by violent content, and young people with higher levels of empathy might profit especially from prosocial or more narrative video games. This is also a function of the cultural backgrounds since, while Anderson et al. (2010) could show that some effects indeed generalize across cultures, others depend on social norms and media environments. Parental mediation, such as discussing game content or setting limits, can further influence the outcomes. These moderating variables line out the nuances within the effects of gaming and point to why generalizations about video games usually are misleading. Video games have diverse influences on adolescent aggression, empathy, and prosocial behaviour; violent games tend to be related to small but stable increases in aggression, whereas narrative-driven and prosocial games may foster empathy, cooperation, and helping behaviours. Importantly, video games do not equally affect all adolescents. Gaming effects depend on the type of content, social context of play, and individual characteristics. In light of ongoing changes in how people use video games, parents, educators, and policymakers are encouraged to foster the adoption of balanced gaming habits, media literacy, and informed engagement with the content of games. Further research with greater nuance is needed to capture varied psychological and social effects of modern video games, rather than assuming that video games are per se harmful or beneficial.

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How can CRISPR gene-editing technology be used to treat genetic diseases, and what are the ethical implications of its use in humans?

By Vanshika P 12.7

The emergence of CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) technology has revolutionized genetic engineering, offering unprecedented precision in modifying DNA within living organisms. Originally discovered as part of a bacterial immune defense system that targets and cuts viral DNA (Gostimskaya, 2022), CRISPR has been adapted into a versatile genome-editing tool that has rapidly transformed biomedical research. Its capacity to correct disease-causing mutations presents transformative possibilities for treating inherited disorders such as sickle-cell anemia, cystic fibrosis, and Down syndrome. However, the same power that enables CRISPR to repair defective genes also raises profound ethical and societal concerns. Issues surrounding germline modification, long-term safety, and the potential creation of "designer babies" have generated significant debate within the scientific and bioethical communities (Ayanoğlu et al., 2020). Consequently, CRISPR represents not only a landmark in scientific innovation but also a test of humanity's ability to balance technological progress with moral responsibility. This essay will evaluate how CRISPR can be used to treat genetic diseases, assess its scientific limitations, and critically analyse the ethical implications of its application in human medicine.

CRISPR is essentially a defense mechanism for bacteria to protect themselves against viruses by storing pieces of DNA from viruses and using this information to target and destroy attacking viruses (Gostimskaya, 2022). It relies on an RNA to locate a DNA sequence, where it uses its Cas9 scissors to cut or slice DNA at that precise location. This is essentially how nature has designed it to work. Scientists are using this technology to delete or insert DNA in eukaryotic cell genes to treat various diseases (Pacesa et al., 2023).

Compared to previous technologies like TALENs and ZFNs, CRISPR provides many advantages, including simplicity, efficiency, and flexibility (Maeder & Gersbach, 2016). The ability to identify almost any DNA sequence by designing only the RNA guide has enabled CRISPR to become a universal platform for genetic engineering. Additionally, its mechanism provides great promise for using it to treat diseases by correcting disease-causing mutations at their origins (Genes & Diseases, 2016). The discovery of CRISPR technology has created a turning point for molecular technology that connects concepts within genetics and therapy.

One of the most promising uses for CRISPR technology is its ability to directly target and correct problematic genes that cause inherited diseases. For instance, researchers have employed CRISPR to mend HBB gene mutations in hematopoietic stem cells for treating sickle cell anemia and β-thalassemia, which are caused by point mutations in the hemoglobin gene (Precision Clinical Medicine, 2021). Preliminary clinical trials have demonstrated that patients administered with CRISPR-corrected stem cells present alleviated symptoms and normalized function for red blood cells.

Apart from blood disorders, other areas where CRISPR has shown promise include cystic fibrosis, muscular dystrophy, and inherited blindness types (Memi et al., 2018). Scientists are also working on its application for immune system improvement, including making T-cells resistant to HIV infection or for better cancer immunotherapy (Janik et al., 2020). The above examples indicate that instead of relying on symptomatic treatment, scientists are working on definitive, long-term treatment solutions at the genetic core of diseases. Now, though non-heritable or 'somatic' gene editing therapy has promising prospects for clinical trials, germline editing is fiercely debated. The usefulness of eliminating inherited diseases has great scientific attraction, but its risks and implications are to be thoroughly evaluated.

Although very promising, CRISPR has its own limitations. One of its biggest worries is off-targeting, where the Cas9 endonuclease can target and cleavage non-intended parts of the DNA, leading to deleterious mutations (Precision Clinical Medicine, 2021). Although inaccuracies are very small, they can prove dangerous when they target essential genes or regulatory elements.

Another issue is how to deliver CRISPR effectively into human cells. Standard ways using viral or lipid nanoparticles can cause immune reactions or cell toxicity or incomplete transduction (Memi et al., 2018). Another issue is mosaicism, where certain cells are not corrected uniformly, resulting in variable therapy responses (Genes & Diseases, 2016).

Long-term safety is still unclear, particularly germline alterations that are passed on to future generations. Scientists are working on new versions of the Cas protein and more accurate guide RNAs to improve specificity and reduce so-called off-target modifications to DNA or RNA (Pacesa et al., 2023). This progress needs to go together with trials and monitoring to bring CRISPR into widespread clinical use.

The most contentious issue in CRISPR technology is its connection to germline vs. somatic cell editing. While somatic cell editing refers to modifications within non-reproductive cells, making them non-transmissible to future generations and therefore safe for treating many diseases (Ormond et al., 2017), germline editing encompasses modifications within sperm, eggs, or embryos, which can be inherited by new generations.

Various ethical points are raised by criticisms. Germline editing abrogates the right of future generations to give their own consent for genetic modifications laid on them (Shinwari et al., 2018). The idea that "designer babies" can now also be created for non-therapeutic purposes sparks worries about equality and commodification of human life (Ayanoğlu et al., 2020). This would exacerbate inequalities in society where only those who can pay can gain enhancements.

For its supporters, germline editing can ensure the prevention of serious genetic diseases and so can promote compassion and solidarity in society (Memi et al., 2018). To mediate between these arguments means establishing well-delimited ethical tracks to separate therapy from eugenic manipulation.
Being an issue that has global implications, its regulation requires global collaboration. Various bodies, including World Health Organization and HUGO Ethics Committee, promote collaboration and proper focus on ethics to ensure that this technology meets its full promise (Ormond et al., 2017). Some scientists have called for a moratorium on germline editing pending a global consensus on its ethics and safety implications (Gostimskaya, 2022).

While regulatory strategies exist in the UK, where research on embryos is licensed very restrictively, and in the US, where research on germline cells has limited federal support, China 'in 2018 'embryo editing' controversy laid bare very grave regulation deficits. Such disparities point to the need for harmonized regulatory environments where misuse is prevented while facilitating innovations utilizing CRISPR technology that are informed by common values of responsibility, equity, and caution.

The future for CRISPR will involve precision clinical medicine, which is tailored to individual genetic makeup (Precision Clinical Medicine, 2021). It has great prospects for tackling difficult diseases including cancer, neurologic degenerative disorders, and metabolic disturbances. However, with its expensive form, gene therapy could enhance inequalities in global healthcare access to only wealthy countries (Ayanoğlu et al., 2020).

Public trust will require transparency, ethical research, and inclusive policymaking (Janik et al., 2020). Public education and international discussion are required to ensure that the development of CRISPR research meets standards of social justice. With proper regulation and ethical foresight, CRISPR can reshape biomedicine while maintaining human dignity.

CRISPR-Cas9 is a historical breakthrough allowing for corrective action in genetic disorders at 'the root level.' Its success in treating sickle cell anemia and cystic fibrosis illustrates 'the emerging paradigm for curative therapies' (Genes & Diseases, 2016). However, bioethical issues pertaining to germline editing, informed consent, and 'human enhancements are not to be dismissed either.' As frontiers of science stretch further, so does the demand for bioethics 'to assert its growing need.' Researchers are called to 'realize that its incremental expansion must align with its ideals – solidarity, security, and justice' (Memi et al., 2018). In conclusion, 'the future legacy of CRISPR will depend not only on its power but also on human wisdom in utilizing it for good – creating a bright future for both health and humanity.

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Can animal venom be safely used in medical treatment?

By Sita S 12.7

Venom – a substance feared by society. Its ability to kill is spoken of in great volumes of fear, fear that – in fact – overshadows its ability to heal. In recent years, animal venom has been discovered to have many medical applications. In fact, the "modern resurgence of interest in animal venoms is driven not only by the unique pharmacological properties of venom components but also by advancements in omics technologies, peptide synthesis, and structural biology." [1] What can this tell us? That the advancements in analysis of the composition of venoms have led us to discover their many beneficial properties. In this essay, I will be revealing the top uses of animal venoms and their potential future uses.

Before uncovering the uses of animal venom in medicine, it is essential to understand its basic structure. Venoms usually consist of "enzymes, proteins without enzymatic activity and peptides. Such a complex composition of the venom results in the combined effects on vital systems of the body and severe poisoning". [2] It is no wonder that venoms are perceived to be extremely deadly, as miniscule amounts can be lethal, due to their complex chemical structure. By isolating and researching specific structures in a venom, we can easily uncover how they can be used to better the future of healthcare. For instance, some venom proteins possess capability to cross the BBB (blood brain barrier). "These findings open up the new possibilities for emergence of medicines for the central nervous system treatment." [3] Perhaps these proteins can be used to transport chemotherapy drugs across the blood-brain barrier to cells in brain tumours, saving the lives of the 322,000 people a year who suffer from this condition?

Surprisingly, one of the most venomous animals in the world has already had its venom used as a treatment for several conditions, including bacterial infections and cancer. The scorpion is regarded extremely potent and deadly, yet its venom contains important anticancer peptides. "Anticancer peptides represent an important resource for the design of tumor-targeting drugs that could allow tackling the cancer development process from different angles. Some of these small molecules display efficient tissue penetration and uptake by the heterogeneous cancer cells." [4] It is important to note that while scorpion venom contains several beneficial compounds, its use as an anticancer treatment is largely anecdotal due to there being limited clinical trials to determine its safety and efficacy. Even though this is true, and the venom as a whole is hazardous, we should not ignore the fact it contains such factors.

The main question many ask is: how can we determine the safety of animal venom in medical treatment? It is fine to accept that, in theory, these venoms are advantageous, but we cannot assume that the reaction of extracted components with the human body will not trigger an unprecedented and unwanted result in patients. The answer? We must use clinical trials. "ReceptoPharm, United States-based biotechnology company, has completed phase I trials with modified versions of toxins from cobra venoms. The company plans to conduct further clinical trials in multiple sclerosis, motor neuron disease". [5] This is one of many examples of the biotechnological advancements of using venom in pharmacology – even though this company has only completed a basic trial, we can see that the safety of this venom in medicine is valid.

It is not just this one venom that must undergo such trials - all new potential drugs must undergo this same sequence of clinical trials. Phase I clinical trials are conducted on humans, not animals, so assurance that the drug reacted safely cannot be countered by the fact it wasn't tested on humans, meaning there is valid and reliable evidence to show that the drug is safe for humans.

This is, however, only one case – there are a multitude of venoms which have undergone this same style of clinical trialling and have achieved similar results. Therefore, it has been proven that clinical trials are the only way to determine the safety of animal venoms in medicine. "Clinical trials are essential for the development of new treatments. Whether a person should participate depends on their understanding of the risks and benefits for themselves and for society as a whole." [6] This systematic process will ensure that the desired extracted compound

will be objectively tested on a wide population, of not only patients but also healthy volunteers, to see not only overall safety but possible side effects. The fact is, with any sample, a larger sample size will increase reliability of results. This means that, when, for instance, testing for the effect of anticancer peptides on malignant tumours, testing on more people will allow for less anomalous results and more cohesive or concordant findings with less range.

Once we find out the safety of a component of animal venom, how are we to incorporate it into a drug compound safe for human consumption? Essentially, we need to synthesise the bulk drug (active ingredient) with several other chemicals. "The term bulk drug is used instead as descriptive of the physical and chemical character of the subject material, with its biological activity taken as obvious. Indeed, the conventional term for the other ingredients added to formulate the dosage form is still inactive pharmaceutical ingredients." [7] To put it in more simple terms, the active ingredient (the useful compound in the venom) is added to non-active ingredients that help keep the dosage and concentration of the active ingredient at a level safe for human consumption.

Some may argue that another issue of using animal venom in pharmaceuticals is that "is that the synthesis of the drug should be eventually amenable to cost-effective scale" [8] Extracting and purifying the active ingredient for pre-clinical trials may be impractical and expensive – indeed, when purifying the ingredient from venoms, extra care must be taken to not contaminate the ingredient with any toxic remnants, to ensure ethical concerns regarding the safety of animal and human subjects are addressed. However, this purification stage is used for extracting all active ingredients from any sample and therefore the cost will be similar for any bulk drug.

To conclude, it is impossible to generalise whether all animal venoms are safe to use in human medicine. While there is an abundance of various beneficial compounds and components in many venoms, each individual venom's active ingredient, once purified, must be tested safely in clinical trials to determine its safety for human or animal medicine and these results can vary massively depending on the substance being trialled. There are real-life examples of safe medicines that have been synthesised with an active ingredient from a venom, and this pattern may continue in the future to target diseases such as cancer, MS and many others, to better the quality of healthcare for generations to come.

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What are antioxidants, and do they really help prevent cancer or disease?

By Nishana K 12.8

Free radicals, characterized by the presence of unpaired electrons, are highly reactive species that play a significant role in human health (Chandimali, 2025). However, overproduction of these has detrimental effects on the body. They will disrupt the balance between oxidants and antioxidants, and they will lead to oxidative stress. Chronic conditions like cancer and CVD have been strongly associated with the harmful effects of free radicals. To keep a balance between oxidants and antioxidants, antioxidants are used- they hold a crucial role in neutralizing free radicals as well as reducing oxidative stress.

The bad thing is that free radicals can be found in environmental pollutants like cigarette smoke, which contain complex mixtures of free radicals and are polluted significantly- in 2023, 6 million adults in the UK smoked cigarettes. Another example is UV radiation.

Institute of Medicine of the US National Academy of Sciences states dietary antioxidants are defined as "a substance in foods that significantly decreases the adverse effects of reactive species, such as reactive oxygen and nitrogen species, on normal physiological function in humans." A well-balanced diet rich in fruits and vegetables containing antioxidants was shown to lower the incidence of prostate, breast, renal, and other cancers (Bennett et al., 2012). Some examples are substances derived from plants, fruits, vegetables, herbs, and other natural sources that possess bioactive properties that are beneficial for health; berries, nuts, apples, and plants.

In addition, further studies are required to determine the potential value of specific antioxidant nutrients and phytochemicals during radiotherapy for cancer (Weiss and Landauer, 2003). This shows that despite the numerical studies that prove the use and benefits of antioxidants, further research is needed. As research has progressed, it has become evident that antioxidants—especially in larger-than-usual amounts—may not always be beneficial. In fact, high doses of one antioxidant, beta-carotene, may increase the risk of lung cancer. Supplements of β-carotene, however, do not have an anti-cancer effect, rather the opposite in smokers (Halliwell, 2000). The fact that there is still some controversy about antioxidants despite them coming to large around the 18th-19th century shows that despite some positive feedback of their use, there is still some sort of risks that are yet unknown which could potentially cause harm than already present.

The main central theory is that free radicals resulting from natural oxidation can damage our cells; and cells protect themselves from free radicals by making or absorbing antioxidants (Scowcroft, 2009). Yet, if you increase the dosage of antioxidants, normally one would think that the benefits of it would also rise proportionally. However, it is far more complex than that. Like the use of analogues between a human and perhaps an animal, we cannot compare the results of a lab experiment to the effects on an actual human.

Generally, antioxidants can stop LDL cholesterol from oxidizing, meaning that there will be less fatty deposits in the lining of arteries so it reduces the likelihood of atherosclerosis, so therefore, allows the arteries to be elastic and can recoil and stretch to maintain blood flow. Also, it can prevent cataracts which are when the clear lens becomes cloudy due to the buildup of protein. This is by the consumption of Vitamin E & C. However, high dosages of Vitamin E can backfire as it can also increase the risk of hemorrhagic stroke which is when there is bleeding into the brain by a rupture of a blood vessel. Antioxidants, in some circumstances, could actually fuel the growth of cancer cells that have moved away from their normal surroundings (Barrie, 2009).

Moreover, despite the big three antioxidants (vitamins C, E, and β carotene) being most common, the most powerful antioxidant is Astaxanthin. It is reportedly 1000x stronger than Vitamin C & E and can be found in wild salmon, trout and lobster.

Overall, the effects of antioxidant compounds vary widely depending on factors such as compound type, dosage, route of administration, cancer type, disease stage, and genetic background (Schmidt et al., 2025). In the future, we expect antioxidants to play a larger role in personalized medicine and combating aging by targeting cellular damage. To sum up the benefits of antioxidants, we require them to support life by preventing oxidation and fighting off infections by the immune system. Yet, they can be detrimental if consumed in large quantities.

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What role do the human microbiome and gut-brain axis play in mental health disorders such as anxiety and depression?

By Mubarak H 12.8

Every human that has ever lived on Earth has felt some type of emotion, whether it be sadness, happiness, anxiety or even depression, we have all experienced some type of emotion. Now obviously you may assume its solely the brain in control of this however, studies show that human microbiome and the gut plays a leading role in affecting mental health. Roughly 90% of the body's serotonin, often referred to as the "happiness chemical," is produced in the gut, not the brain. The gut contains hundreds of millions of neurons, a vast network known as the enteric nervous system (ENS), which is more than in the entire spinal cord, leading some experts to call it the "second brain". The intricate relationship between the human microbiome and mental health has become a rapidly expanding area of scientific inquiry. A substantial body of research shows that the gut-brain axis—a bidirectional communication network linking the gastrointestinal tract and the central nervous system—plays a crucial role in regulating mood and emotional well-being (Cryan & Dinan, 2012). Studies demonstrate that alterations in the gut microbiota can influence neurotransmitter production, immune activation, and the hypothalamic–pituitary–adrenal (HPA) stress response, all of which are implicated in anxiety and depression (Foster, Rinaman, & Cryan, 2017). Evidence also indicates that individuals with depression often exhibit distinct microbial compositions, suggesting a potential causal relationship between dysbiosis and mood disorders (Jiang et al., 2015). Moreover, experiments transferring gut bacteria from depressed humans to germ-free rodents have been shown to induce depressive-like behaviors, further supporting a microbiome-mediated pathway (Zheng et al., 2016). As research advances, the microbiome is increasingly recognized not only as a key factor in mental health but also as a promising therapeutic target for anxiety and depression.

The gut–brain axis operates through a complex network of neural, endocrine, immune, and metabolic pathways that enable continuous communication between the gastrointestinal tract and the central nervous system. One of the primary routes is the vagus nerve, which allows gut microbes to influence brain activity and emotional regulation. Cryan et al. (2019) highlight that vagal signalling plays a crucial role in transmitting microbial signals that regulate stress, anxiety, and mood-related behaviours. In addition to neural pathways, microbial metabolites such as short-chain fatty acids (SCFAs) actively modulate brain function. According to Dalile et al. (2019), SCFAs help maintain the integrity of the blood–brain barrier and regulate neuroinflammation—key factors involved in anxiety and depressive disorders. These findings demonstrate that the gut microbiome is directly involved in shaping neurobiological processes relevant to mental health.

A growing body of research suggests that disruptions to the gut microbiome, or dysbiosis, are associated with anxiety and depression. Clinical evidence indicates that individuals with major depressive disorder (MDD) often exhibit lower microbial diversity and increased levels of pro-inflammatory bacterial species (Jiang et al., 2015). Such changes may drive chronic inflammation, which has been linked to altered neurotransmitter synthesis and impaired stress regulation. Experimental studies provide further support for a causal role of the microbiome in mental health disorders. Zheng et al. (2016) demonstrated that transferring gut bacteria from depressed human patients into germ-free rodents induced depressive-like behaviours and metabolic disturbances in the animals. These results underscore the possibility that gut dysbiosis contributes not only to the symptoms of depression but to its underlying biological mechanisms.

The emerging understanding of the gut–brain axis has stimulated interest in microbiome-based interventions for mental health conditions. Probiotics—often called “psychobiotics” when used to affect mood—have shown promise in reducing symptoms of anxiety and depression in both clinical and preclinical studies. For example, specific strains of Lactobacillus and Bifidobacterium have been associated with decreased cortisol levels and improved emotional regulation (Sarkar et al., 2016). Diet-based interventions, particularly those that increase fibre intake and promote SCFA-producing bacteria, have also been linked to better mood outcomes. Although more large-scale human trials

are needed, current evidence indicates that modifying the microbiome through diet, probiotics, or prebiotics may offer a novel adjunct approach to traditional psychiatric treatments.

The gut–brain axis functions as a multidirectional communication system involving neural, hormonal, and immune pathways that link the gastrointestinal tract with the central nervous system. A central component of this system is the vagus nerve, which serves as a rapid signalling route allowing microbial activity in the gut to influence brain function. According to Cryan and Dinan (2012), microbial signals transmitted through the vagus nerve can alter emotional processing, stress responses, and mood regulation. Additionally, gut bacteria produce key metabolites—such as short-chain fatty acids (SCFAs)—which have been shown to regulate neuroinflammation and maintain the blood–brain barrier, both of which are essential for healthy cognitive and emotional functioning (Dalile et al., 2019). These pathways demonstrate how the gut microbiome plays an active biological role in shaping mental health outcomes.

Overall, the research clearly demonstrates that the human microbiome and the gut–brain axis play an integral role in shaping mental health outcomes, particularly in relation to anxiety and depression. Through interconnected neural, immune, and metabolic pathways, gut microbes influence key processes such as neurotransmitter production, stress regulation, and inflammatory responses. Evidence from both clinical and experimental studies shows that disruptions to the microbiome are linked to depressive and anxiety-related behaviours, suggesting that gut dysbiosis may contribute to the onset or severity of these disorders. At the same time, emerging therapeutic approaches—including probiotics, dietary interventions, and microbiome-targeted treatments—highlight the potential for modulating gut bacteria to improve psychological well-being. While further research is necessary to fully understand these mechanisms and translate them into clinical practice, the microbiome represents a promising frontier for the development of novel, biologically informed strategies to support mental health.

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"Hormones, Hysteria, and the Half-Tested Body: What Does Medical Experimentation Reveal About Gendered Science?"

By Tia T 12.9

Gendered science: a term which (in the eyes of the American Psychological Association) refers to the "examination of how gender can influence scientific inquiry and practices" (Kirschner, S. R. 2020) It is a topic that has only just begun to gain attention in the scientific and medical worlds alike. There are many layers to this issue within medical testing and experimenting, as well as availability for women trying to get into a career in medicine. With ideas surrounding gender bias affecting children as young as 11 years old (Gauthier, G. Robin 2017), it is vital that we, as the next generation are aware of the historical bias women are up against when entering the medical world, or looking for advice concerning our health and medical care we have access to.

As our society has evolved and expanded in the last 100 years, aiming to become more inclusive and accepting of different minority groups around us, the largest of those groups is women. Women make up 49.73% of our population (United Nations 2024), and yet the society we live in today, for all its modern developments that are propelling us into the future, is still passively influenced by ancient and damaging stereotypes. Looking back, people have only recently allowed their eyes to be opened to the drastic changes needed to take place for our community to be more inclusive and equal. As a woman we face challenges in almost all aspects of life, whether it is workplace inequality, with the gender pay gap, lack of representation in the media and important positions of power, or even out own safety and mental health. However, the most frustrating as someone growing into a young woman, is the lack of medical testing and experimentation into the female body.

The female body, as we all know, is vastly different to that of our male counterparts. We are impacted different hormones, have different organs, metabolize medication differently and yet most medical devices like pacemakers and stents are curated to fit and operate in a male body (Phillips SP, Gee K, Wells L 2022). They often pose major risks when implemented into a woman's body as they are not calibrated to be working in such a different environment. This is purely due to the lack of medical testing involving women in their studies. Women have repeatedly not been represented in clinical trials, with a clinical trial into implantable cardioverter-defibrillators (ICDs) illustrating this gender blindness. Fifteen of 126 participants in the sole pre-market study were women (Phillips, S.P., Gee, K. and Wells, L. 2022), making only 11.9% of the test subjects female.

Medical testing, or lack thereof, can also have detrimental effects on mental health as well as just physical health. Chronic conditions, health conditions, or diseases that are persistent or otherwise long-lasting in their effects or a disease that comes with time (Bernell S, Howard SW 2016-08-02). It is no surprise to most women being told by a doctor that the pain she is imagined- or psychosomatic, a term referring to the pain being "imagined." Healthcare providers often dismiss or minimize women's pain, labeling it as "emotional" or "psychosomatic" rather than physical (Samulowitz et al., 2017), and despite any recent medical advancements, women frequently face underdiagnosis and inadequate treatment of pain (Pieretti et al., 2016). Some of the most painful chronic conditions are predominantly affecting women, yet research into treatment remains minimal or methods are inaccurate. There is a significant bias against women who attempt to access healthcare or treatment (Halas, Mary A 1979), even though women both outlive men, and undergo more complex medical procedure than men do (Keville, T.D. 1993). And yet due to lack of research into potential treatments or the background of chronic conditions affecting women, a sizable percentage of the female population is forced to live in unimaginable amounts of pain. Lupus is a chronic disease that can cause inflammation and pain in any part of your body. It is an autoimmune disease, which means that your immune system that usually fights infections — attacks healthy tissue instead. Around 90% of those diagnosed are women, often between ages 15 and 44. (Lupus Foundation America 2020). Despite it being such a widespread and painful condition, there is currently no cure, with treatments only available to reduce pain. Another autoimmune disease is rheumatoid arthritis. It causes joint inflammation and stiffness and affects women two to three times more than men. This often-debilitating condition disproportionately affects women. Only in the last

decade have researchers such as Arizona State University's Melissa Wilson, a chromosomal biologist, started examining whether these diseases might have an evolutionary connection to pregnancy. Her work, she says, gives us a blueprint for how sex differences may influence disease (Wheeler 2024). Endometriosis and polycystic ovaries syndrome (PCOS) are conditions that both affect only women, and yet research into treatment once again remains minimal. Both are extremely painful conditions affects menstrual cycles, fertility, and metabolic health. Both have a suggested treatment of taking birth control pills which already have several dozen added risks to them and can have long term detrimental effects on the sufferer's fertility. The list, in terms of chronic afflictions affecting predominantly or exclusively women is extensive and that was just a few of the many. Cancer is also another area of medicine where women are at a disadvantage. 96.5% of men survive testicular cancer for 10 or more years, but this percentage decreases for women with breast cancer with 76.6% females survive breast cancer for 10 or more years (Cancer Research UK 2018). The number of deaths between the years 2021 and 2023 also vary, with only 70 deaths from testicular cancer but 11,200 deaths from breast cancer in females (Cancer Research UK 2023). Much of the silent battle against said chronic conditions can lead to mental health problems like anxiety and depression. Depression is another condition affecting 1 in 8 women in their lifetime, twice the rate of men (a 2:1 female predominance) (Paykel ES 1991), and yet it is often brushed of as an exaggeration and/or imagined.

Medical testing also puts women at a disadvantage, with too many studies into finding medication omitting women. For example, AIDS studies frequently omitted women in their tests even though they are the fastest growing infected population (Keville, Terri D 1993). Similarly, in a piolet project of how obesity impact breast and urinary cancers, the primary test subjects were white males (Dresser 1992). Women remain less likely to be included in clinical trials—they make up only 41 percent of total clinical trial participants, according to a 2022 meta-analysis, which found even fewer female subjects in early-stage clinical trials, designed to test experimental therapies for safety and evaluate potential doses.(Wheeler 2024). This lack of testing can lead to dangerous circumstances, like the over or under dosing of medication for women, as a safe accurate dose range has not yet been investigated into. A 2022 study found complex reasons behind different drug reactions related to sex beyond weight—including hormones, fat distribution, and immune response. Propofol, for example, is an intravenous anesthetic agent used for induction and maintenance of general anesthesia (PubChem. "Propofol" accessed 2025). Females may require a higher infusion rate of propofol than males to achieve adequate sedation while undergoing implant-related surgery. (Maeda, Shigeru 2016)

The issue of lack of research into the female body is something we can no longer ignore. We are living in the 21st century with ample resources and test subjects who are more than willing to put themselves forward for medical experimentation and clinical testing and trials. To help contribute to new and very much overdue change that is required within our so-called 'modern' civilization. In some places change has begun, at a slow rate, but it is still happening. However, until safe and effective medical treatment is available to all people worldwide, will we as a society be able to say we are even close to being equal.? Because as Melissa Wilson of Arizona State once said, "We could do better".

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How can CRISPR gene-editing technology be used to treat genetic diseases, and what are the ethical implications of its use in humans?

By Dia C 12.9

CRISPR, otherwise known as Clustered regularly interspace short palindromic repeats, is an immune system that is used by microbes to recognise and eliminate invading viruses (Qi, 2014). More specifically, CRISPR gene-editing refers to technology that can edit and modify DNA of living organisms. Over the last decade, the use of this gene-editing technology has rose exponentially, as researchers are not wasting any opportunity to try implement this technique into modern medicine, for example, xenotransplantation, therapy for type 1 diabetes and human viral diseases (Karpov, 2024) and especially in personalised medicine to help prevent genetic diseases. Although the effects of CRISPR are and will continue to be revolutionary, should we not stop to consider the ethical issues that lie with this advancement in technology? Editing of human embryos is technically possible, but remains highly controversial due to concerns about safety, off-target effects (Knoppers and Kleiderman, 2019) , and heritable genetic changes. Considerably, germline editing can be easily misused by trying to edit non-medical and non-life-threatening traits, such as height and overall physical appearance. So where do we draw the line?

According to a report published by MJH Life Sciences (U.S.) in 2022, approximately 300,000 babies are born with sickle cell disease per year globally, and nearly 5% of the world's population is affected by the disease . Evidently, the rate of this genetic blood disorder is increasing, scientists needed to find a way to stop this issue at the root, to prevent it from developing in foetuses, and the answer to this may be CRISPR. "CRISPR is not merely a tool for research. It's becoming a discipline, a driving force, and a promise that solves long-standing challenges from basic science, engineering, medicine, and the environment," said Stanley Qi, an associate professor in the Department of Bioengineering and institute scholar at Sarafan ChEM-H (Qi,2014). CRISPR has two components: a single guide RNA molecule (sgRNA), which is specifically designed to seek and bind to precise targets in the genome that are to be modified; and an associated enzyme, Cas9, which cuts the DNA at the target site and initiates the genetic modification process (Jarrod, 2019). Compared to typical gene editing, CRISPR's target recognition sequence is mostly encoded within an RNA rather than a protein, and redesigning this sequence is one of the simplest things you can do in molecular biology. As a result, this tool dramatically reduces the burdens, cost, timing, while increasing the precision and accuracy of a gene-editing system (Qi, 2014).

Notably, in late 2023, the FDA approved a cell-based gene therapy called CasgevyTM for the treatment of sickle cell disease. CasgevyTM is the first FDA-approved therapy utilizing CRISPR/Cas9-based genome editing technology (Karpov, 2024) which proves how there is real application of CRISPR gene-editing in humans, demonstrating how this new technology allows people to hope to cure hereditary diseases, maybe even before they are born. Antenatal screening tests are offered to women who have a higher chance of passing down genetic diseases, and by using amniocentesis to identify whether these foetuses have these disorders, we can use CRISPR gene editing to correct harmful mutations before birth. However, the target efficiency of CRISPR in natural health products (NHPs) is still low as "successful gene replacement in monkeys via the CRISPR/Cas9 system remains elusive, possibly due to the complexity of DNA repair mechanisms in monkeys" (Luo et al., 2016, p. 242), and "there are still some technical limitations for its use in non-human primates" (Guo and Li, 2015).

Although the use of this technology is relatively new and needs to develop, the impacts this could have on mortality rate is extraordinary: from battling inherited diseases to advanced cancers, CRISPR will be the forefront of medicine-to cure someone before they are even born. In utero editing offers the potential to target genes before disease onset, critical for diseases with high prenatal or perinatal morbidity and mortality (Rossidis et al, 2018). However, researchers are struggling to draw an ethical boundary on the extent at which the gene-editing technology can be used. Heritable genome editing could, in principle, be carried out in human embryos, but the scientific and ethical uncertainties are profound. Known as 'designer babies', their DNA has been edited, normally for inherited diseases that would have a detrimental impact on their quality of life. However, this technology is too new to determine the long-term effects of CRISPR. But do the benefits outweigh the risks? The global burden of genetic diseases seems

to be increasing, with it being estimated that 5.3% of newborns will suffer from a genetic disorder, when followed up until the age of 25 years (Verma and Puri, 2015) . Although CRISPR is meticulously precise, can we solely rely on this technology and put in its hands the future of many embryos without fully outweighing the risks? Not to mention the evolutionary effects that we have yet to consider. "With this technology, one person can decide to edit a lab organism that—if released—will change the entire species," said Kevin Esvelt, Massachusetts Institute of Technology. No such change should be broached without consideration of whether it can be ensured that any proposed use would conform to […] the welfare of the future person and the principle of social justice and solidarity, according to the Nuttfield Council on Bioethics (2018).

In conclusion, CRISPR represents one of the most powerful breakthroughs in modern science, offering limitless potential to treat, prevent, and possibly eliminate genetic diseases that have affected humanity for generations. The success of therapies such as Casgevy demonstrates that this technology is no longer a theory but has already begun reshaping clinical medicine. However, the same qualities that make CRISPR so revolutionary also make it difficult to navigate and integrate it safely into medicine. This is because its limitations, such as off-target effects and variable efficiency, show that it is not yet perfect and requires refinement, while ethical concerns surrounding embryo editing, heritable changes, and the possibility of "designer babies" reveals how easily this could be misused.

Ultimately, I believe the question is not whether CRISPR gene-editing will influence modern medicine, but whether society establish strong boundaries and regulate its use to ensure CRISPR is not misused, because it easily has the power to change the successive human generations. Technology will continue to develop, and it will always have its benefits and risks, but it's our responsibility to ensure the risks remain lower than the benefits. CRISPR should be a tool to prevent and eliminate disease, rather than a tool that causes irreversible harm and creates new forms of inequality.

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How can advances in personalised medicine improve cancer treatment outcomes based on individual genetic profiles?

By Pranshu P 12.10

Personalised medicine, also known as precision medicine, is becoming one of the most important changes in cancer treatment today. In the past, most cancer patients received very similar treatments, even if their tumours were biologically different. This meant that some people responded well to treatment while others did not. With new advances in genetic sequencing and molecular testing, doctors can now choose treatments based on a patient's individual genetic profile, including inherited variations and tumour-specific mutations (Collins & Varmus, 2015). This approach has the potential to make treatments more effective, reduce harmful side effects, and help doctors predict how a patient might respond. Since cancer is such a varied disease, a personalised approach recognises that two patients with the same type of cancer may still need very different treatments.

A major way personalised medicine improves cancer care is through genomic profiling. Modern sequencing technology can identify important mutations that help the tumour grow. Once these mutations are found, doctors can select targeted drugs designed to block specific pathways that cancer cells rely on (Mardis, 2018). For example, patients with EGFR mutations in non-small cell lung cancer (NSCLC) often benefit much more from drugs like gefitinib or erlotinib compared to standard chemotherapy (Zhang et al., 2016). Similarly, breast cancer patients with HER2 amplification can be treated with trastuzumab, which has been shown to improve survival rates (Slamon et al., 2011). Without genetic testing, these patients might receive less effective treatments, so genomic profiling helps ensure they get therapy that targets the exact weakness in their cancer.

Another advantage of personalised medicine is reducing unnecessary toxicity. Standard chemotherapy affects both cancer cells and healthy cells, which leads to strong side effects. Genetic testing helps doctors avoid treatments that are unlikely to help a patient, which prevents them from going through painful or risky side effects for no benefit (Tsimberidou et al., 2014). Pharmacogenomics — the study of how genes affect drug metabolism — also helps doctors tailor drug doses. For example, patients with certain DPYD gene mutations are at high risk of severe reactions to fluoropyrimidine drugs. By testing for these mutations beforehand, doctors can adjust doses to keep the patient safe (Boisdron-Celle et al., 2017). This means personalised medicine not only improves how well treatments work but also reduces the physical burden on patients.

Immunotherapy is another area strengthened by personalised medicine. Some tumours have large numbers of mutations, making them easier for the immune system to recognise. These patients are more likely to respond to immunotherapy drugs such as pembrolizumab (Goodman et al., 2017). Biomarkers like microsatellite instability (MSI-H) or mismatch-repair deficiency (dMMR) now guide doctors when deciding whether immunotherapy is suitable. Because these biomarkers predict success so well, pembrolizumab became the first cancer drug approved for any tumour showing MSI-H/dMMR characteristics, regardless of where in the body the cancer began (Le et al., 2017). This shift from treating cancers by location to treating them by genetics shows how powerful personalised medicine can be.

A recent technology that supports personalised treatment is the liquid biopsy. This simple blood test looks for circulating tumour DNA (ctDNA) to detect mutations, monitor treatment progress, and identify new drug resistance (Wan et al., 2017). Unlike traditional biopsies, which are invasive and examine only one part of the tumour, liquid biopsies show real-time changes in the whole tumour. For instance, in EGFR-mutant lung cancer, the appearance of the T790M resistance mutation can be detected through ctDNA. Once this mutation is seen, doctors can switch to osimertinib, a drug that specifically targets this resistance (Yu et al., 2018). This allows treatment to be adjusted quickly, helping delay or prevent treatment failure.

Although personalised medicine has many advantages, there are challenges. Not every mutation found through genetic testing is easy to understand; some are called "variants of unknown significance," which means doctors do

not yet know what they mean for treatment (Meric-Bernstam et al., 2015). Cancer cells can also change over time and develop new ways to resist targeted therapies (Holohan et al., 2013). This means doctors often need to repeat testing and sometimes use combinations of treatments. Another issue is cost: genetic testing and targeted drugs can be expensive, and not all hospitals or patients have access to them (Tsunematsu et al., 2020). To fully benefit from personalised medicine, healthcare systems need to improve access, technology, and funding.

Even with these challenges, continuous scientific progress is strengthening personalised medicine. Artificial intelligence (AI) and machine learning are now used to analyse large genetic datasets and identify new biomarkers that may guide future treatments (Libbrecht & Noble, 2015). Scientists are also combining information from different fields such as genomics, proteomics, and metabolomics to gain a more complete understanding of tumour biology. This helps researchers design even more specific and effective treatments. As databases grow and technology improves, personalised cancer treatment will become more accurate and more widely available.

In conclusion, personalised medicine has transformed cancer treatment by matching therapies to each patient's genetic profile. Through genomic testing, targeted therapies, pharmacogenomics, immunotherapy biomarkers, and liquid biopsies, doctors can choose treatments that are more effective and safer. Although challenges such as cost, genetic uncertainty, and treatment resistance still exist, the overall impact is extremely positive. As technology continues to advance, personalised medicine is expected to become even more central to cancer care, improving survival and quality of life for many patients.

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What is the role of genetic and environmental factors in the development of personality disorders?

By Molly R 12.10

According to the Diagnostic and Statistical Manual of Mental Disorders – Fifth Edition, personality disorders (PDs) are defined as an enduring, inflexible pattern of inner experience and behaviour that deviates from a person's culture (American Psychiatric Association, 2013). In some cases, PDs can result in impulsive acts of violence, which eventually translate into recidivism. As a result, PDs can be classified as a prominent factor when delving into the justifications for criminality. However, whilst we can comfortably conclude PDs to be one of the many reasons for violent crime, the root of PDs is yet to be investigated – do they stem from complexities in our genotypes, or the influences in our surroundings? This essay will centre around this, concerning whether the cause of PDs resides on the nature or nurture side of this deliberation. Whilst applying my ideas in a forensic context, I will explore the evidence supporting both genetic and environmental influences in forthcoming PDs, such as neurochemistry and twin studies, and my opinion on the debate, which is how PDs are produced through an interaction of nature and nurture.

Primarily, there is a variety of evidence which connotes how PDs can arise due to genetic and neurobiological factors. For instance, twin studies have generated findings which demonstrate that there are higher concordance rates for PDs in monozygotic twins against dizygotic twins (Livesley et al., 1998). This indicates how hereditary components have a profound impact on the development of PDs, as it is visible that similar genotypes do shine through in the PD phenotype amongst identical (MZ) twins. Meanwhile, abnormal levels of specific neurotransmitters have also been correlated to PDs. Specifically, serotonin (responsible for regulating mood) in low levels alongside high activity of dopamine (responsible for reward-driven behaviour) have been proven to reduce individuals' capacity to control aggressive impulses (Seo et al., 2008). Consequently, this impulsivity can evolve into PDs such as borderline personality disorder, and eventually into risky, criminal behaviours like substance misuse and homicide. Furthermore, in cognitive neuroscience, malformations in brain structures, including the prefrontal cortex and amygdala, have been associated with failure to empathise with others and poor risk assessment (Blair, 2007). These traits may be expressed in the form of PDs, particularly antisocial personality disorder (Raine et al., 1997), and in a forensic context, both violent and sexual assault, because offenders struggle to possess any concern for victims – they lack a clear conscience in their actions. Therefore, twin studies and evidence from both neurochemistry and cognitive neuroscience suggest a strong genetic factor in the development of PDs, potentially resulting in recidivist, antisocial behaviour.

On the other hand, environmental influences can play a significant role in acquiring PDs. For one, childhood trauma has been consistently tied to an inability to regulate our emotions, in addition to impulsivity and maladaptive personality traits. In particular, those exposed to abuse, neglect, or domestic violence at a young age were found to be more likely to display antisocial behaviour in adulthood (Farrington, 2005). This illustrates how instability in early environments can shape the foundations of PDs, in this case including borderline or antisocial personality disorder. Furthermore, classical conditioning also elaborates on the development of PDs: if a child repeatedly associates aggression or manipulation (behaviours parents may exhibit) with safety or attention (behaviours parents are culturally expected to exhibit), these behaviours may later form part of their personality structure. Operant conditioning reinforces this further; if an individual were to receive rewards, particularly intrinsic emotions such as pride, for committing offences, the behaviour may be encouraged and more likely to reoccur. This is evident in forensics, as recidivism can be continued for individual offenders through positive reinforcement when the offender perceives crime as thrilling, profitable, or empowering. Additionally, vicarious reinforcement may occur when high-profile serial killers, for example Jeffery Dahmer, are glorified by the media, normalising violence among vulnerable individuals (Hickey, 2015). Environmental factors thereby offer an alternative break-down of how PDs may arise, including childhood trauma, conditioning, and vicarious reinforcement.

However, in my overall opinion, it is most plausible to declare that PDs develop from an interaction between genetic vulnerabilities and environmental stressors, as proposed by the diathesis-stress model. This theory argues that individuals may inherit predispositions for traits such as impulsivity or emotional dysregulation, but these traits consolidate into PDs when only specific, high-intensity environmental conditions trigger them (Caspi et al., 2002). The diathesis-stress model is regarded as highly valid in psychology, as it provides sufficient reasoning for many ambiguous concepts – not only PDs. For example, an individual can inherit a genetic vulnerability to addiction, but this can only be triggered by peer pressure, which acts as an environmental stressor. In forensic psychology, this interaction between nature and nurture can be expressed in the case of famous American serial killer Ed Gein. Although some researchers have hypothesised about biological abnormalities contributing to psychopathic traits (Glenn & Raine, 2014), environmental triggers are very much present in Gein's upbringing. His mother, Augusta, vigorously enforced a puritanical belief system, inducing fear, guilt and emotional isolation throughout his childhood. This environment likely interacted with genetic vulnerabilities, gradually constructing traits which characterise psychopathy, such as emotional detachment and distorted moral reasoning (Hare, 2003). Gein also developed abnormal associations between death, identity, and affection. These are behaviours that can be understood through classical and operant conditioning, as repeated exposure to his mother's forceful, moral teachings, alongside prolonged isolation on the farm contributed towards his distorted personality structure (Hickey, 2015). Therefore, both Gein's genetic predispositions and his traumatic early environment resulted in the emergence of violent, antisocial behaviour, which can be categorised as the PD psychopathy.

In conclusion, this essay has explored the role of both genetic and environmental factors in the development of PDs, focusing in on a forensic context. Evidence from twin studies, neurochemistry, and cognitive neuroscience depicts how biology in itself can predispose individuals to impulsivity, emotional dysregulation, and diminished empathy, which significantly heighten the risk of criminal offense. Conversely, environmental factors including trauma, conditioning and reinforcement mould maladaptive behaviours, eventually contributing to the emergence of PDs. However, an interactionist approach better encapsulates the complexity of PD development than either genetic or environmental explanations alone. As illustrated through the diathesis-stress model and the case of Ed Gein, it is the interaction between genetic vulnerabilities and environmental triggers that best explains how PDs develop and are expressed in violent recidivism.

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