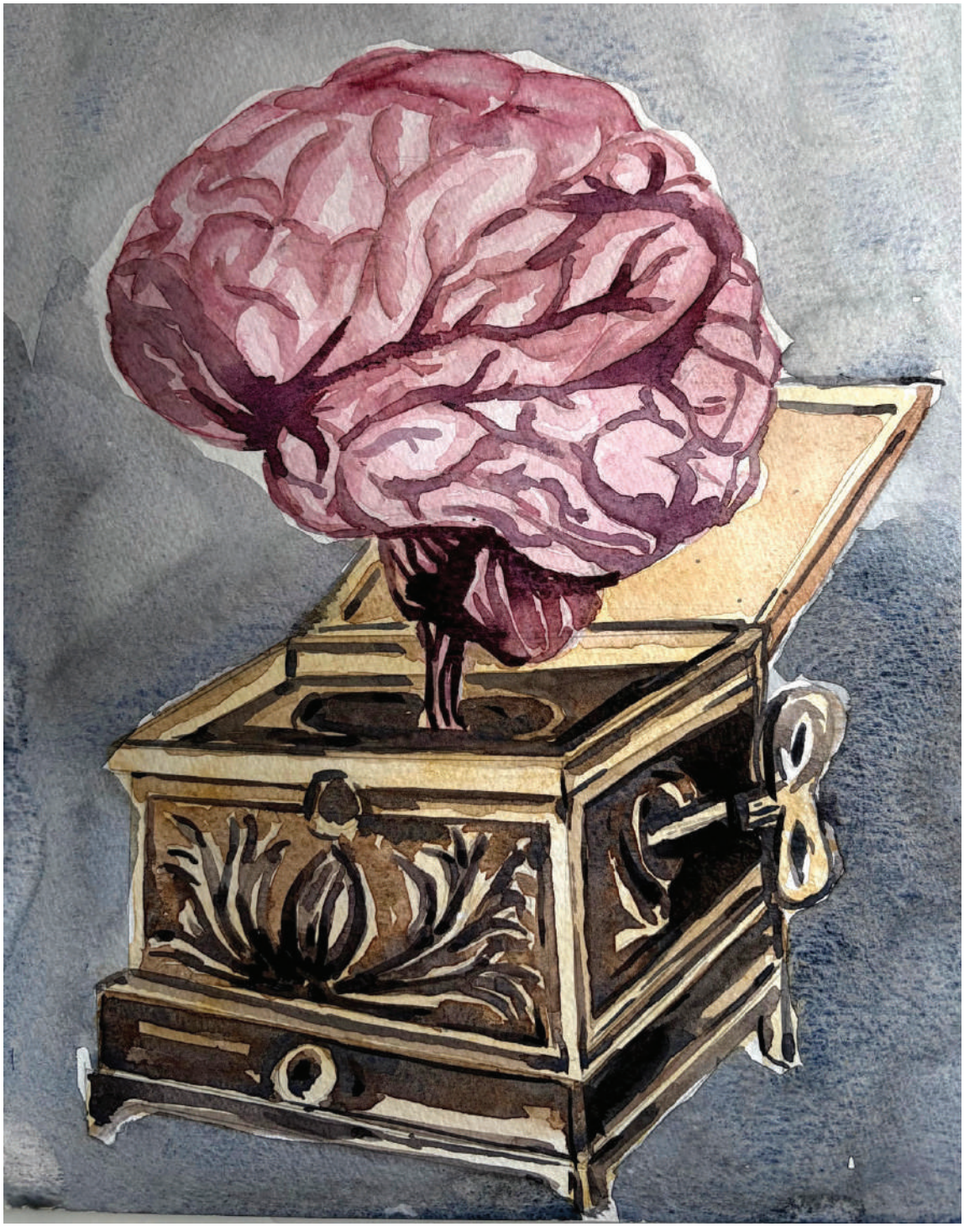
MAZE

ISSUE X

University of St Andrews Psychology and Neuroscience Magazine



Inside the Mind's Music Box

There's a certain kind of image that doesn't just catch your eye, it unsettles something beneath it. The cover for this issue of MAZE captures that feeling precisely. At first glance, the illustration seems nostalgic, portraying a wind-up music box, the kind that brings back childhood melodies. But instead of a ballerina turning at its centre, a human brain rests inside. An organ that is typically associated with abstract thought, imagination, and memory is now placed in a container built for repetition. The winding key jutting from its side glints with the suggestion of intervention. This represents the forces that wind us up, shaping our habits, steering our emotions, and nudging our thoughts. These include societal pressures, our beliefs, expectations, and childhood conditioning that tighten this key, often without our conscious permission. Yet the image doesn't claim that the mind is purely mechanical. Rather, it highlights the tension at the core of being human: our minds are influenced by patterns and pressures, but never defined by them. A music box plays a fixed tune, but a mind holds symphonies that are constantly being rewritten. Therefore, if these mechanisms exist, they can be understood, questioned, or reshaped. So as you open this issue, I hope you follow the threads that tug at your curiosity. Let yourself question what feels familiar. And perhaps, look inward at the quiet workings of your own mind and consider which parts you're finally ready to reshape.

LETTERS FROM THE EDITORS IN CHIEF

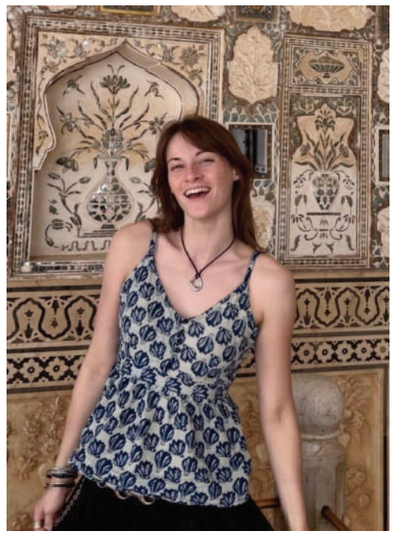
Dear Readers,

Effective writing has the power to stop us for a moment. Our attention, captured by words methodically placed on a page, and in that stillness, a shared understanding emerges. We find reflections of our own lives written in someone else's words, and in that recognition, we find comfort. Writing can so beautifully capture the shared human experience, and it is for this reason that I am particularly excited to share this newest issue of MAZE Magazine with you.

Our writers have found themselves drawn towards topics exploring the psychology and neuroscience behind human emotions, delving into the complexities of how the brain processes love, nostalgia, and grief. This issue also branches beyond these themes to examine therapeutic alternatives, decision-making under pressure, the lasting legacy of trauma, the mechanisms behind deja vu and focus, and novel innovations rehabilitating speech in aphasia patients and enabling non-invasive brain cancer detection.

This issue, and MAZE's continued growth and success, would not be possible without the dedication and inspiring passion of our MAZE team. Not a semester goes by without me being blown away by the raw authenticity and care poured into MAZE Magazine. Its pages never fail to instil a sense of awe, as readers flick through thought-provoking art and writing, masterfully assembled and designed by a group of talented students who strike the balance between creativity, deadlines, and coursework without ever compromising on quality. What stands out to me in this issue is that these pages form a narrative of love, not only in the research topics they share, but the love put into every part of how that story ended up in your hands.

Serving as co-Editor-In-Chief for the past year has been a privilege words cannot begin to capture. As this is my final co-EIC letter, I wanted to take a moment to express the immense pride I have felt in holding this role within MAZE. Being part of the MAZE Magazine family has been not only an honour, but a true highlight of my time at the University of St Andrews. I have been fortunate enough to share the role of co-EIC with my wonderful fellow co-EIC Giulia Schuster, whose guidance and leadership have been instrumental in carrying MAZE to where it is today. I cannot wait to see where she takes the magazine next. Though I am incredibly sentimental at the thought of leaving MAZE after graduation, I am grateful to be delaying that departure and returning as a writer for our next issue.



I will be passing my Co-EIC role to my successor, Lisa Lavrova, whom I am confident will thrive in this position and undoubtedly carry MAZE to new heights.

With that, it is with great pride that we present the newest edition of MAZE Magazine, Issue X. I truly hope you enjoy it!

Sincerely,

Hannah Betts,

MAZE Co-Editor-In-Chief

Dear Readers,

It is my absolute pleasure to introduce to you the 2025/2026 Semester 1 issue of MAZE Magazine! From articles uncovering the truth about common psychological misconceptions to analysing the effect of love on the brain, this magazine tackles a myriad of fascinating discoveries and perspectives that will leave you in awe of the field of psychology and neuroscience.

With the start of a new year and new semester, last year's highlights inevitably come to mind. In addition to publishing our latest magazine, we also hosted an incredibly successful Psychology and Neuroscience Internship Panel, held a bake sale, participated in the Fresher's Fayre, and sold last semester's magazines. This is all thanks to the teams that make the backbone of MAZE, from the Heads of MAZE overseeing events, art, social media, writing, editing, fundraising, design, and secretarial duties, to the members of MAZE who went above and beyond our expectations to produce such masterpieces of work. This is especially inspiring when considering that the members of this society performed these roles and even volunteered for additional duties, all while balancing university coursework, internship applications, and more. The work that our team has put into this magazine is truly admirable and none of this would have been possible without their dedication.

This will be the second issue published during my time as co-Editor-in-Chief, therefore marking a one-year milestone as co-President to this St Andrews Union-Affiliated Society. Having started in this society as a part of the editing team two years ago and working my way through to co-EIC, I feel an immense pride and gratitude for what this magazine has accomplished and continues to achieve.

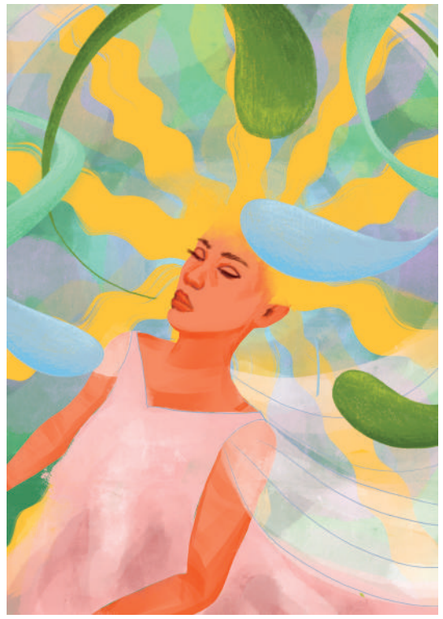
Most of all, I would like to thank Hannah Betts, my fellow co-EIC, for all the incredible work she has put into this Society. I wish her well in her last semester of university and could not have been more grateful to have learned from her these past two semesters. This upcoming semester, we are delighted to introduce a few new Heads of the Team: Meg Thomson, Sarannya Nanda, and Lisa Lavrova, who will be taking over as Head of Events, Head of Artists, and co-EIC alongside me!

We are looking forward to what this new semester will bring for MAZE, and are excited to have you along for the journey. Happy reading!

Best regards,

Giulia Schuster

Co-Editor-in-Chief



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The Sleeping Mind

This section explores what happens when our minds drift into sleep. Neuroscience and psychology meets the subconscious through a lens of perception, consciousness and imagination. Here, we unpack how dreams form, what they might mean psychologically, and how different theories from fundamental psychologists or contemporary neuroscience approach dream interpretation. Topics such as dreaming, nightmares, memory consolidation during REM sleep, and the link between sleep quality and mental health will be covered. This aims to bridge the line between hard science and understanding your own subconscious being as it influences your habits, beliefs, reactions, and decisions. How can university students understand themselves better when they are both asleep and awake? Consider this the guide to introspection and what your dream journal means.

Edited by Kat Roush

From Chaos to Calm: Why Letting Your Thoughts Wander Helps You Fall Asleep Faster

by Isabella Abbott

How often have you been drifting toward sleep and, out of nowhere, a long-forgotten childhood memory flashes through your mind? Or a half-finished task from earlier in the day suddenly jolts you awake? The moments before we fall asleep are often filled with thoughts, feelings, and dreams, but why is this? These strange, unpredictable thoughts that surface just as we are slipping away aren't random at all. In fact, they are a key feature of an essential phase of falling asleep, known as hypnagogia. Everyone, including you and I, experience this phenomenon before we fall asleep. The exploration of this twilight zone between consciousness and dreams, or hypnagogic state, will unveil an understanding of sleep, and how we can use this as a helpful sleep aid.

What is Hypnagogia?

Hypnagogia, according to Schacter (1976), refers to "spontaneously appearing visual, auditory and kinaesthetic images; qualitatively unusual thought processes and verbal constructions; tendencies towards extreme suggestibility; symbolic representations of ongoing mental and physiological processes; and so on" during the short period before you fall asleep (Schacter, 1976). Hypnagogic states occur during sleep-onset (falling asleep), while the state during sleep-offset (awakening) is known as a hypnopompic state (Ghibellini & Meier, 2022).

Hypnagogic imagery is one of the most prevalent symptoms during hypnagogia, which can range from vague impressions to fully formed images and full hallucinogenic dreams (Noreika et al., 2015). This phase during sleep-onset is also associated with hypnic jerks, an interesting phenomenon involving a sudden, startling, wake-up during the hypnagogic period (Whitney & Weiss, 2018). These jerks can often be unnerving and can provoke anxiety, and even insomnia in some people (Whitney & Weiss, 2018). The brain areas associated with hypnagogia can be seen in an EEG hemispheric asymmetry analysis study, where it was found that linguistic intrusions or hallucinations had higher alpha and gamma power in the left hemisphere electrodes and perceptual imagery hallucinations held an association with higher beta power in the right hemisphere (Noreika et al., 2015). This shows that modality of hypnagogic experiences are associated with distinct EEG results. Clearly, hypnagogic states can be associated with specific parts of the brain, providing an interesting view, as different brain areas correlate with different symptomatic aspects of hypnagogia.

Hypnagogia is an essential part of falling asleep, but comparatively little is known about it. It has been suggested that hypnagogia plays an essential role in sleep for many reasons. For example, in a study by Lacaux et al. (2022), it was found that the initial onset of sleep (hypnagogia) was important for memory consolidation and was a distinct physiological phase with its own memory processing dynamics (Lacaux et al., 2022). Disrupting this period of sleep-onset had a negative impact on memory consolidation. Although an extremely brief part of the sleep process, hypnagogia represents a unique window in the brain as it shifts from awakeness into sleep. Dysregulation of the sleep-onset process is associated with sleeping disorders such as insomnia and narcolepsy (Gottesmann, 1999). It is therefore necessary to understand this process in order to help treat these disorders. Therapeutic practices that incorporate hypnagogic imagery, relaxation and mindfulness techniques have shown improvement in improving sleep-onset (Ong et al., 2012).

Sleep Paralysis and Exploding Head Syndrome

Other sleep-phenomena that share similarities with hypnagogia, have much more intense symptoms. For example, during sleep paralysis, voluntary muscle movements are inhibited during brief periods of awakeness, whilst sleeping (Denis et al., 2018). This provides a very distressing experience for the sufferer as they lie awake, unable to move. These episodes can also include hallucinations and pressure felt on the chest (Denis et al., 2018). Sleep paralysis is also associated with other sleep-disorders such as narcolepsy and cataplexy. Whilst not a common symptom of hypnagogia, sleep-paralysis generally occurs during this period of sleep-onset or offset (Denis et al., 2018).

Exploding head syndrome (EHS) describes the experience of a loud explosive noise during hypnagogic or hypnopompic states. This means that as a person is falling asleep or waking up, they experience a very loud abnormal auditory hallucination (Ghibellini & Meier, 2022). Although harmless, this experience can cause distress and can sometimes manifest into a more chronic condition, affecting the person's ability to sleep. Some have argued that EHS can be attributed to simply amplified auditory hypnagogic intrusions (Ghibellini & Meier, 2022). This is a clear example of symptoms of the hypnagogic state manifesting into much more concerning symptoms of hallucinations. Both exploding head syndrome and sleep paralysis are relatively uncommon, but they provide an interesting look into how hypnagogic states can essentially 'play tricks' on the mind, and manifest into more chronic conditions.

Hypnagogia represents a unique window in the brain as it shifts from awakeness into sleep. Dysregulation of the sleep-onset process is associated with sleeping disorders such as insomnia and narcolepsy.

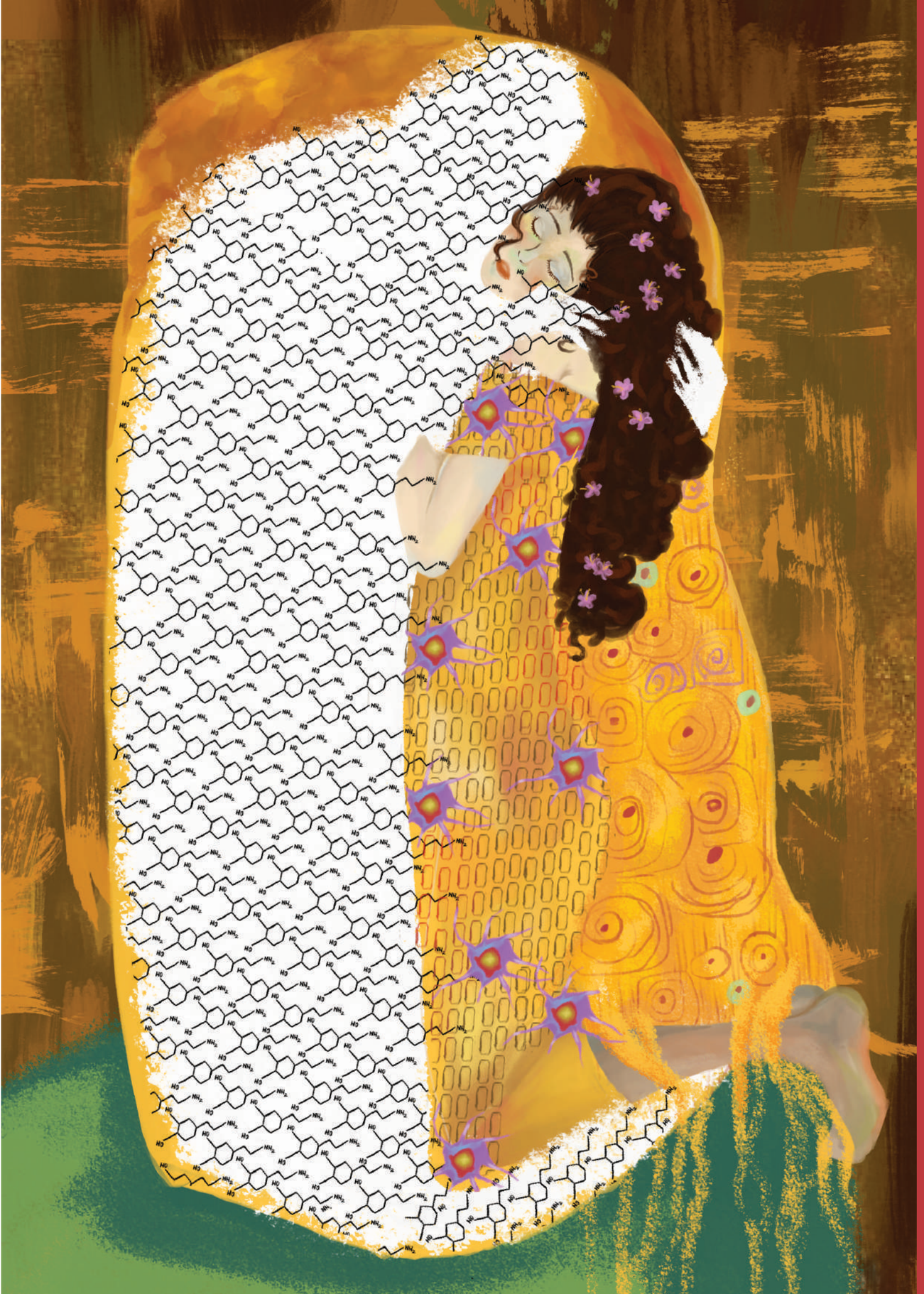
Hypnagogia as Sleep Aid

Understanding hypnagogia could help improve sleep-onset in those who struggle with sleep. In a study by Bellaiche et al. (2024), participants were prompted to think about a common everyday object while entering either a hypnagogic-like, or mind-wandering state (Bellaiche et al., 2024). This study showed that deliberate cueing of a simple object during the relaxed, drowsy state can shape hypnagogic imagery, and influence the content of the hypnagogic state. This experiment does not test whether thinking of random objects as a method speeds up falling asleep, or measures sleep-onset latency. These findings do suggest, however, that hypnagogia can be easily influenced in content, and therefore could be induced in order to aid sleep.

In a different study by Beaudoin et al. (2016), poor-sleepers from a university took part in a serial diverse imagining task (SDIT) in the form of an app. Participants were randomly presented with recordings of words one at a time, with an eight second interval between, during which the participant created and maintained a mental image of the word until the next image prompt (Beaudoin et al., 2016). This allowed the poor-sleepers to divert attention away from interfering thoughts and improve sleep quality. It was found that cognitive and somatic pre-sleep arousal, sleep effort, and sleep quality improved significantly for these poor-sleep participants. This task induces an effect similar to aspects of hypnagogia, which may explain why sleep was improved.

Conclusion

Hypnagogia is an interesting, and extremely common phenomenon, with 85% of university students reporting both sleep-onset and sleep-offset hypnagogia (Ghibellini & Meier, 2022). Hypnagogia is a normal part of falling asleep that happens to everyone, and may help you understand why unexplained thoughts and feelings often appear in the moments before you fall asleep. However, some phenomena associated with hypnagogic and hypnopompic states are not normal, such as sleep paralysis and exploding head syndrome (Ghibellini & Meier, 2022). Both of these phenomena exhibit exaggerated symptoms of hypnagogia, and may help us better understand aspects of sleep-onset. Understanding this transition into unconsciousness is essential in helping improve sleep-practices and potentially reducing struggles in falling asleep. Here, it has been shown that hypnagogia could be mimicked in the form of imagining random objects and words in order to help induce sleep. So, next time you're struggling to fall asleep, try this technique of thinking random thoughts, and it might help you enter hypnagogia, and fall asleep faster!



LOVE ON THE BRAIN: of Dopamine and other Aphrodisiacs

The number of times words like anxious or avoidant are thrown around between friends or online is astounding; you would think everyone is a well-seasoned expert on attachment theory. Our obsession with the psychology of love is nothing new, however, just a new way to analyze one of humanity's most hated... and loved... emotions. This section fosters writing and discussion around the neuroscience, neurophysiology, and broader psychology of love, and why sometimes, we just can't get over it! From Bowlby & Ainsworth's attachment system, to the psychological appeal we find in the romance horoscope, or even exploring the challenges/addictive feelings of a crush, this section offers a broad theme for creative and interesting work, marrying (no pun intended) humankind's obsession with romance with our particular interest in Neuroscience and Psychology here at MAZE.

EDITED BY: THANE GRAHAM

THEY LOVE ME NOT

We have all played the world's most frustrating game of the "library crush". It begins with a shared glance that lasts a millisecond too long, or a smile that seems to hold a secret meaning. Our minds, often fueled by a mix of hope and an overwhelming number of romantic comedies, launch into a frantic internal debate. *Was that a signal? Is it attraction? Or am I reading into things?*

For centuries, the plucked petals of a flower have been our best bet for answering this question. However, recent scientific research suggests a more reliable way to decode this. Our bodies are constantly broadcasting a series of subtle, often involuntary, signals that are as measurable as they are mysterious.

This article will explore the science behind these nonverbal cues, drawing on insights from psychology, anthropology, and evolutionary biology to examine the silent language of attraction, featuring expert insight from an interview with Dr. Mark G. Frank, a renowned specialist in nonverbal communication. The goal is not to become a human lie detector or justify overstepping boundaries. Instead, it is to ground our understanding of attraction in science, helping us become more empathetic observers, reduce misunderstandings, and navigate social interactions with greater clarity. With this, let's demystify the silent language of attraction.

An Introduction to Nonverbal Cues

Before we decide the signs of attraction, why do they exist in the first place?

In discussing the primary role communication plays in our daily lives, as well as the survival advantage it has given as a species, Dr. Mark Frank emphasizes that within communication, nonverbal cues are an "essential part" of communication because "it adds nuance to everything we say and do". It helps to remember that we are animals too, similar to birds that puff out their chest and foxes playfully posing. These gestures lie deep in evolutionary roots. Givens & White (2022) describe love signals as part of the "reproductive force", a biological drive that underlies many social instincts. Attraction is not always a conscious choice but rather a survival mechanism rooted in the human need for connection and reproduction.

These cues are powerful, with over two-thirds of human communication occurring through them (Danesi, 2019). More interestingly, we are primed to find others attractive when they display traits our own bodies portray when we are attracted. Beneath our layers of logic and self-awareness, we are still creatures of nature that send out signals hoping they are seen, and maybe, returned.

"They Love Me" Petals

The search for a single indicator of attraction is futile. Dr. Frank notes that there is no "Pinocchio's nose", a sole and obvious signal of genuine interest. Instead, it is broadcasted through a cluster of synchronised nonverbal cues, a combination of rapid, involuntary micro-expressions and more deliberate and still unconscious body language. To accurately decode interest, you must look for patterns of behaviour across all of these:

The Face and Micro-expressions

Attraction rarely announces itself as obviously as we may think. Instead, it is more elusive, with brief involuntary movements known as microexpressions. First identified by psychologist Paul Ekman, these signs are rapid, uncontrollable flashes of emotion that can betray affection, surprise, or embarrassment before we even register them. In moments of attraction, these expressions are difficult to fake and even harder to suppress, especially when someone actively tries to. In other words, our faces often speak before we do.

- The Smile: A social smile involves only the mouth. "We are drawn to people with upbeat personalities, and people who smile with not just the zygomaticus major (the smile muscle in your cheeks) but also the orbicularis oculi (muscles around the eyes) are seen as more pleasant, happy, and approachable," writes Dr. Frank. This expression originates from the primate "play face" and is a powerful sign of approachability (Givens & White, 2022).
- The Eyes: Upon recognising someone we like, we often display a rapid, involuntary quick raise and lower of the eyebrow (Moore, 1995). At the same time, the autonomic nervous system can cause pupil dilation. Research shows that identical photos of individuals are consistently rated as more attractive when their pupils are artificially dilated, as it is a subconscious signal of arousal and focused attention (Frank et al., 2022).
- The Blush: Increased blood flow to the cheeks and lips is a classic sign of physiological arousal. This flush is a sign of the body's heightened state and is perceived as attractive, as it signals receptivity (Frank et al., 2022).

The Body Language

When the face tries to conceal, the body can often reveal a person's attraction.

- Postural Proximity and Orientation: When attracted, people unconsciously reduce the physical space between them. They lean in and tend to orient their torso and feet directly toward the person of interest and enter the "intimate zone" of less than 18 inches (Frank et al., 2022; Moore, 1995).
- Gestures: Attraction triggers a desire to look our best, which often leads to preening and gestures such as flipping or stroking hair, smoothing clothes, straightening a tie, or adjusting a collar (Moore, 1995). The term is borrowed from birds who smooth their feathers during courtship rituals when preparing for closer contact, and it serves the same function in humans (Frank et al., 2022).
- Touch: The ultimate 'distance closer' is touch. Dr. Frank says, "I believe we human beings are tactile creatures, and like Harlow's baby monkeys who choose the soft warm fake mother over the cold wire but with milk mother, it matters to us. We know babies born prematurely will be more likely to survive if they are touched. And we human beings need that, and it is an essential element in human connection, and indispensable with love". Danesi (2019) agrees with this, stating how touch is the "bedrock of how we bond". Such contact can

release oxytocin, facilitating feelings of trust and bonding (Frank et al., 2022).

Putting Things Together

In order for these behaviours to be signals of attraction and interest, it cannot be in isolation. Rather, look for simultaneous occurrences. If you notice all of these, it is most likely not a series of coincidences but rather something worth exploring!

"They Love Me Not" Petals

However, if reading attraction was as simple as spotting a few positive signals, dating would be a solved equation. Instead, our evolutionary history has created a communication system where many cues are ambiguous. As Dr. Frank cautioned in the interview, "the thing to keep in mind when you see emotions being expressed in others is that emotions do not tell you the reason why a person is feeling that emotion". This is where the dangers of misinterpretation lie, and it is crucial to learn how to identify these scenarios.

A Friendly Face

It must be noted, however, that many of the most common signs of attraction could also just be a baseline for friendly human interaction.

- The Polite Smile: we are a social species wired for pleasant interaction. The simple, mouth smile without the genuine eye-crinkling mentioned before is a universal social behaviour, but does not guarantee romantic interest (Frank et al., 2022). Mistaking general friendliness for specific attraction is one of the most common errors in reading nonverbal cues.

- Cultural and Contextual Differences: In certain cultures, sustained eye contact is the norm for any conversation, while in others it can be perceived as challenging or disrespectful (Danesi, 2019). Similarly, Dr. Frank mentions how "norms about touch and distance" differ across cultures, and this may translate into how the body reacts to attraction. Context also holds heavy weight in determining attraction and can dramatically alter the meaning of the same gesture. For example, a touch on the arm might be a standard part of communication without any romantic intentions.

Nerves Mismatch

The body's physiological response to attraction, such as an increased heart rate, sweating, and blushing, is nearly identical to its response to anxiety and stress. This can be a huge point of confusion.

- The Nervousness Mimic: the "light sweat on the hands can be nervousness - like meeting the boss - or attraction", notes Dr. Frank. A person fidgeting or blushing may simply be experiencing social anxiety rather than attraction. A person's hopeful perception can easily lead you to mislabel nervous arousal as attraction.

- Inexperience in Attraction: research on adolescent flirting shows that younger, less experienced individuals often use more exaggerated versions of courtship signals (Moore, 1995). A teenage girl's dramatic hair flip or loud, prolonged laughter might simply be an early attempt at fun flirting rather than serious interest. Taking these signals at face value without considering a person's social experience can lead to misreading motivations as disproportionate to what they are really attempting to convey.

Evolution of Makeup

One of the most fascinating pieces of information from my email interview with Dr. Frank is the makeup mirage. He explains how "traditional patterns of makeup application in heterosexual females" are not random. He says, "it tends to mimic or emphasise those things that indicate sexual arousal [...] shadowing and eyelining around the eyes emphasises them; red lipstick mimics the mild engorgement of lips when aroused, blush on the cheeks mimics the blush that accompanies arousal, etc." It is important to keep this in mind as these could be misconstrued as natural physiological signs when it is only makeup.

As mentioned before, the cluster is everything. A single smile is meaningless, and a nervous laugh is inconclusive, but a combination of signals creates a much more reliable picture. However, it is not a guarantee, simply a sign to explore further. When cues are contradictory or exist in isolation, the most scientifically sound conclusion is often the simplest: They Love You Not.

The Growth of Intimacy

But what about love? The nonverbal cues shift accordingly. The frantic, dopamine-driven signs of new attraction mellow into oxytocin-fueled signs of attachment and commitment. Frank et al. (2022) describe long-term love as something characterised by deep attention, trust, and commitment, expressed through sustained eye contact, calm and secure touch, and a state of comfort where couples synchronise movements and postures.

Nevertheless, Dr. Frank tells us that "given love is still the hot topic in art of various forms" means it is something we are "each trying to fully understand or explain". Even as we are "hoping it is more than just a dopamine surge in our brains", it is important to know that the "surge is essential".

Putting The Flower Down

After breaking down the science of attraction, it is time to put the guesswork away. We have built an understanding of how our body speaks a complex language of glances, blushes, and leans. However, it is a language that can often be misunderstood and it is crucial to be cautious. The danger lies not in noticing these signals but in interpreting them through hopeful eyes rather than an objective lens. This is why the "Pinocchio's nose" approach is not just futile but potentially harmful.

The solution isn't to stop reading signals, but to read them better, keeping in mind their ambiguity. Dr. Frank brings up some crucial points, saying "human beings are imperfect recognizers of emotions and other nonverbal states" and that "knowing there is an involuntary element of attraction is important". Most importantly, Dr. Frank reminds us, "what the other person says will be the gold standard. Having an involuntary reaction that produces signs is one thing, what you do about the reaction is entirely voluntary. We are not slaves to our physiology". In other words, no matter what someone may be signalling, no means no.

Whilst it is important and useful to know these nonverbal cues and gestures, all the subtle signs in the world can't replace the clarity of honest conversation. The most respectful and courageous signal you can send is not written in microexpressions or your body language - it is found in asking a genuine question and being prepared to honour the answer.

Written by: Zaleia Ilaika Zain

WHEN LOVE ENDS

What Your Goodbye Says About You

What Our Goodbyes Reveal

The pain and struggle of a breakup can be just as powerful as the sweetness of falling in love. Some people choose to sit down and talk calmly, some quietly disappear, while others fall into a cycle of hesitation. Between the ages of 18 and 25, love often becomes an exploration in which people test boundaries, move closer or step back in relationships to discover what they truly want (Gehl et al., 2023). In this sentiment, separations and breakups can act as a sort of mirror that helps a person reflect on their own need and fears in a relationship. In fact, the way a relationship ends often says just as much about a person's inner self as it does about the other person. Why do people end relationships in such different ways? These differences are often linked to how individuals manage intimacy, rooted in deeply personal psychological mechanisms. According to attachment theory, people's behaviours in intimate relationships are shaped by their early emotional experiences (Collins & Gillath, 2012). Through this lens, we can gain a deeper understanding of how different attachment styles influence people's reactions and choices when facing a breakup. This perspective also helps us reflect on how understanding can guide us towards a more mature and balanced approach when a relationship comes to an end.

Understanding Love Through Attachment Styles

Attachment theory, first proposed by Bowlby (1958), holds that the emotional bond between a child and their primary caregiver lays the foundation for later social and emotional development. They suggested that the way an infant's need for closeness and protection is met influences how that person will understand intimacy and trust in future relationships. When a caregiver responds with warmth and consistency, the child develops an inner belief that "I am worthy of love and others can be trusted." In contrast, when the caregiver is cold or unresponsive, feelings of insecurity and defensiveness begin to grow. These early interactions quietly leave traces that guide how individuals connect with others in adulthood. Later, Hazan and Shaver (1987) extended attachment theory to adult romantic relationships, suggesting that love in adulthood shares similar psychological mechanisms with early attachment. The level of closeness or distance between romantic partners can clearly reflect the attachment patterns that were formed during childhood. In other words, the way a person approaches love, including how they seek comfort, express affection, or pull away emotionally, is often influenced by how they were once cared for, comforted, or neglected. From this perspective, attachment theory not only explains emotional development in childhood but also provides insight into adults' behaviours in intimate relationships, including the ways they respond and act when a relationship comes to an end.

How Attachment Styles Influence Breakup Choices

Ainsworth et al. (1978) argued that attachment styles consist of a secure type and an insecure type, with the insecure type further divided into anxious and avoidant styles. The main feature of secure attachment is stability in emotional relationships. Individuals with a secure attachment style are more comfortable with intimacy and less anxious about abandonment or excessive closeness (Simpson, 1990). When facing a breakup, they tend to respond with respect and open communication, expressing their emotions and needs directly (Fagundes, 2012). In contrast, avoidant attachment is characterised by difficulty in making long-term commitments or fully trusting others. People with this style often feel uncomfortable with intimacy, struggle to rely on others, and experience anxiety when others try to get too close (Simpson, 1990). As a result, avoidantly attached individuals are more likely to become "ghosters," ending relationships by cutting off contact to avoid confrontation and emotional responsibility (Powell et al., 2021). Anxious attachment, on the other hand, is marked by strong insecurity and emotional instability. Individuals with this style often show high levels of dependency and anxiety within relationships (Simpson, 1990). When faced with a breakup, they tend to experience intense emotional reactions and resist separation, for example, by repeatedly contacting their partner in an attempt to repair the relationship (Fagundes, 2012). If their partner suddenly disappears, they are more likely to experience deep sadness and depression (Powell et al., 2021). The differences in how people end relationships are not random emotional reactions, but echoes of attachment patterns shaped by early emotional experiences. Each reaction reflects the complex connection between personal emotional experiences and attachment styles. Recognising these differences is not about judging what is right or wrong, but about understanding that every response has its own cause.

Advice for Those Who End and Those Who Are Left

By becoming aware of these patterns, we can learn to treat ourselves with greater kindness and extend more empathy towards others when a relationship ends. Understanding the psychological logic behind breakups may, in fact, be the first step towards healing from pain and rebuilding inner balance. Research has shown that about 19.6% of people report their depression is related to the end of a romantic relationship, and around 29.7% of university students experience anxiety after a breakup (Gehl et al., 2023). These figures remind us that the emotional impact of a breakup is far more common and significant than many might assume. Learning to face a breakup more healthily is not only an emotional healing skill but also a form of self-protection. It allows the person who initiates the breakup to part with greater kindness and responsibility, and helps the one who is hurt recover balance and regain strength through self-reflection. For those who decide to end a relationship, the key question is not simply how to end it, but how to ensure the ending does not become a form of harm. The first step is to become aware of one's attachment style and the emotional reactions it may trigger. Reactions that seem calm or decisive may actually come from inner conflict or feelings of insecurity. Facing the complexity of one's emotions requires courage, as reason and emotion rarely remain balanced under the tension of attachment. In this process, empathy becomes particularly important.

It enables individuals to express their own needs while recognising the emotional weight of the other person's feelings, preventing communication from turning into defence or blame. Those with empathy are more able to perceive the emotional complexity within the relationship and to express their decision to leave in a gentle and considerate way (Collins & Gillath, 2012). At the same time, recalling genuine and warm moments from the relationship can help reduce defensiveness and make open communication easier. In terms of approach, having an honest face-to-face conversation and explaining the reasons sincerely is a thoughtful and responsible way to end a relationship. Such communication can effectively reduce emotional distress after a breakup (Dailey et al., 2023). The tone and choice of words also play a crucial role. A gentle yet firm manner helps the other person understand the situation clearly without intensifying feelings of loss or anger. Compared to a cold and distant way of ending a relationship, such as saying "I think it is time for us to end this,"

Written by: Yishu Zhang

expressing genuine feelings and experiences helps the other person understand the changes in the relationship instead of blaming themselves. After communication, maintaining a certain level of distance is also an act of kindness. Temporarily limiting contact can help both sides rebuild psychological boundaries and avoid emotional fluctuations, which is especially important for individuals with higher attachment anxiety to restore emotional balance. On the other side, those who are broken up with often fall into self-blame or endless reflection. Understanding that the other person's behaviour may be partly influenced by their attachment style can provide a more complete perspective on the experience. This understanding does not excuse the other person's actions but helps one recognise that detachment, withdrawal, or silence are not necessarily personal rejections, but rather emotional defences rooted in their own insecurity. Realising this can ease unnecessary guilt and help emotions return to a space of understanding and acceptance. During the healing process, rebuilding a sense of security and self-identity helps people move through sadness and regain emotional strength. Research suggests that social support plays a crucial role in emotional recovery (Kansky & Allen, 2017). Staying connected with trusted friends or family allows emotions to be heard and empathised with, helping one regain a sense of connection. At the same time, re-establishing daily order is equally important. Returning to regular routines, whether completing work, revisiting hobbies, or setting concrete goals, helps rebuild a sense of self-worth (Apostolou & Kagialis, 2025) and provides individuals with a renewed sense of direction and control over life. There is no fixed timeline or single path for recovery after a breakup. When a past relationship is no longer seen only as a symbol of loss but as a part of personal growth, one can approach farewell with greater maturity and calmness.

From Attachment to Understanding

In conclusion, a breakup, as the ending of an intimate relationship, often forces individuals to confront their own attachment patterns and emotional responses. Understanding these psychological mechanisms allows one to gain a clearer awareness of one's position and needs within a relationship. When people become conscious of the attachment logic behind their behaviours, they are better able to remain mindful of their emotions and find balance amid turbulence. Such understanding may not eliminate pain, but it enables individuals to face loss with greater maturity, with both reason and warmth.

Why Our Nervous System Misses The Person Who Destroyed It:

THE PSYCHOLOGY OF MISSING OUR CRUSH

For the lovesick of the world, thousands of romance novels and countless rom-coms seem inescapable. Contemporary media has shown a keen interest with infatuation, deadest on defining unrequited 'matters of the heart' everywhere we look. This obsession isn't so confusing, however, when we consider the intense emotions and importance most of our brains attribute to love at some point in our life. Taking this into consideration, we can clearly observe an appeal towards the mystery of infatuation: despite it being the cause of many sleepless nights and unexpected crash-outs, it sometimes can't help but be missed by those who have suffered pining and heartache. This might seem contradictory, but many psychological factors can be considered to reveal the logic behind the not-so-logical brain that is 'hooked on love'.

What inflames a crush and lingers afterward: mechanisms of infatuation

Overthinking could be associated with a temporary reduction in serotonin levels, a neurotransmitter involved in mood stabilization, anxiety regulation and attentional flexibility (Marazziti et. al.,1999), (Hensler, 2010). These fluctuations in serotonin levels can help explain why infatuated individuals sometimes find it difficult to disengage from emotionally charged cues, since lower serotonin levels have been associated with a reduced attentional flexibility. Dips in serotonergic signaling have also been associated with impaired recognition of positive stimuli (Hensler, 2010), which might help in explaining why some infatuated individuals lose sleep over encounters they interpret as disastrous or embarrassing. The attentional flexibility impairment could also create a sort of loop where the crush becomes a central focus: a text message or a small gesture is given disproportionate importance because our brain finds it difficult to redirect its attention elsewhere. While serotonin dips aren't a direct cause of an infatuated individual's tendency to overthink, they can help explain this aspect of the experience: drops in serotonin can increase the sensitivity of the subject to certain cues, no matter how insignificant they might be. If lower serotonin levels associated with infatuation were shown to affect an individual's attentional flexibility and mood stability, a restored serotonin function when the emotional intensity fades could help restore the rigidity that previously made it impossible to redirect one's attention away from their crush. Post-infatuation thinking may become, therefore, less emotionally charged and overwhelming. While it's beneficial that the mind isn't over-engaged with every idea and event, everyday interactions can start feeling flatter, since the normal secretion of serotonin may lessen the previously heightened emotional reinterpretation of every conversation or other small cues. Research links infatuation with **elevated cortisol levels**: the hormone that keeps the body in a state of alert, keeping us attentive to what's around us (Marazziti and Canale, 2003). That's why heightened cortisol levels can have the effect of making everything seem more emotionally charged: small signals become meaningful, anticipation becomes energizing and the tension of small conversations is elevated. Heightened cortisol levels can be associated with the stress involved in the experience of being infatuated, the "stomach butterflies" we feel at the slightest form of contact. While uncomfortable, this physiological alertness can also make life seem unusually vivid. Because cortisol keeps the body prepared, in a constant state of tension and expectative attention (Thau et. al.,2023), the aftermath of returning to a normal amount of cortisol might make life feel unusually quiet by comparison. The infatuated mind often learns to expect a certain baseline of emotional intensity that disappears once our crush fades. It's like the sensation felt after getting off a roller-coaster only to find out how underwhelming the stillness of the world is. This contrast can be considered central to why some people miss having a crush: although increased cortisol levels make the experience of being infatuated uncomfortable and stressful, the sharp edge it gives to our experiences can make them seem more meaningful. The absence of that heightened state can make the formerly infatuated individual miss not necessarily their crush, but the emotional intensity they felt. The intense desire and pleasure felt by infatuated people has been associated with **heightened dopamine secretion** (Merrill et.al., 2018). For this reason, dopamine has earned the nickname of the "feel-good neurotransmitter", and it's known to give the sense of pleasure, relaxation and motivation to engage in activities that promise its release (Dopamine, 2022), triggering a euphoric feeling similar to that given by cocaine and alcohol (Love and the Brain, 2015). Moreover, dopamine plays a crucial role in the brain's reward circuits. In the scenario of having a crush, heightened dopamine levels can explain in part why so many of us illogically prioritise our new love interests above anything else. Our reward systems are wired to seek out the pleasurable sensations we feel during interactions with our crush, pushing us into an ongoing pursuit of possibility, running on the hope that the next interaction could be meaningful. Dopamine's strong response to uncertainty (Fiorillo, 2003) can be associated with thrilling spikes in the expectation of a text or of a glance, and therefore a small cue can feel so much bigger simply because it was anxiously waited for, with expectations that gradually built up in its wait. This same anticipatory mechanism can help explain why some people end up missing the experience of being infatuated despite the stress and uncertainty: although the ambiguity of some situations can feel unnerving at the moment, in their absence the reward system receives fewer bursts of anticipation, and daily life may feel less stimulating by comparison. Ironically enough, it is exactly the uncertainty which consumes us that makes us later on miss the experience of having a crush.

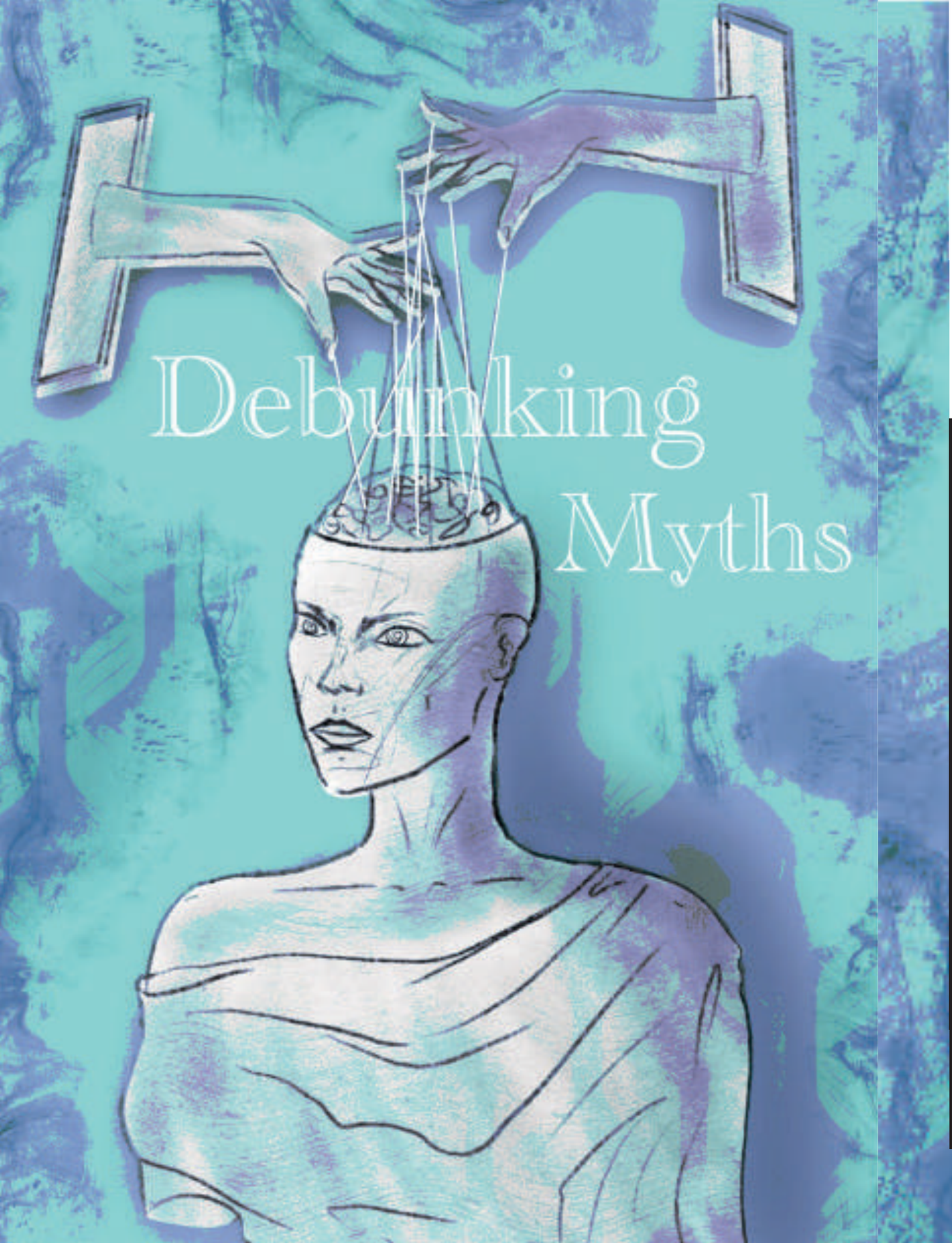
Giving meaning to what overwhelmed us: the reinterpretation of the infatuated experience

Dorothy Tennov defines the term of limerence in her book "Love and Limerence" as an intense and involuntary obsession with a certain individual she calls a "limerent object" and considers it to be "an aspect of basic human nature" (Tennov, 1999, p.ix). She states that her interviewees who got over a limerent attachment are always waiting for another similar experience, while also maintaining a slight closeness to their former crush, a "hope that can be periodically rekindled" (Tennov, 1979/1999, p.108). While the feeling of being infatuated with someone can feel stressful at the time, some people claim to miss this feeling and crave its thrill. This tendency to miss one's crush is not only potentiated by the mechanisms I've outlined above, but also by the construction of a positively biased version of the infatuated experience. We are prone to recall certain memories through a more positive lens, due to a cognitive bias defined as **"the rosy retrospection bias"** (Nica, 2023). While the memories are stored in our subconscious, the emotional experience associated with them is observed to fade. That is why our brain attributes a more positive emotional response to the memories we have of our crush, even if at the time they might have been stressful and scary. Research has also unveiled another form of cognitive bias called **"the fading affect bias"**, which suggests that nega-

tive memories fade faster than positive memories. This would imply that people tend to remember positive events and encounters more vividly than negative ones, thus creating a "healthy coping process operating in autobiographical memory" (Walker et. al.,2019). Consequently, an event that might have felt awful or embarrassing will not maintain its' emotional weight after the intensity of one's feelings dies down. That can lead us to conclude that having a crush was not that bad and underestimate the stress we were feeling at the time. The reconstruction of a retrospective version of the infatuated experience that often looks gentler than reality is a phenomenon described by Dorothy Tennov in her work on limerence. She describes this process of idealisation as "**crystallisation**", a transformation in which a person's traits are reinterpreted and selectively amplified according to the infatuated individual's preferences (Tennov, 1979/1999). Consequently, the limerent object's (LO) traits are "crystallized by mental events in which LO's attractive characteristics are exaggerated and unattractive characteristics given little to not attention" (Tennov, 1979/1999, p.30). She also highlights how potentiating the limerent object's absence can be, saying that it is easier to maintain an attachment sustained by little to no action than too much of it: "limerence can live a long life sustained by crumbs. Indeed, overfeeding is perhaps the best way to end it" (Tennov, 1979/1999, p.104). These processes help explain why people often conclude, in hindsight, that "it wasn't that bad", or even sometimes wish to return to the feeling of having a crush. When the heightened states produced by infatuation highlighted earlier in the article (anticipation, alertness, overanalysis) return to the baseline, the absence of that intensity can make normal life feel underwhelmingly flat. This gives some people the opportunity and need to construct altered versions of the infatuated experience that may seem more positive, something worthy of missing.

During the process of having a crush, the mind shifts into a heightened mode of processing, leaning into the tendency to exaggerate small cues and suffer intense dopamine spikes in the expectation of new encounters. Biological patterns such as fluctuations in serotonin and increases in cortisol can help explain why infatuation can paradoxically feel both stressful and energizing at the same time. In the absence of these overwhelming feelings, some people begin looking back at the experience through a biased lens, gaining the impression that the experience wasn't as bad as it seemed at the moment. Therefore, this confusing nostalgia some people develop towards the infatuated experience can simply be defined as the shock of returning to as steadier baseline of emotional responses and informational processing. In the end, some people miss the very thing that tore them to pieces, and the explanation for such a phenomenon makes an unexpected amount of sense.

Written by: Stefania Marta Irimia

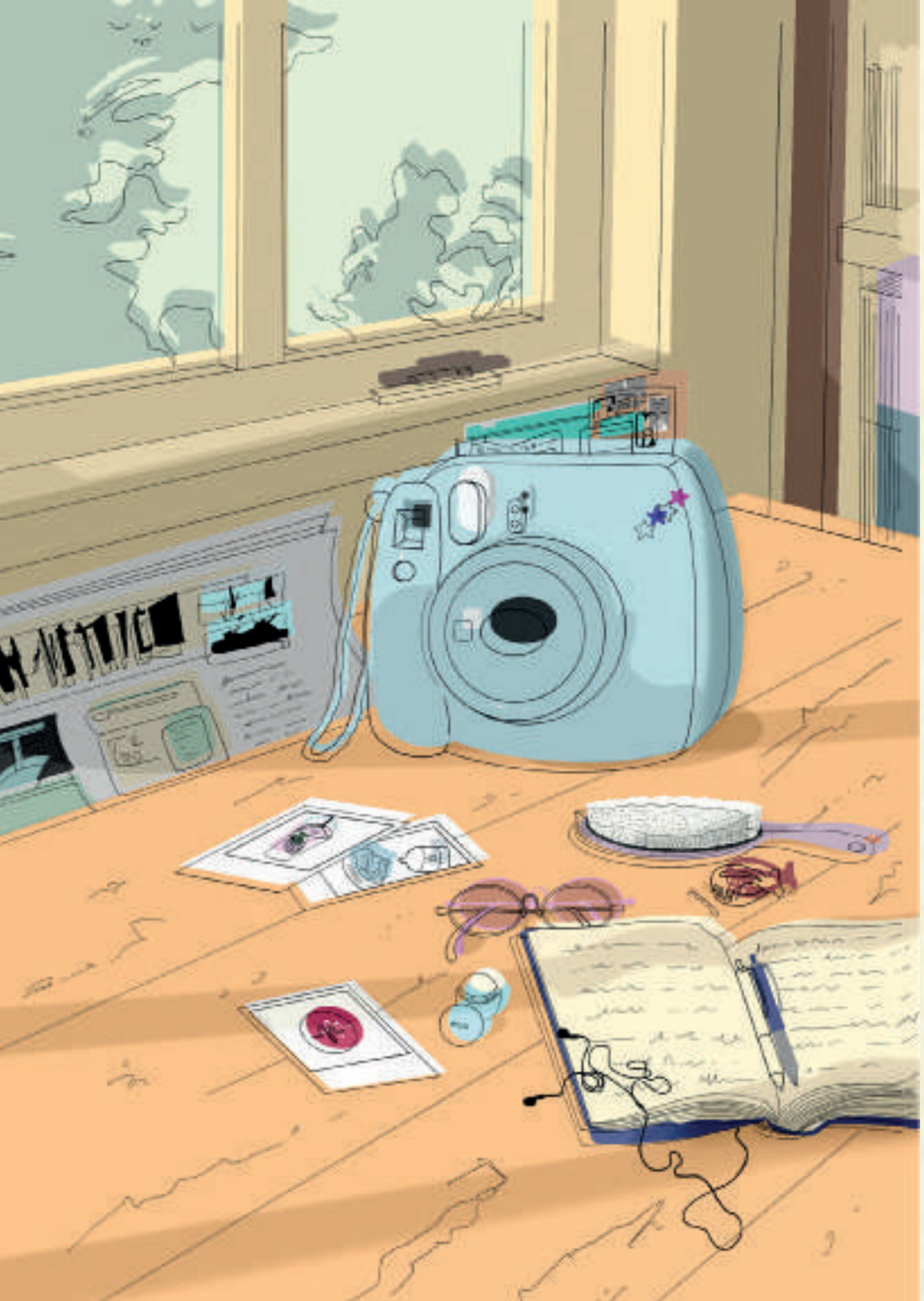


Fact or Fallacy?

Debunking Myths in Pop Psychology & Neuroscience

Fact or Fallacy? investigates and challenges the widespread misconceptions, misinterpretations and oversimplifications that pervade popular psychology and neuroscience, particularly those perpetuated by social media, films, mainstream publications and self-help/wellness culture. From claims such as “we only use 10% of our brain” to the misunderstanding of various disorders, for example that OCD equates to perfectionism or the causes of autism, and misinterpretations of buzzwords like “dopamine detox” and “attachment styles”, this section examines how pop science often distorts genuine research - and then sets the record straight, separating scientific fact from appealing fiction. Articles should address these myths through evidence from peer-reviewed journal articles in the field of psychology and/or neuroscience, unpacking the scientific principles behind them and clarifying what is supported by the evidence and what is not. Writers are also encouraged to consider how media narratives, social media and cultural trends, and the rise of online psychology shapes the public’s (mis)understanding of the mind.

Edired by: Anja Demsar



Taking Off the Rose-Tinted Glasses: The Truth Behind Memories and Nostalgia

Author: Jessica Dimitrova

After centuries of evolving definitions, psychologists now conceptualise nostalgia as a 'sentimental longing for the past' (Wildschut, Sedikides, & Routledge, 2008). However, despite this scientific consensus, nostalgia remains widely misunderstood in the popular psychology and social media discourse. Therefore the aim of this article is to challenge four of the most common misconceptions about nostalgia, namely that (1) it is inherently depressive, (2) it traps people in the past, (3) that nostalgia provides an accurate, unfiltered representation of the past rather than an idealised reconstruction, (4) it is merely an aesthetic trend.

Nostalgia as a Depressing Emotion

As early as the 19th century, nostalgia began to be defined as a form of melancholia or depression (Wildschut et al., 2008). This view was strengthened throughout the 20th century by scholars working in the psychodynamic tradition, who framed nostalgia as a pathological response linked to loss and unresolved grief. It was labelled everything from 'a mentally repressive compulsive disorder' (Frost, 1938; as cited in Wildschut et al., 2008) to 'a repressive manifestation closely related to the issue of loss, grief, incomplete mourning, and, finally, depression' (Castelnuovo-Tedesco, 1980; as cited in Wildschut et al., 2008). Although these outdated interpretations have long been challenged with psychology, the assumption that nostalgia is inherently depressive has resurfaced in contemporary culture.

In recent years, social media platforms such as TikTok and Instagram have fuelled a new wave of discussions and posts around what many users call "nostalgia depression". Meyerowitz (2022), writing for Glamour UK, documented the prevalence of such sentiments, noting comments such as "Why do I feel a deep sadness whenever I experience nostalgia?", "Why does this advert depress me?". These online posts reflect a common experience among young people: nostalgia is described as a bittersweet emotion where the happiness associated with recalling memories is accompanied by sadness brought up by the inability to relive the moment. Over time, this has become mistakenly interpreted as causing emotional harm, hence leading to the widespread belief that nostalgia itself is 'depressing' and emotionally damaging.

To test whether nostalgia genuinely produces negative mood, Wildschut et al. (2006) conducted a controlled experiment with 52 university students using a simple between-subjects design. Participants were randomly assigned to either a nostalgia condition, where they recalled a personal nostalgic memory which was meaningful to them, or a control condition, where they described a routine event from the previous week. After the task, participants completed brief validated items measuring positive affect (e.g., feeling happy and content), negative affect (e.g, feeling sad or blue), self-regard (e.g., feeling significant or high in self-esteem, and social connectedness (e.g., feeling loved or protected (Wildschut et al., 2006).

Contrary to the depressive characterisation of nostalgia, the results showed that participants in the nostalgia condition reported significantly higher positive affect compared to controls, with no corresponding increase in negative mood. This shows how nostalgia elevated feelings of happiness without triggering sadness or melancholy, demonstrating that nostalgia enhances emotional wellbeing, functioning as a mood-boosting resource and is not a source of depressive mood. The popular notion of "nostalgia depression" thus simply reflects a cultural misconception rather than scientific reality which clearly demonstrates that nostalgia reliably produces positive emotional benefits while leaving negative affect unchanged.

Furthermore, Routledge et al. (2011) conducted six studies demonstrating that nostalgia also plays a role in cultivating a sense of meaning in individuals' lives. In one study, 357 adults completed an online survey in which they listed two of their favourite songs and rated how nostalgic each song made them feel, how "loved" it made them feel, and whether it made life feel "worth living," using 5-point scales (1 = not at all applicable to me, 5 = highly applicable to me). Higher nostalgia ratings predicted a stronger sense of existential meaning, primarily because nostalgic songs increased feelings of social connection.

Lastly, nostalgia has been found to be able to provide individuals with physiological, not just psychological, comfort. In a study by Zhou et al. (2012) 64 participants were placed in a room with half being asked to recall a nostalgic memory while the other half an ordinary event. Following this, participants were asked to estimate the temperature of the room. Despite the conditions being identical, the nostalgia group perceived the room as significantly warmer (M = 19.81 °C) than the control group (M=17.44 °C), and this difference was statistically reliable, $F(1,62) = 4.51$, $p = .039$. Rather than altering the physical environment, nostalgia shifted participants' perception of warmth, demonstrating that nostalgic reflection can influence how comfortable and supported people feel in the moment.

Being stuck in the past

A pervasive cultural belief holds that nostalgia traps people in the past, preventing them from fully engaging with the present (Meyerowitz, 2022; Feiles, 2018). This framing presents nostalgia as maladaptive, a form of psychological stagnation that hinders personal growth. However, experimental evidence contradicts this idea. For example, in a study by Sedikides et al. (2016), university students in China and the UK were randomly assigned to recall either a nostalgic autobiographical event or an ordinary past event. After reflecting on the memory, participants completed the four-item Self-Continuity Index (e.g., "I feel connected with my past"). Those in the nostalgia condition reported significantly higher self-continuity than controls, indicating that nostalgic reflection increased the feeling of being connected to one's past self. Rather than freezing people in the past, nostalgia appears to support psychological adjustment by allowing individuals to feel more stable across life changes, thus contradicting the popular belief that looking back on nostalgic memories "keeps you stuck in the past" (Sedikides et al., 2016).

Idealising the 'Good Old Days'

Another common misconception about nostalgia is that nostalgic memories accurately reflect the past. For instance, someone may look longingly at a former relationship and miss the feeling of being part of it, even though they were unhappy at the time. In reality, nostalgic reflection often distorts memory, highlighting positive elements while downplaying difficulties (Mitchell et al., 1997). As Feiles (2018) explains, nostalgia often works "like a natural sedative" highlighting the most positive elements of past experiences while coating them "with a heavy coat of euphoria and idealisation." Similarly, Raypole (2021) notes that people often remember childhood or adolescence as "simpler times," overlooking less pleasant realities such as academic pressure, arguments with parents, social stress, or the emotional turbulence of early relationships. Psychological research provides empirical grounding for this tendency: Mitchell et al. (1997) found that participants' ratings of their enjoyment of the event were significantly lower when measured during the event compared to subsequent rating several weeks after the event took place, offering support for the so called "rosy retrospection." People consistently recall real-life events, such as holidays and outings, as more enjoyable in hindsight than they experienced them at the time. This bias helps explain why the "good old days" feel so appealing in retrospect, even when those periods were far less perfect in reality.

Nostalgia as a Mere Aesthetic

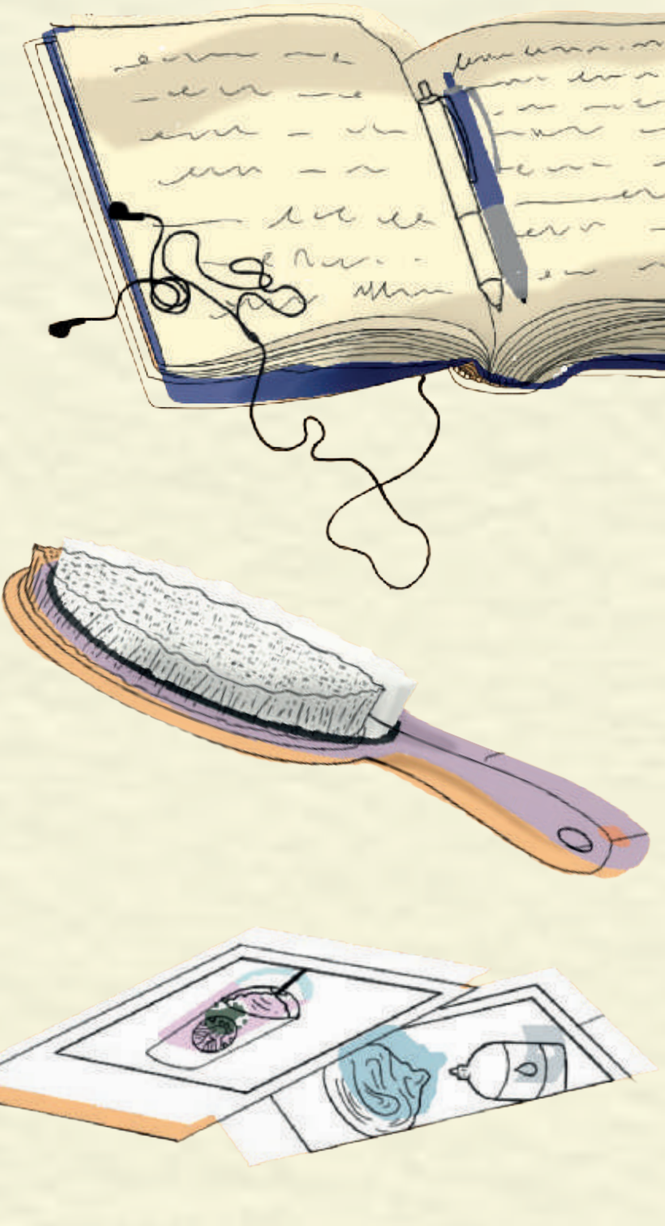
Finally, platforms such as TikTok and Instagram often present nostalgia as nothing more than an aesthetic. As Travers (2025) notes, short edits, collages, and curated "-core" trends have transformed earlier eras into visual micro-cultures, with terms like "nostalgia core" used to group together filters, fashion and music linked to the early 2000s. This movement has resurfaced Y2K staples such as MySpace filters, low-rise jeans, flip phones, and early-2000s pop anthems. On the surface, this makes nostalgia appear purely stylistic. However, psychological research suggests that these trends reflect something deeper.

A longitudinal study found that social media nostalgia functions as a social practice, not merely an aesthetic one. Across repeated interviews from 2012 to 2022, participants used digital memories including: Instagram archives, "one year ago today" reminders, and old photographs as a way of reconnecting with friends, reviving shared experiences, and reaffirming a sense of identity (Jungselius and Weilenmann, 2023). In this sense, nostalgia online operates as a ritual of belonging. This aligns with research on collective nostalgia, which highlights the social and relational functions of looking back. In an experimental study, Cheung et al. (2017) asked university students to recall a meaningful event from their group's shared past (collective nostalgia condition) or a personally meaningful event unrelated to the group (control condition). Those who engaged in collective nostalgia reported stronger in-group identity, greater pride, and higher social connectedness compared to controls. Likewise, online "nostalgic aesthetic" videos and throwback trends allow people who lived through the same cultural moments to connect over shared experiences, strengthening both group identity and personal meaning. Therefore, beyond the filters, fonts, and fashion cycles, nostalgia online serves as more than a mere aesthetic – it evokes social emotion binding people together through collective memory and identity.

Conclusion

Overall, nostalgia is a predominantly positive emotion with well-documented psychological and physiological effects. Research shows that it enhances meaning in life (Routledge et al., 2011), restores emotional equilibrium, strengthens feelings of love and connection (Wildschut et al., 2006), and can even shape perceptions of physical comfort (Zhou et al., 2012). Far from trapping people in the past, nostalgic reflection supports self-continuity and personal growth, helping individuals feel grounded across life's changes (Sedikides et al., 2016). Additionally, shared nostalgic experiences online reinforce collective belonging, allowing young people to connect through shared memories and significant cultural moments (Jungselius & Weilenmann, 2023; Cheung et al., 2017).

Taken together, these findings challenge the widespread misconceptions in popular psychology that nostalgia is depressive, regressive, misleading or merely an aesthetic. Instead, the evidence clearly shows that nostalgia is a powerful social and emotional resource that enriches our sense of identity and connection, helping us navigate the present with greater meaning and coherence.



The Real Fraud: How Popular Psychology Misunderstands the Imposter Phenomenon

Author: Rebecca Dalgleish

We have been sold a myth about imposter syndrome. Since starting at university, I have heard the term being used more often than ever, with every essay and assignment usually shrouded in self-doubt. It's normal to come to university and question your capabilities. However, as the term 'imposter syndrome' has broken into the mainstream, normal feelings of uncertainty have been made to seem more serious. This further heightened those initial feelings of self-doubt. Popular psychology has framed the phenomenon of imposter syndrome as something that covers all feelings of self-doubt surrounding self-perceptions of capability and worth, however, this is far from the initial scientific origins of the term. What was first introduced as a result of external factors and situational influences, has stemmed into a broad term used when an individual is experiencing normal feelings of self-doubt.

The myth was established through the way the imposter phenomenon has been viewed as a result of an individual's shortcomings, rather than that of external factors and pressures that are out of an individual's control. Social media has only fueled this myth, marketing imposter syndrome as a "curable diagnosis", offering quick tips and tricks to "cure" feelings of self-doubt. It has even progressed to a point where there are countless self-help books promising to eliminate feelings of fraud if you follow their advice. Take Jessamy Hibberd's (2018) book The Imposter Cure: Beat Insecurities and gain self-belief for example. It promises a cure within the title, telling readers that the book will give you tools to "break-free" from the feeling which frames the phenomenon as a mindset concern (Hibberd, 2018). In addition to this, influencers, authors, as well as managers in the workplace, run seminars with a promise to 'banish' feelings of fraud, and have grasped onto the idea of imposter syndrome as an individual pathology, even though it is not listed as an official disorder in the DSM-5 (Weir, 2013). As a result, the phenomenon has evolved so far past its original scientific roots in pop psychology that it is now used as a label to account for various professional insecurities, such as work performance. This minimises the need to investigate the deeper inequalities that actually give rise to these feelings in the first place.

The term "imposter phenomenon" was first coined by Pauline Clance and Suzanne Imes, in a 1978 study investigating the imposter phenomenon among high-achieving women and the factors that contribute to their feelings. Common symptoms of the phenomenon included anxiety, lack of self-confidence, and depression. They found that the phenomenon primarily affected high-achieving women, and the feelings of being a fraud persisted even when faced with strong external validation. Crucially, they suggested that the imposter phenomenon originated from factors such as family dynamics that the women internalised during childhood and the societal influences of traditional gender stereotypes which understood women's successes to be luck rather than genuine effort, or underminable entirely. They did not understand the phenomenon to be a mental disorder, but something situational; an experience which is linked to the individual's environment (Clance & Imes, 1978).

However, nowadays, the (mis)understanding of the imposter syndrome has become shallow and generalised, largely disregarding the expansive field of empirical research on the phenomenon. What began as the "imposter phenomenon" has increasingly been presented in the media and lay literature as a "key behavioural health condition" which impairs people's performance (Bravata et al., 2019). Along with this change, the term '*imposter syndrome*' has become more prevalent when discussing the phenomenon. This shift from 'phenomenon', which is defined in the APA Dictionary of Psychology (2018) as "an observable event or physical occurrence", to "syndrome", which is defined as 'a set of symptoms that indicate a particular physical or mental disease or disorder', is a significant one, not just through terminology, but how it reflects the wider misunderstanding (APA Dictionary of Psychology, 2018). The original term described the phenomenon as a response to the situational factors, while pop psychology pushes the narrative that it is an individual pathology due to mindset and self-doubt. The change in terminology further reflects how the term has been used to promote the idea that these feelings stem from self-weaknesses rather than systemic factors. This, again, highlights the problem with popular psychology where credible science gets caught up in narratives that strive to be relatable and marketable.

Although Clance and Imes' (1978) research focused on women, further research has expanded the imposter phenomenon's scope in order to examine these feelings in both men and women. The study conducted by Kumar and Jagacinski (2006) investigated the link between imposter fears and achievement goals and found that women may have experienced significantly higher imposter fears than men, yet the phenomenon is still evident in the male participants (Kumar & Jagacinski, 2006., Bravata et al., 2019). Popular psychology and a lot of current research, however, takes these findings as evidence that the imposter phenomenon is a universal struggle with self-doubt, framing it as a problem that arises within the individual rather than as a result of environmental factors (Feenstral et al., 2020). This overlooks the cultural and systemic conditions that can produce these feelings. Academic research reveals a much more complex picture. Kumar and Jagacinski (2006), for instance, found that the motivational patterns and psychological mechanisms that produced imposter fears differed between men and women. Men's imposter fears were more associated with avoidance and fear of failure, while women's imposter fears were linked with wanting to prove themselves despite holding fixed views of intelligence. These findings reflect the importance of situational and environmental factors on imposter fears. While the root of imposter fears may differ between genders, both are suggested to be a product of social norms which prescribe how men and women 'should' achieve. By overlooking the social and structural origins of these feelings, popular psychology can typically be seen to reduce the imposter phenomenon into an 'individual flaw', often disregarding much of the research that grounds the phenomenon in broader societal contexts.

These findings extend beyond just gender to show how the imposter syndrome can affect other groups more significantly based on systems of inequality and oppression faced, something that popular psychology often overlooks. Recent research, once again, pushes back against oversimplified narratives by re-situating the imposter phenomenon within broader systems of oppression: arguing that imposter feelings are not simply internal psychological flaws but are socially produced feelings, prevalent especially among marginalised groups who already face low self-esteem due to discrimination and stereotype threat (Nadal et al. 2021). Furthermore, a review by Cokley et al. (2024) suggests that experiences of imposter syndrome should be understood not by the individual's pathology, but rather through the lens of structural inequality, and the discrimination the individual faces. The review also highlights how discrimination and stereotype threat cultivate imposter feelings among ethnic minorities and frames the imposter phenomenon in a way that shows it to be a manifestation of the environment, rather than what popular psychology tells us is an individual failing to overcome self-doubt (Cokley et al., 2024).

The distortion of the term '*imposter phenomenon*' over the years has significantly minimised the scientific reasoning behind the concept. It has become pathologized to an extent where normal feelings of self-doubt encourage blaming the self, rather than focusing on and critiquing the oppressive systems that give rise to these fears of being an imposter. As a result, people feel 'broken' when actually they are experiencing a completely normal response to a biased system. Going forward, there should be more effort put in by workplaces, schools, and universities to recognise, address and challenge the fundamental effects of how the environment can produce imposter feelings, and how they can manifest differently in each individual. Steps should be taken to ensure that the imposter phenomenon is widely understood within the context of its scientific roots, and not diminished to a shallow 'umbrella term' for regular feelings of self-doubt.

Memory Misfire: What neural mechanisms underlie the experience of déjà vu?

Author: Mishel Kudel

Introduction

Have you experienced something new, only to feel like you had done it before? “Déjà vu” is experienced by over 60% of the population and literally translates to “already seen”, referring to the phenomenon of feeling recognition with a new stimulus(Aitken, Jentzsch and O’Connor, 2023; Brown, 2003). There is significant debate regarding the phenomenon’s conclusive definition, with different researchers proposing either a focus on the salient sense of familiarity or the conflict imposed by awareness of how it is new to the perceiver.

Although the term was coined in the 1800s, it did not become widely used until decades later (Brown, 2003). Now, Déjà vu often holds negative connotations such as an association with declining health (Aitken, Jentzsch and O’Connor, 2023; Urquhart et al., 2018).

This article examines the neural mechanisms that underlie this phenomenon and how this addresses the perception that déjà vu is a sign of deeper issues.

***“I just experienced déjà vu, something must be wrong!”* - Does the peculiar feeling that déjà vu elicits indicate deeper problems?**

The initial reaction to déjà vu can often be one of worry. However, despite the peculiar feel it elicits, déjà vu is not evidence of one’s health deteriorating. Kennedy (2023) does characterise the experience as something that resembles delusion, but only in the sense that it briefly presents “a belief that is not supported by facts” (Kennedy, 2023). However, the distinction between delusion and déjà vu is that the brain can |correct” itself. This distortion of a perceived memory is evaluated by the brain’s decision-making regions. Furthermore, in order to understand why deja vu makes people feel this way, it is important to understand how we have studied the experience thus far.

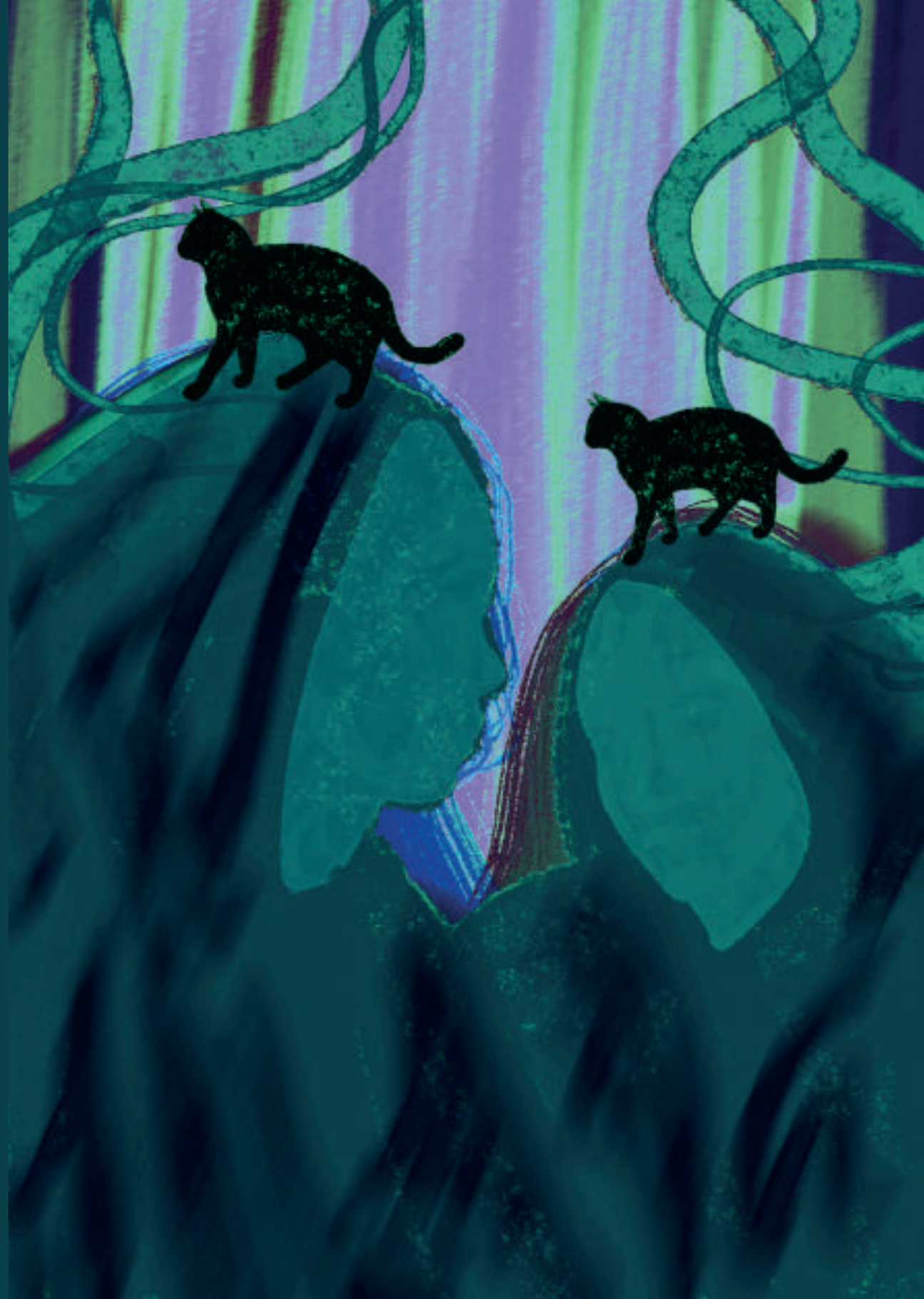
How do we study déjà vu?

Most research to understand the underlying mechanisms of an experience of déjà vu has stemmed from retrospective and prospective surveys, as they can provide insight into the subjective aspect of individual déjà vu experience. For example, Neppe developed a quantitative and qualitative survey, later refined and expanded on by Sno et al. (1994), to provide a clear understanding of measuring frequency, duration and emotional intensity exhibited during an individual expressing déjà vu (Brown, 2003) (Brown, 2003; Sno et al., 1994).

However, there are a few methodological limitations, such as the use of convenience sampling, interpretative bias and lack of clarity regarding the questions used in the surveys. Due to these, the measures cannot provide conclusive and causal reasoning behind the neurological experience surrounding the sensation (Brown, 2003). Nevertheless, compared to other surveys, retrospective ones still provide the most clarity about the physical and physiological circumstances involved in the experience (Brown, 2003).

How can we use speculative models to better understand deja vu?

Since there is no standardised method for studying the neural mechanisms underlying déjà vu, we rely on speculative models (divided attention theory, dual processing model, and neurological timing model) to provide a clearer picture of what happens in the brain during déjà vu (Cristofori, 2015; Thompson, 2014; Eurich et al., 2000). The divided attention theory argues that when we concentrate on more than one piece of information, relevant information can be missed due to the limited capacity of cognitive processes (Cristofori, 2015). Moreover, this model suggests the feeling of a familiarity characteristic in déjà vu is created by partial interpretation of the event, the first time we perceive it before fully focusing on it the second time around.



However, other models suggest different mechanisms. The dual-processing model, for instance, suggests that déjà vu occurs when the systems responsible for familiarity and conscious recall fall out of sync. This involves the interplay of one system creating a quick, automatic sense that something is familiar, while the second system (reliant on working memory) retrieves the specific memory associated with this feeling. When these systems are not synchronised, the feeling is generated before the associated memory is associated, thus creating a "false repetition", as the stimulus is not consciously recalled (Thompson, 2014).

Thirdly, the neurological timing model attributes the experience to a glitch in neural transmission that triggers a misplaced sense of recognition (Eurich et al., 2000). In typical conditions, neurons adjust transmission delays so that both the memory and sensation of recollection arrive together, but when this timing is unaligned, the signals do not reach the postsynaptic neurons at the same time. This will then cause the brain to label the new stimulus as familiar to the individual (Eurich et al., 2000).

Despite their different explanations, these models converge on one point: déjà vu does not have connotations with deeper neurological problems.

What are the most likely neural pathways involved in déjà vu?

The most telling explanation involves looking at the two key processes that underlie normal recognition memory: recollection (occurring in the hippocampus and parahippocampal cortex) as well as familiarity (perirhinal cortex). When looking at the brain's activity in déjà vu in isolation, there is an acute activity in the perirhinal cortex without any activation of recollection (Aitken, Jentzsch and O'Connor, 2023). Furthermore, if the hippocampus generates a signal that suggests recollection, which contradicts the signals of stored memory, this creates a brief conflict, often expressed as confusion. This results in the unsettling feeling associated with déjà vu that many people have reported (Brown, 2003). Of the discussed speculative models, this aligns most with the dual-processing model. Notably, the interactions of these processing systems are generally temporary, suggesting that déjà vu is not indicative of anatomical features but an isolated physiological event (Aitken, Jentzsch and O'Connor, 2023). In addition to this, neuroscientific work suggests that déjà vu arises when the temporal lobe identifies stimuli as a repeated experience. This then prompts the frontal regions of the brain to "check" whether this is the case. When this notion of recognition is dismissed by the frontal regions, déjà vu emerges. Significantly, O'Connor elaborates that perhaps the corrective process conducted by the brain is actually a positive sign. One could argue this is because it demonstrates how the brain is effectively preventing misremembering events, therefore rationalising one's memory (Aitken, Jentzsch and O'Connor, 2023).

What are the factors that can cause an individual to experience deja vu?

Often, people will characterise specific traits in association with deja vu. The conditions under which déjà vu is experienced are framed around the accumulation of a range of physiological and psychological factors, such as mood, stress, dopamine levels and age (Kennedy, 2023). For example, dopamine (a neurotransmitter) is relevant to experiencing familiarity in typical situations; therefore, disruption to dopamine's production (whether the change is an elevation or a decrease) can intensify an experience of familiarity, possibly causing the expression of déjà vu (Kennedy, 2023).

While researchers have suggested that an increase in fatigue and stress can induce a higher frequency of déjà vu experiences, this is because these factors result in increased neuronal misfiring of the brain's regulatory system (Kennedy, 2023). This is because fatigue leads to inefficiency in neuronal systems regulating themselves. However, this only accounts for the preliminary experience of déjà vu where the neuronal "misfire" occurs, ignoring the secondary process in which the memory feeling is dismissed by regulation through the temporal region.

Additionally, often, déjà vu is associated with deteriorating health due to the role that age plays in the experience. However, studies show that younger individuals tend to experience déjà vu more often due to the increased activity within neuronal circuits as well as a more acute awareness of "fact-checking" the memory using the frontal regions of the brain (Kennedy, 2023).

Overall, our current understanding of déjà vu does not conclusively indicate that it illustrates any underlying pathology.

Conclusion

Overall, there are many aspects of déjà vu we still have to explore. Current evidence frames déjà vu as a temporary, brief, mismatch within regions of the brain, rather than a sign of dysfunction. While at its core, the experience is regarded as random, its frequency appears to be indirectly influenced by the combination of factors such as stress, mood and age that contribute to the familiarity and recollection processing systems.

Despite most findings on neural mechanisms of déjà vu remaining correlational, they provide a stepping stone for more research in this area. These studies are especially useful in highlighting brain regions that are critical to the phenomenon, understanding neural timing and the effects of these systems slipping out of sync.

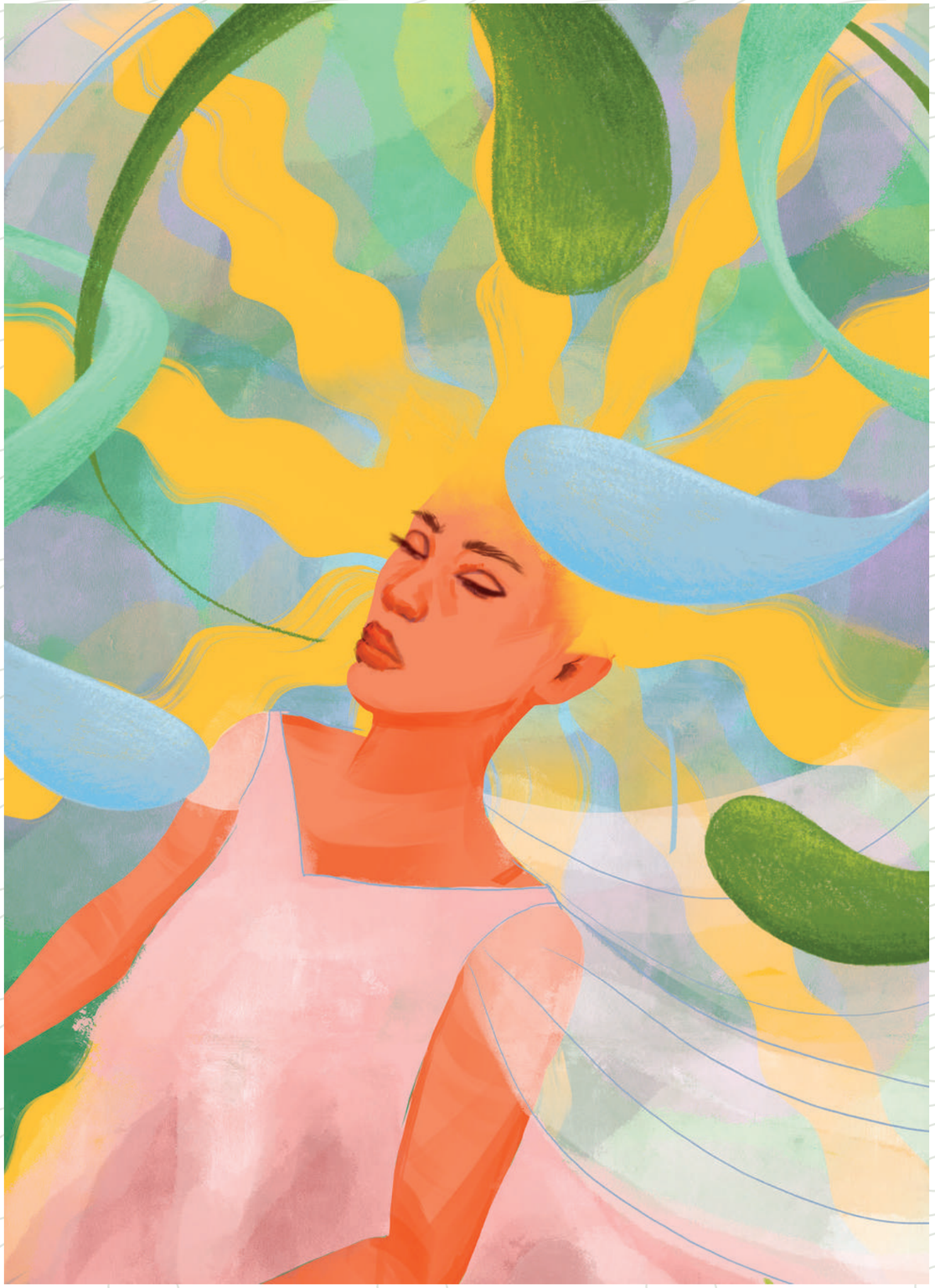
To conclude, déjà vu remains a mysterious, fascinating experience. If nothing else provides insight into how the brain can attempt to "correct" itself, revealing one of the working memory's intricate processes to support our day-to-day lives.

Changing Perspective:

Alternative Treatments & Approaches to Psychology

This section explores alternative therapies or treatment methods to psychopathologies and overall mental wellness. This section shines a light on novel, developing, or exploratory approaches to psychological care. Alternative therapies may include looking at holistic medicine to treat psychopathology. Topics may range from neuroscience approaches such as microdosing to non-invasive, psychological approaches such as meditation-based therapies. Alternative therapies and treatments can be more time consuming, costly, or have limited supporting research, but it is important to explore alternative methods that may be effective while being less invasive and have less side-effects.

Edited by Matilde Forcina



Breathwork as a Mental Health Tool:

Regulating Energy Through a Natural System

Alex Tenney

Introduction

Sometimes, taking a breath of fresh air is all you need to bring yourself back to Earth. As a recently certified yoga teacher, I have been using breathwork as an everyday tool since I discovered its simple, yet powerful utility. Whether it be for simple grounding to connect my mind, breath, and body, for preparation before competitive sports matches, or everything in between, the practice of breathing has changed my perspective on how we can use natural processes to our advantage. In this article, I will delve into how breathwork can be used in our daily lives and how it works, so that this easily accessible tool can, well, be accessible!

The Science Behind Breath

- An Evolutionary Weapon

A key to understanding breathwork is knowing how the autonomic nervous system (ANS) regulates this process within the body. As a component of the peripheral nervous system, the ANS controls all involuntary actions in the body, including breathing. To regulate this process, the vagus nerve, which is the primary nerve of the parasympathetic nervous system, carries both sensory and motor fibers to and from various organs in the body (Wehrwein, Orer, and Barman, 2016). This allows your diaphragm to contract and move downward, thereby allowing your lungs to expand into the increased space within your chest cavity. Additionally, your intercostal muscles allow your ribs to expand gently, providing more space to breathe into.

As you take a deep breath of air through the mouth and nose, the air travels down through your trachea, also known as your windpipe, and into the lungs. From passing through the bronchial tubes, air reaches the alveoli. This is where gas exchange takes place; our body takes in oxygen and releases carbon dioxide through cellular respiration.

Okay, you can breathe out now, the science is over. Additionally, breathing out does not require any additional energy from your body!

Breathe Deep and Smile

- How Breathwork Boosts Happiness

Have you ever heard the saying–'It's like taking a breath of fresh air'--usually referring to something that feels freeing, like trying something new? Well, here, we can take it literally!

In a nutshell, your emotions can control your breath and vice versa! Perhaps one day, you'll be stressed due to a deadline and find yourself holding your breath. Or, if you're feeling sad and need to cry, is your breath speeding up? Sometimes, we notice an increase in heart rate or other physical responses, such as increased sweat production; however, our breathing often remains unchanged. Breathing is directly tied to emotions in many ways, so let's use it to boost happiness, on purpose!

Many motor controls for breathing outputs are regulated by complex neural networks within the brain. This respiratory output is very easily influenced by internal and external environmental changes (Brems, 2024). Termed as 'behavioral breathing', this process is usually considered separate from the homeostatic, metabolic one (Homma and Masaoka, 2008). The reason we can use breath to boost happiness is because when we increase the flow of oxygen to the brain, the brain releases feel-good neurotransmitters such as serotonin and endorphins. Since many enzymes require oxygen as a molecule to function, a higher amount of oxygen can result in more feel-good hormones in our bodies. The center of emotions is located in the cerebrum nestled in our brain's limbic system. Emotions here are processed and deemed as either positive, or negative. The hypothalamus then receives these perceived emotions and signals to the pituitary glands to release the respective hormones into the blood stream. (Rokade, 2011). Thus, when feel-good hormones are released by breathing, it ultimately results in increased happiness.

The active practice of breathing can be traced back for millennia within Eastern tradition, specifically originating in India, where many believed it to be a crucial aspect of reaching the meditative state of consciousness (Zaccaro et al., 2018). This originated as 'pranayama', a set of breathing techniques that consciously aim at regulating aspects of respiration within the physical body. Some examples of this include the depth or frequency of your breath. For instance, 'Nadi Shodhana' or 'alternate nostril breathing' is a pranayama technique that involves breathing through one nostril at a time, which is believed to balance the two hemispheres of the brain and calm the mind. Typically, pranayama is used in yoga classes to hone the breath for presence and awareness. This ancient technique is often paired with the belief that controlling the breath has positive effects on wellness, such as boosting happiness.

One, Two, Three... Breath!

Adenosine Triphosphate (ATP), or energy, is a main component that supports life on Earth. This molecule provides cells with energy to fuel their processes, allowing all living organisms to survive. ATP consists of a ribose sugar, adenine, and three phosphate groups. The energy release comes from the bond between the second and third phosphate groups. Due to hydrolysis, the process through which the end phosphate is broken off, energy is released as the ATP turns into ADP (Musante et al., 2007). When we breathe, oxygen becomes one of the key ingredients in creating ATP. So, breathing is directly and heavily correlated with energy release, meaning that you can use breath to control and conserve energy!

Respiration = Relaxation:

Simple Breathwork for Daily Life

Breathing is an essential function of life, so let's use it to benefit us even more. Specific techniques can be used to optimize our psychological health, all of which are readily accessible.

In an interview with Stella Lucano, a University of St Andrews Netball Sport Scholar, the topic of breathwork during sport was discussed. Positioned primarily as a goal keeper, Lucano mentioned that one typically gets frustrated, but that she quickly shuts these emotions down by using breathing techniques. The scholar said that as captain, "people see what you're feeling," so breathing helps her be "that pillar of calmness–with extreme passion, not turning into frustration." She then went on to discuss that taking deep breaths during match play allows her to become less stressed and brings quick relaxation. Psychologically, taking a deep breath stimulates your parasympathetic nervous system, a part of the autonomic nervous system that helps the body rest and digest. This in turn soothes the body's typical stress reaction to a competitive situation, which usually features a 'fight-or-flight' response, shifting more towards a 'rest-and-relaxation' state that better serves athletes to be more present.

In a following conversation with a psychotherapist, breathwork was discussed in a therapeutic context. She stated, "I teach my clients to use breathwork when they are anxious and need to calm their nervous system, when they become emotionally dysregulated, or when they need to 'pause' to think more clearly and make good choices." She goes on to mention how alternative techniques are always provided, and that "one size doesn't fit all." Still, slowing down and focusing on breathing is used in various ways to help people return to the present, focus, and function more efficiently.

Even if not playing a sport, or using it for therapeutic purposes, taking a deep breath can help in your daily life. Have you ever had to speak in front of a room full of people? Or taken a test where you've been confused? Taking a moment to notice your breath can help bring you back to the present and lower other vital functions, such as your heart rate and blood pressure (Cuda, 2019). So, the next time you feel distant from where you want to be, take a breath and think again!

MORE THAN A MELODY:

THE THERAPEUTIC POTENTIAL OF MUSIC

(CHANGING PERSPECTIVE: ALTERNATIVE TREATMENTS AND APPROACHES TO PSYCHOLOGY)

Written By

Sarah Choi

MUSIC IN THE BRAIN

Music is loved across cultures, demographics, and time. We put on our headphones as we go about our daily lives, attend concerts by our favorite artists, and share our favorite songs with our loved ones. But what really happens in our brains when we hear our favorite song? How does music calm us down during times of stress, connect us with others, and allow us to reminisce over certain times in our lives? By uncovering the mysteries of these processes in the brain, we can form an understanding of how to use music therapeutically within personal and clinical contexts.

When we listen to music, sensory input (sound) is processed in our brain's auditory system to create sensations, and our expectations of the melodies and rhythms of the music affect our perception (Vuust et al., 2022). As a result, our sensory systems, past experiences, culture, preferences, and musical background each affect the music engagement experience. After transfer of sound input from our ear to nerve input, music enters the brain through processing in the auditory cortices. It then travels through neural pathways in the brain to areas such as the cerebellum and motor cortices (which coordinate and carry out movement), the hippocampus (which aids in memory) (Watanabe et al., 2008), and to the amygdala and insular cortex (affecting emotion) (Brattico et al., 2016). Integration of diverse brain systems is the basis behind the relation of music to movement, emotion, and memory.

By nature, music elicits a wide range of emotions, some of which can be hard to put into words. Music of either happy or sad nature that we enjoy causes more brain activity in neural reward circuits than music we dislike (Brattico et al., 2016). Thus, there is a neural basis behind the use of music to process sad feelings and cope with difficult emotions. Enjoyment of music is underlined by communication between the auditory cortex and reward systems in the brain. Using functional magnetic resonance imaging (fMRI), a study on music chord sequences found that the amygdala and hippocampus light up during surprising chords in pop songs (Vuust et al., 2022). Besides giving insights into the mystery of the human mind, understanding this mapping of music in the brain has implications for its use in clinical practice.

WHAT IS MUSIC THERAPY?

Music therapy (MT) is a clinical and evidence-based practice in which music interventions are utilized by an accredited professional to achieve therapeutic goals (American Music Therapy Association, 2015). MT has been found to be an especially effective form of psychotherapy for individuals with autism spectrum disorder (ASD), PTSD, anxiety disorders, depression, and Alzheimer's Disease (AD) (Koelsch, 2009). Because listening to music is a process that heavily involves our perception, motor control, emotion, and memory mechanisms, it can be an especially useful tool in the therapeutic treatment of disorders relating to these cognitive mechanisms. In practice, MT techniques vary based on the nature of the setting and preferences of the client. It can include creation of music vocally and instrumentally, movement/dance, composition,improvisation, and digital music activities. Therapists aim to help clients achieve their personal goals as they would in traditional talk therapy, but through the advantages of music (American Music Therapy Association, 2015).

MT AND TREATMENT OF NEURODEGENERATIVE DISEASES

One example where MT is put into practice is for treating neurodegenerative disorders (NDs). The 'degeneration' or loss of neurons in NDs can cause symptoms of dementia, or cognitive decline, such as memory loss, problems with language, and difficulty managing daily tasks. For millions of people that face NDs, disease-specific treatments importantly target biological progression of the disease or attempt to alleviate symptoms. Although understanding of physiology behind NDs continues to broaden, most recent treatments are focused on symptomatic improvement, and can be expensive or inaccessible (Lamptey et al., 2022).

Based on the aforementioned findings that music activates several areas in the brain associated with these difficulties, some have looked at how MT caters to individuals with dementia. Madsø et al. (2022) systematically examined the value of MT for the wellbeing of patients and sociable interaction of dementia patients with their caregivers. 10 weeks of MT began with assessment of the music background of each patient and development of a treatment plan focused on their personal goals. MT sessions included a range of musical activities that catered to individual patients, and represented typical approaches to MT treatment for dementia. Among the most common of these was singing together. Songs were chosen by either the patient or the therapist, with the therapist often accompanying using guitar or piano. Playing instruments such as drums or guitar together accommodates the strengths and skill capabilities of patients. Musical improvisation was often employed and focused on the patients' musical background. Listening to live (played by the therapist) or recorded music was used to foster emotions and emotion regulation. Relaxation exercises to music with the patient were used for social goals such as improved communication and relationships. During these 45 minute sessions, the therapist facilitated these activities based on the needs of the patient (such as energy level, attention span, and verbal abilities) and spoke to patients about the music and memories that came to mind during the session. A decrease in neuropsychiatric symptoms associated with dementia was found. Sociable behavior between patient and caregiver as well as observed well-being increased minorly to moderately between pre- and post-sessions. Significant increases in self-rated positive emotions and non-verbal sociable interactions were also observed (Madsø et al., 2022).

This aligns with collective findings from the effects of MT on dementia patients, particularly in terms of wellbeing in enjoyment, happiness, and positive expressions of identity (as reported by the Observable Well-being in Living with Dementia-Scale). Personalized and familiar music has been found in some cases to maintain feelings of identity and trigger autobiographical memories. Increases in musical collaboration and turn-taking during MT sessions suggest potential of music therapy for facilitating social behavioral expressions outside of therapy (Madsø et al., 2022). This is especially important because engagement in social connection and interaction is often a major treatment goal of dementia patients (Øksnebjerg et al., 2018) as it can improve personal wellbeing and relationships with caregivers. These emotional and interpersonal goals are targeted in a personalized and powerful way through MT.

WHY IS IT IMPORTANT?

One incredibly important aspect of music therapy is that it can often reach more individuals than traditional (talk) therapy as a non-invasive, artistic medium. This is especially relevant for individuals who communicate in a non-traditional way (Koelsch, 2009). For treatment of communication disorders and for patients who cannot verbally communicate due to physical barriers, engaging in MT allows for communication and support beyond words. This is relevant in clinical MT settings, but also for the use of music for dementia patients in music related programs. One example is Memory Makers, which runs music programs weekly for dementia patients and their caregivers here in St Andrews! Additionally, accessibility of music therapy for children with autism spectrum disorder (ASD) has been shown to be beneficial for development of communication skills, auditory and sensory-motor processing, and emotional regulation (Reschke-Hernandez, 2011). Finally, the use of sad music was found to decrease the difficulties with verbalization of emotions experienced by patients with major depressive disorder (Bodner et al., 2007).

CONCLUSION

Music lights up the brain in numerous areas, including those involved in sensory-input, emotion, cognition, memory, sensory-motor integration, and prediction. Biological mechanisms behind the cognition of music help us to understand what music means to us on a psychological level, and its potential for personalized therapies. Our experience, processing, and response to music beautifully illustrate the biopsychosocial nature of neuroscience. Music therapy matters because it is for everyone. MT can be beneficial to those suffering from disorders such as NDs, ASD, anxiety, and depression, as it reaches individuals with fewer treatment options, whether that be due to physical or cognitive barriers. However, even on a personal level, recognizing music as a therapeutic tool in a non-clinical context can provide validation in the comfort we take in music. It has the biological foundation and psychological potential to make us feel and communicate deep emotions, connect with others, reflect on memories, and treat currently incurable diseases.

Replacing the Couch with Code
EXPLORING AI AS A THERAPEUTIC ALTERNATIVE

@_Kari_Sparrock_

Introduction

Recent years have seen an influx of new technologies applied to mental health care. As the Pew Research Center finds, over 97% of young people connect to the Internet on a daily basis, demonstrating a strong familiarity with the medium, and further suggesting that internet-based interventions have high potential to reach and resonate with young audiences. Amongst a growing discourse, the potential of AI as a therapeutic alternative has arisen, through forms such as virtual reality exposure therapy and cognitive behavioral therapy (CBT) delivered by chatbots. The history of AI use in mental health care extends as far back as the mid-1960s, which saw the development of the first chatbot, ELIZA. It was modelled after Rogerian psychotherapists, who practice a person-centered form of therapy that encourages the patient to discover their own solutions (D'Alfonso et al., 2017). Chatbots are computer programs that simulate real-life conversations with users through text or speech. This recreates the experience of a natural interaction, enhanced by the chatbot's understanding of natural speech patterns (D'Alfonso et al., 2017). AI has evolved greatly since the creation of ELIZA, and now has applications ranging from early detection of mental health issues to creating personalized treatment plans (Zhang & Wang, 2024). This has led many to question whether AI is capable of performing, or even replacing, the role of the human psychotherapist.

The Benefits

Many of the advantages offered by AI therapy are inherently tied to the limitations of traditional, in-person therapy. Primarily, it widens the accessibility of mental health resources, which are in increasingly short supply due to mental health issues reaching a pandemic level (Zhang & Wang, 2024). This leads to problems such as longer wait times and a lack of long-term support. AI therapy is able to mitigate these challenges by working with patients that are facing less severe mental health issues, allowing professionals to allocate more time towards those requiring more support. According to psychologist Dr. Peter C. Forkner, 55% of presenting students were determined by clinicians to require support but not necessarily a therapist; many such cases could instead benefit from AI as a therapeutic alternative (McCarthy, 2025). AI also comes with the additional benefit of having 24/7 availability, and is therefore easier to access in times of crisis. Furthermore, AI therapy could be considered as a means of post-treatment support following the conclusion of in-person sessions, as discharge from clinical treatment increases the risk of relapse (D'Alfonso et al., 2017). On a global scale, AI therapy has the benefit of being less inhibited by geographical, economic, and resource constraints, allowing it to help underserved populations. It is also more likely to reach communities in which accessing mental health services is accompanied by a sense of shame and stigma. Research has shown that people are often more willing to share sensitive information with a machine interface due to its non-judgmental nature; by lessening the stigma associated with mental health issues and treatment, AI can improve patient engagement and honesty (Zhang & Wang, 2024).

Despite the concerns of AI posing a threat to therapists' employment, it can actually provide them with valuable support. When used in conjunction with traditional therapy, AI can save them a lot of precious time by reducing the number of tedious tasks. For instance, AI can write intake summaries, transcribe counseling sessions, and summarize them in the SOAP note format often utilized by mental health providers. From this information, AI can create treatment plans and offer ideas for therapeutic interventions. There is also the potential for other analytic applications for AI that could give therapists insights into their own work, such as providing a ratio of speaking time taken up by the therapist versus the patient. It could also provide a dynamic speech feature that allows therapists-in-training to practice particular skills through roleplay with the chatbot, which, in turn, can provide detailed feedback on their progress (McCarthy, 2025). By supporting therapists in these different ways, AI can help reduce their emotional burnout–a big risk within this occupation due to frequent exposure to heavy conversations and high-stress situations. Burnout affects both the health of the therapist and their performance professionally, as they may become less attentive to their patients, which in turn has an impact on their patient satisfaction and progress (Zhang & Wang, 2024). AI is also insusceptible to other emotional burdens of therapy including variations in mood, fatigue, and personal biases, allowing for greater consistency in the quality of care. Finally, AI technology possesses the ability to retain and retrieve large quantities of information, which can improve the personalization of care, particularly for patients with more complex conditions or history requiring a more precise approach (Zhang & Wang, 2024).

The Limitation

There are two main types of concerns regarding the use of AI for therapeutic use: those that focus on its efficacy in treatment, and those that question the ethics of its use altogether. Many believe that there is something to be said about the fact that AI is primarily designed to produce the response that will most satisfy the user, and while it provides a decent imitation of human empathy and understanding, it lacks these qualities innately. This could potentially pose a threat to the therapeutic relationship between therapists and their patients, which is established based on components such as shared human experiences, mutual understanding, and nonverbal communication that the algorithmic design of AI fails to capture. Moreover, there is the potential for the intimacy of this relationship to be exploited due to data security and privacy concerns. In some cases, AI could also become an unhealthy crutch for patients who would benefit from in-person therapy as a result of having unrestricted access to it, preventing them from learning to cope with their feelings independently.

Despite its highly technical design, AI is not impervious to flaws that can impact its effectiveness. While it may not fall victim to the same human biases that therapists often do, algorithmic bias resulting from the data used to train AI models could have inadvertent consequences on patients. These could range from overlooking cultural nuances to unequal treatment on the basis of factors like race, gender, or socioeconomic status, which may exacerbate already present gaps in mental health care (Zhang & Wang, 2024). In fact, there have already been recorded instances in which chatbots were seen varying their responses based on the user's perceived identity and demographic cues (McCarthy, 2025). Another practical concern is the longevity of AI's memory and efficacy. Even though AI can retain detailed information over a short period, it struggles to keep track of user interactions over time. This may further fragment the therapeutic relationship and lead to inconsistencies in the delivery of care. Additionally, while human therapists can alter their strategies over time, AI does not possess such a high degree of flexibility. In fact, studies have even demonstrated that early improvements from AI-based interventions typically diminish resulting in a lack of meaningful sustained progress (Zhang & Wang, 2024).

Case Studies

As is becoming evident, the research into the effectiveness of AI therapy in practice is quite conflicting, and the consensus of existing literature is not altogether unanimous. However, several recent studies sought to shed light on this underinvestigated area. Kuhail et al. (2024) was one such study, in which 63 therapists compared the therapy transcripts of human-human sessions to those of human-AI sessions, which involved the use of the chatbot Pi. Researchers found that therapists could only distinguish between the two at a rate comparable to chance (only 53.9% of the time). The therapists also rated the quality of the human-AI transcripts an average of 3.70 out of 5 compared to their rating of just 3.43 out of 5 for the human-human transcripts. Based on these findings, and particularly in contexts where human therapists are in short supply, the researchers extend provisional endorsement for the role of AI chatbots in supporting those facing mild to moderate mental health challenges.

Similarly, Spytska (2025) looked at the effectiveness of another AI chatbot, Friend, in providing psychotherapy, specifically to women in active war zones with diagnosed anxiety disorders. Spytska monitored the change in anxiety levels of participants receiving support either from the Friend chatbot or through traditional human-human psychotherapy sessions. However, Spytska found that while there was a decrease in anxiety levels across both groups, the recipients of human-human therapy had an approximately 15% greater reduction in anxiety levels compared to those using Friend. She concluded that while Friend was capable of providing immediate support, it lacked the emotional depth of psychotherapy. Nonetheless, Spytska still emphasized the value in utilizing AI in under-resourced contexts or crisis situations where human-human therapy is in limited supply, ideally creating a hybrid model for mental health care.

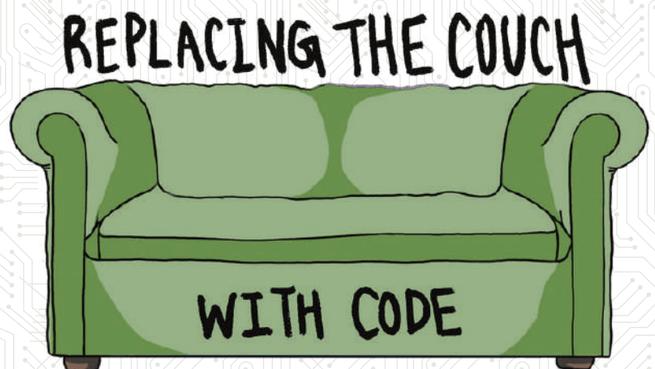
Moving Forward

It is clear that the solution to the question of AI use in therapy is not so straightforward, and in order to make the most of this new technology, changes at both the societal and individual level should be considered. Currently, this area is not so heavily regulated, and as Dr. Forkner warned, failing to address these limitations will permit technology companies to determine the trajectory of mental health care. Regulation could look many different ways, including disclaimers about the limitations of AI therapy, providing contact information for counseling centers, requiring clinician oversight of AI interactions, greater transparency on the part of technology companies, and more thorough research on the efficacy of AI therapy over time.

At the individual level, it must be recognized that the suitability of AI therapy will vary amongst patients. For instance, those who already have a strong support system in place and are deemed to have less severe mental health issues will likely benefit more from its use. AI could also be regarded more as a tool to strengthen the therapeutic relationship between therapist and patient, rather than a substitute. Therapists may recommend that patients make use of the chatbot in between sessions to supplement their care, and provide advice on how to create prompts that will lead to more effective AI interactions. In addition, chatbots can listen in on sessions and later offer its insights to the therapist and patient, generating a therapeutic triad of sorts (McCarthy, 2025).

Conclusion

AI is neither a universal solution nor a substantive danger to mental health care, but instead a developing tool whose value depends on responsible implementation. While it offers unprecedented accessibility and consistency for patients and clinicians, it also raises substantial concerns pertaining to efficacy, equity, privacy, and the preservation of the therapeutic relationship. The future of AI in therapy lies not in replacing human therapists, but in complementing them, particularly in instances where resources are scarce and individuals may otherwise go without patient care. Continued research and regulation will be necessary in ensuring that AI elevates, rather than undermines, the field. Ultimately, the question remaining is not to decide whether AI belongs in therapy, but to determine how to harness its potential ethically and wisely.



REWIRING THE MIND'S EYE: EMDR AND THE COST OF DELAYED HEALING

KAAVYA CHANDRASEKAR

INTRODUCTION

In an age of self-diagnosis and digital mental health culture, many young people are turning to online spaces for understanding rather than seeking professional help (McVay, 2023). This delay in accessing evidence-based treatment allows trauma and emotional dysregulation to become embedded during crucial stages of development. Eye Movement Desensitization and Reprocessing (EMDR) offers a striking example of both the consequences of delayed healing and the possibilities of neurological repair once treatment begins. Developed by Francine Shapiro in the late 1980s, EMDR has evolved from a controversial experimental therapy to a globally recognised intervention for trauma-related disorders (World Health Organisation, 2013). Exploring EMDR through a developmental and preventative lens reveals not only how trauma alters the brain, but also why timely intervention is essential to healthy cognitive and emotional growth.

UNDERSTANDING EMDR

EMDR was first described by psychologist Francine Shapiro (1989) as a structured, eight-phase therapy designed to help individuals reprocess distressing memories. The central technique involves bilateral stimulation (i.e. guided eye movements) that enable clients to recall traumatic experiences while simultaneously engaging working memory. This process is believed to reduce the emotional charge of the memory and facilitate adaptive cognitive restructuring, helping individuals identify and challenge negative thought patterns to replace them with more constructive ones (Landin-Romero, et al., 2018). Unlike traditional psychotherapy, EMDR does not require detailed verbal descriptions or prolonged exposure; instead, it leverages neurocognitive mechanisms to promote integration between emotional and rational brain systems. Across studies it has generally been found that it takes less time to see results from EMDR than regular psychotherapy. For example, in one clinical trial, 70% of participants achieved a "good outcome" in three active treatment sessions (Ironson, et al., 2002). In another study, three lots of ninety-minute EMDR sessions saw a clinically significant change for the patient (Wilson, et al., 1995). Neuroimaging research suggests that EMDR activates similar pathways to those involved in rapid eye movement (REM) sleep, a state linked to memory consolidation and emotional processing (Van der Kolk, 2014). As such, EMDR is not only a therapeutic tool, but a window into how the mind can physically and psychologically rewire itself after trauma.

THE COST OF DELAY

The consequences of delayed psychological intervention are profound, particularly during adolescence, a period of heightened neuroplasticity and identity formation. When trauma or chronic stress goes untreated, it can disrupt neural pathways responsible for emotion regulation, executive function, and social cognition (Teicher, et al., 2016). These disruptions can often manifest as anxiety, depression, or maladaptive coping strategies in adulthood. Research shows that early adversity can alter the development of the amygdala and hippocampus, key structures involved in fear conditioning and memory, which potentially lead to hypervigilance or emotional numbness (McCrory, et al., 2011).

Compounding this biological vulnerability is a widespread reluctance among young people to seek professional support. Stigma, misinformation, and a preference for self-reliance are among the most frequently reported barriers to help-seeking behaviours (Gulliver, et al., 2010). Consequently, many individuals only turn to therapies such as EMDR after years of untreated distress, by which time maladaptive neural patterns have become deeply entrenched. Addressing these developmental and cultural delays is essential to foster preventative, rather than reactive, models of mental health care.

EMDR AND NEURAL REPROCESSING

EMDR's mechanism of change lies in its ability to engage both hemispheres of the brain through bilateral stimulation while simultaneously activating distressing memories. This dual attention process is thought to create a "reconsolidation window" in which maladaptive memories can be updated with new, adaptive information (van den Hout & Engelhard, 2012). Functional MRI studies indicate that successful EMDR sessions are associated with decreased activation in the amygdala and increased regulation from the prefrontal cortex, suggesting evidence of restored emotional control. (van der Kolk, 2014)

For individuals who experienced trauma during childhood or adolescence, EMDR can thus act as a corrective tool for developmental experiences. By reprocessing memories that once overwhelmed their still-developing cognitive systems, patients can form new, more positive, associations and emotional responses. This neural flexibility underscores EMDR's potential not only as a treatment for PTSD but as a means of repairing the consequences of delayed intervention particularly during development. In essence, EMDR demonstrates that while the brain bears the imprint of early trauma, it also retains the remarkable ability to heal through guided, intentional reprocessing.

PREVENTION OVER REACTION

Although EMDR is an effective treatment for trauma, its necessity often highlights a deeper systemic issue: the failure to intervene early. Most mental health disorders emerge before the age of twenty-five, yet help-seeking during adolescence remains limited (Patel, et al., 2018). Preventative frameworks that promote early recognition, destigmatization, and access to evidence-based care could reduce the long-term need for intensive interventions like EMDR.

Public health strategies must therefore shift from reactive crisis management to proactive mental wellness education. School-based emotional learning programs, for example, have been shown to strengthen cognitive control and resilience (Durlak, et al., 2011). If such initiatives were widely implemented, individuals might be less likely to internalize trauma and more likely to engage with professionals early on. EMDR illustrates what is possible when the brain is given the opportunity to heal, but it also reminds us of the human cost of waiting too long to seek that healing. The challenge for modern psychology is to bridge the gap between awareness and action, turning self-diagnosis into professional prevention.

LIMITATION

EMDR has several limitations that help explain why it is not universally adopted as a first-line therapy. It can provoke intense emotional reactions, with the recollection of traumatic memories during therapy having a potential to cause re-traumatisation, emotional flooding, or temporary worsening of symptoms (Pinnacle Therapy, 2024). In addition, whilst EMDR's efficacy for PTSD is relatively strong, the quality of other studies is less robust, particularly in non-PTSD populations (Cuijpers, et al., 2020). Finally, there is still ongoing debate about its mechanism of action, with critics questioning whether eye movements or other bilateral simulation are really necessary for its effectiveness, which can make some clinicians sceptical about its distinctiveness compared to other therapies, thus perceiving it as an alternative treatment (South California Sunrise Recovery Centre, 2025).

CONCLUSION

Eye Movement Desensitization and Reprocessing stands as both a testament to the brain's capacity for renewal and a warning about the effects of delayed care. While EMDR can effectively reprocess traumatic memories and restore emotional balance, its very success underscores how much suffering might be prevented through early, professional intervention. In an era dominated by digital self-diagnosis, it is vital to reframe therapy as a proactive investment in cognitive and emotional health rather than a reactive measure. As neuroscience continues to reveal the plasticity of the developing mind, psychology must advocate for prevention, not just cure. The story of EMDR ultimately reminds us that healing is possible, but it is far more powerful when it begins before the damage becomes deeply wired.

Do you ever wonder if people actually have control of their behavior or if they are simply creatures of habit? This section would explore the science behind habits and decision-making, especially decisions that are made under stress. Drawing from studies, experiments, and experiences, this section aims to explore how the brain makes decisions, why the brain makes decisions that are harmful for the individual, and the degree of control we have over our choices.

Edited by Iris Pritchard

PRESSURE MAKES DIAMONDS

by Tyra Bogan

Each day humans are asked to make decisions that are as simple as what to wear for the day to questions as complex as how to what to do with their future. Decisions, like diamonds, are often made under the most pressure filled and intense circumstances. Understanding how the brain functions during decision-making, how culture and gender influence it, and how much control we have in our decisions, may give perspective on why decision making is so difficult and so important.

The Brain and Decision Making

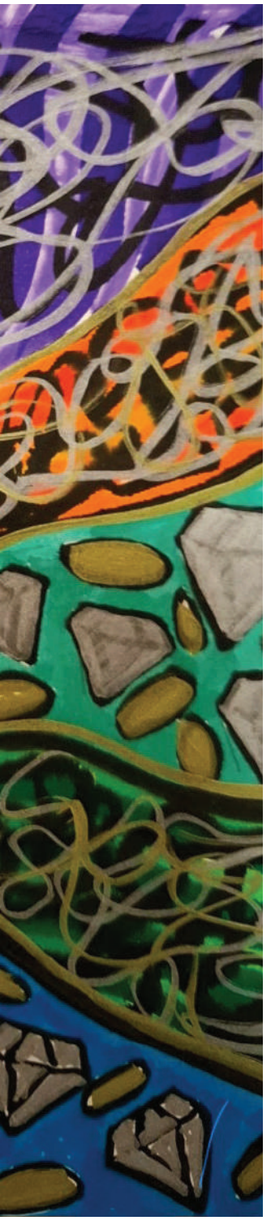
Parts of the brain like the prefrontal cortex and amygdala, cortisol levels, and cognitive appraisal work together to play a role in how decisions are made, since both the emotional side and logical side contribute to decision making ability. The prefrontal cortex plays a major role in decision making, because it allows individuals to process the information they are given and it serves as the working memory inside the brain.

The function of the amygdala is to aid in processing emotion and responding to fear. The amygdala is located near and in line with the hippocampus which allows individuals to retain past memories and use them to help make the best decisions going forward. In addition, the hypothalamus and pituitary gland play a role because cortisol is regulated by those regions after being produced by the adrenal glands. During stressful situations and high pressure decisions, cortisol is increasingly involved as it causes appraisal impairment in unbalanced amounts and is linked with the stress reaction.

Overarchingly, cognitive appraisal directly controls emotions and affects executive function as a result. It allows individuals to process situations as they come about and understand how impactful the situation will be emotionally. This allows for an appropriate level

of action to be taken and the decision to be made on a timeline suitable for it. Cognitive appraisal is what causes certain decisions to be made in a relaxed and controlled environment and other decisions to feel like they are made under high pressure.

As these aspects work together and in competition with one another, finding a balance of the more emotional regulation with more direct executive function is where the best decisions are made. Inherently, the emotional side overarchingly called the limbic system is in competition with the rational side which mostly consists of the prefrontal cortex.



Influences of Culture and Gender on Decision Making

It is interesting to understand how differently the circumstances and cultural variation in how people are raised can affect this decision making ability. Whether united by an upbeat song pregame in the locker room or by joining a society like EmpowHER or Women for Women dedicated to thriving and growing in a women-led space, these groups create a sense of belonging and allow tight-knit communities to form based on shared goals and interests.

One's culture is often a strong source of pride. With culture comes customs and traditions which influence individuals in a myriad of ways including by providing an additional sense of community and pride through shared values and beliefs. For instance, individualistic cultures like the United States tend to think more creatively than other students because they generally value self-expression and independent thought. As a result, they tend to use their own achievements and future goals to influence their decisions. This might include a scientist with a novel research idea propelling themselves forward by connecting with other advanced researchers in a similar field and then setting out to work towards a revolutionary advancement that in turn leads to a Nobel Prize. In comparison, collectivist cultures found in places such as Latin America typically decide to benefit those around them and focus on social relationships. For instance, they may start a family business that is reliant on the strengths of different members of the family using different skills like marketing, cooking, and money management to successfully transform the business model into a successful restaurant. The differences in cultural upbringing between the individualist nature and collectivist nature allow different decisions to be made because they have different priorities.

Similarly, gender affects decision making as women are brought up to be receptive and understanding to others, while men are often very rigid in their beliefs and unwilling to consider an additional viewpoint. Men are also generally perceived to be more confident and are more assertive in their beliefs and opinions that lead to their decision making. Recognizing how these potential differences in upbringing can influence the decisions of certain individuals allows for the most holistic understanding of how decisions are made.

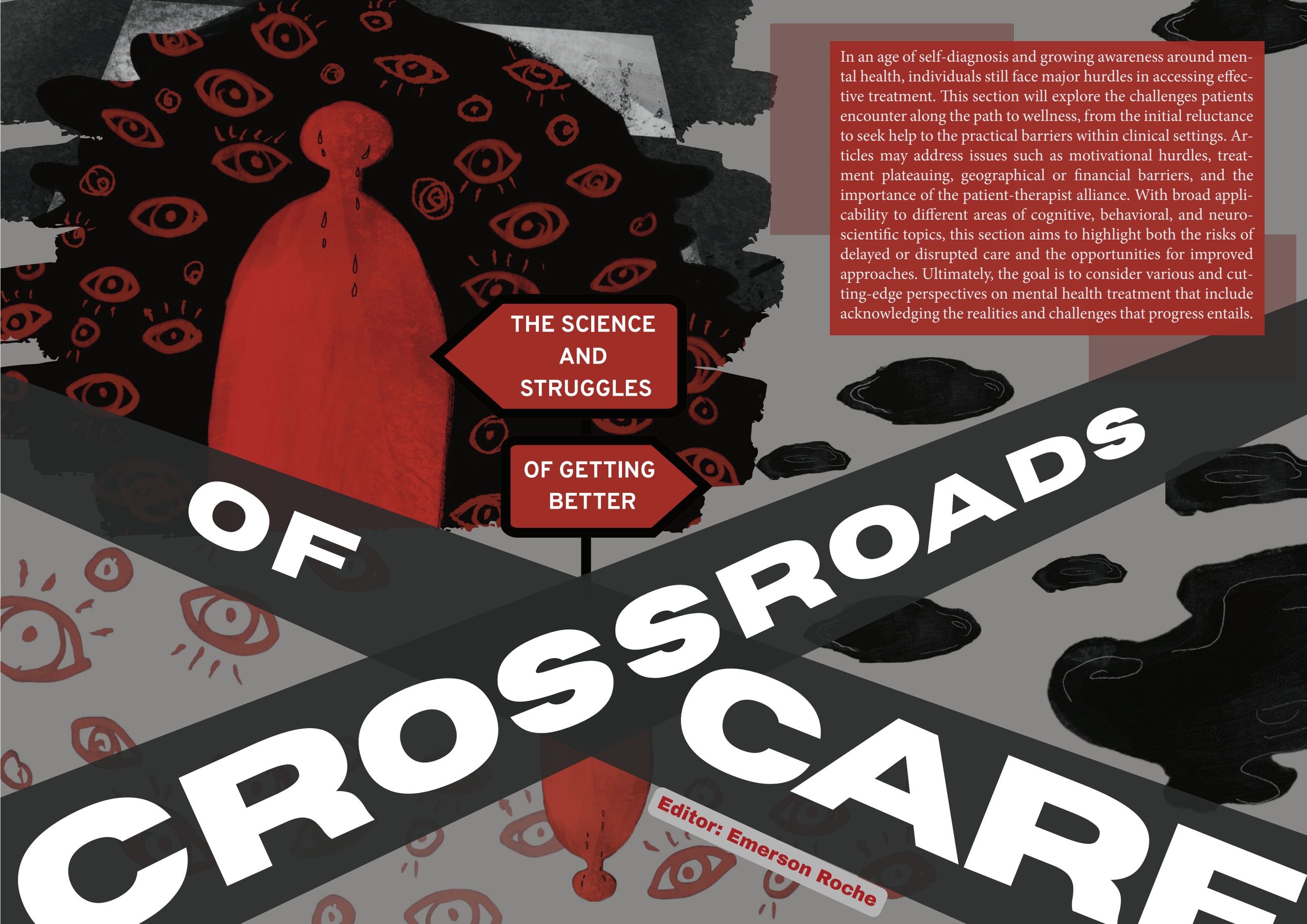
Decision Making Under Pressure

Understanding how decision making is shaped within the brain and how it is influenced externally by culture and gender is pivotal to influencing individual decisions.

Making decisions under pressure stems from decision making otherwise. Goalkeepers have to make split second decisions every day. They choose which technique to use to make the save based on the information unfolding in front of them. They fly across the frame of the goal and come out to swipe the ball straight off the feet of strikers and they do it repeatedly making split second decisions that lead to brilliant saves time and time again. The different kinds of saves are then practiced and repeated under low pressure situations thousands of times in preparation for big games. With all this repetition, goalkeepers are prepared to make the best decision quickly and execute on it when it matters most. It is extremely difficult to make these decisions fast enough to then react and make the save which is why errors happen and learning to handle these fast approaching decisions is imperative.

Conclusion

Making decisions is inherently more complex than just taking in information and deciding the best path forward. Alongside the influences of culture and gender, the different areas of the brain play a role in creating the baseline for decision making. Even under high stress situations, learning to manage the internal and external influences leads to the most reliably positive decisions.



CROSSROADS OF CARE

In an age of self-diagnosis and growing awareness around mental health, individuals still face major hurdles in accessing effective treatment. This section will explore the challenges patients encounter along the path to wellness, from the initial reluctance to seek help to the practical barriers within clinical settings. Articles may address issues such as motivational hurdles, treatment plateauing, geographical or financial barriers, and the importance of the patient-therapist alliance. With broad applicability to different areas of cognitive, behavioral, and neuroscientific topics, this section aims to highlight both the risks of delayed or disrupted care and the opportunities for improved approaches. Ultimately, the goal is to consider various and cutting-edge perspectives on mental health treatment that include acknowledging the realities and challenges that progress entails.

Editor: Emerson Roche

Between Love and Letting Go:

The Brain's Battle with Grief

Author: Ina Lazari

INTRODUCTION

Grief is one of the most universal yet deeply stigmatised experiences we humans go through. The death of a loved one doesn't just break our hearts, it can change our neural circuitry, reshaping how we think, feel and view the world. Many people still think of grief as moving through linear stages, but research over the past two decades paints a different picture. Grief doesn't follow rules or timelines; it transforms the brain in deeply individual ways (Shear & Shair, 2005). Whilst some people gradually adjust to the loss of a loved one, a particular percentage of people find themselves unable to move forward, trapped in a loop of yearning. This particular phenomenon is referred to as Prolonged Grief Disorder (PGD), and it is most commonly seen in bereaved individuals who have experienced a sudden and tragic passing (Simon & Shear, 2024). However, those suffering from a loss are often made to feel like they have to 'move on' or 'let go', ignoring that the process of adapting to loss is rarely linear and cannot be rushed. This article explores the neuroscience behind grief and attachment, how the brain rewires after profound loss, the growing understanding of PGD, and why traditional therapies don't always meet the needs of those in recovery.

CHANGES TO THE BRAIN

In the first days and weeks after a loss, the brain enters a state of alarm and disorientation. Regions like the amygdala and thalamus, which detect emotional cues and sensory information, respectively, flare with activity as the mind tries to process what has happened (Chen et al., 2020). The nervous system is overworked, which can lead to physical symptoms such as fatigue, insomnia and a weakened immune system, potentially leading to illness. However, it has been noted that people may also experience behavioural changes as they adjust to loss. As a result, individuals may descend into a profound state of confusion making them unable to focus during basic tasks due to their cognitive power being directed almost entirely toward managing the weight of the loss (Cleveland Clinic, 2023). According to Chen et al. (2006), this early period of acute grief

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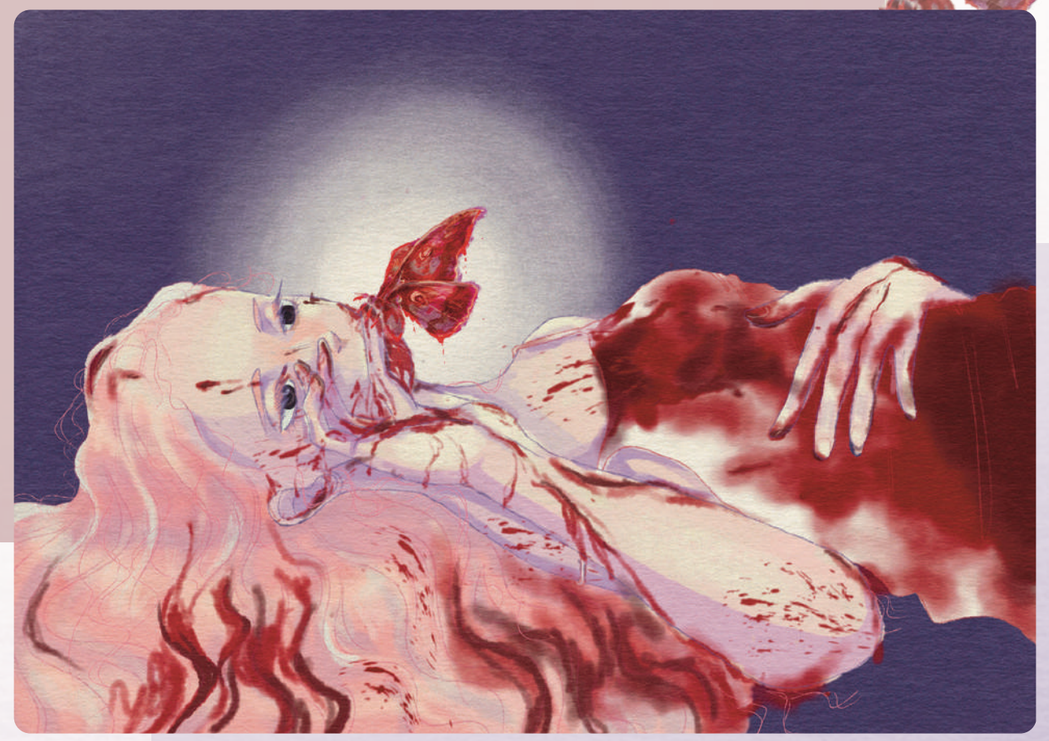
PROLONGED GRIEF DISORDER: WHY AND HOW?

Neuroscience shows that grief activates the same attachment and reward systems that bond us to those we love - which is why loss can feel as physically painful as it is emotional. For most people, these systems gradually quiet as the brain adjusts to a new reality. But sometimes, they remain "stuck," giving rise to what clinicians now call Prolonged Grief Disorder (PGD), recently recognised in the DSM-5 (Szuhany et al., 2021). In PGD, the brain's circuits for attachment and reward (especially in regions like the amygdala and nucleus accumbens) continue to fire as if the loved one were still present. This sustained activation can fuel intense yearning, emotional pain, identity disruption, and difficulty moving forward. To meet diagnostic criteria, these symptoms must last a year or more and go beyond what's culturally expected (Szuhany et al., 2021). Certain risk factors make some people more vulnerable. Thoughts like 'I should've done more' or 'It's my fault' can keep the mind locked in guilt, preventing emotional processing. Although avoidance behaviours such as refusing to look at photos or recall shared memories may momentarily ease pain, they can also reinforce a cycle of craving and distress, keeping the brain's reward systems on high alert (Simon & Shear, 2024). A lack of emotional support can worsen this loop, leaving the bereaved isolated and unable to regulate the overwhelming emotions that follow loss.



STIGMA

Despite growing clinical recognition, PGD continues to exist in a culture that often misunderstands grief itself. Primarily the western world tends to romanticise 'moving on', expecting mourners to heal neatly within months and return to their lives as though loss were a wound that simply closes with time. Those who continue to struggle may feel pressured to hide their pain, fearing that seeking help signals weakness. As mentioned previously, this is a major risk factor of developing PGD, as social connections and closeness are key to helping the brain rewire after loss (Simon & Shear, 2024). This social pressure to move forward can result in increasing isolation, as the bereaved withdraw from others rather than risk judgment or discomfort. In reality, the process of healing after profound loss is neither linear nor predictable; the brain's attachment systems, emotional regulation, and sense of identity do not reset on schedule (Ennis et al., 2022). By recognising that prolonged grief is not a failure of will but a disruption in both the brain and the bonds that shape it, we can begin to replace stigma with understanding.Through such compassion, we can provide effective ways to help those struggling with PGD.

ROAD TO HEALING

Recovery from PGD is rarely straightforward. Even with treatment, healing unfolds unevenly. Although traditional treatments for depression or anxiety can often miss the attachment roots of grief, evidence-based therapies such as Complicated Grief Therapy (CGT) and targeted Cognitive Behavioural Therapy (CBT) can help people confront avoided memories, rebuild identity, and find new meaning (Ennis et al., (2022). However, CGT and CBT may not be exactly tailored to people struggling with PGD, indicating that there might need to be more research within the field. Neimeyer et al. (2010) painted grief as a process where the patient has to reconstruct meaning into the world which has been disrupted by a traumatic loss. The study also focused heavily on constructive therapies to help those experiencing grief learn to live alongside loss. These therapies include narrative retelling (helping patients tell and re-tell their story of loss) and therapeutic writing (using writing as a way to explore meaning and feelings). These approaches often add more meaning to grief therapy sessions than talking therapies and CBT (Neimeyer et al., 2010). Another approach that has been used but with little success has been pharmacological approaches like prescribing patients antidepressants; however, these have not succeeded in reducing the intensity of PGD (Szuhany et al., 2021). Nevertheless, what's most encouraging is that treatment for prolonged grief is evolving. With growing attention to creative and integrative methods, recovery is no longer just about 'moving on" but about learning to carry love and loss together and finding new strength and connection in the process.

CONCLUSION

Grief is one of the most universal human experiences, yet for some it lingers and reshapes life in painful ways. Prolonged Grief Disorder reveals just how deeply our brains, our bonds, and our social worlds are intertwined in loss. Science reminds us that healing isn't about 'getting over it' but the slow, intricate work of adaptation—where therapy, support, and self-compassion help the brain and heart find new balance. When we understand the neurobiology of grief, we also learn to honour the individuality of healing: everyone's timeline is different, and that's okay. In time, grief softens its edges. It doesn't vanish, but it transforms, becoming something we carry with love and not just sorrow. And in that carrying lies something profoundly human: the capacity to grow through loss, to reconnect, and to rediscover hope.

The Secret Inheritance:

Generational Trauma and its Lasting Impacts

INTRODUCTION:

In a world seemingly plagued by ongoing tragedies, it is important to recognize the people impacted by such events. We must understand the lifelong impacts that exposure to trauma can have on survivors as well as the impacts that may even outlive them. This often forgotten phenomenon is known as generational trauma.

Generational trauma occurs when the psychological impacts of trauma are passed onto future generations who were not present when the actual event occurred. Understanding this phenomenon matters so that we can support all victims of trauma. Trauma can leave lasting marks on survivors' children, grandchildren and even great-grandchildren. These effects are seen through their brain structure, genetic coding and the way they learn to behave. However, while the effects of trauma can be inherited, this is not to suggest that there is nothing that can be done to mitigate the effects, or that if you yourself have experienced trauma, you are automatically harming your future children. In fact, these changes are the body's way of adapting and evolving, which can lead to positive changes – notably increased resilience (D'agata et al., 2017).

So what does generational trauma actually look like? Future generations may feel the effects of generational trauma through an unnecessarily heightened response to everyday pressures which can present itself clinically as anxiety, depression and post traumatic stress disorder (PTSD) (Roberts et al., 2012). Unfortunately, a lack of understanding can result in feeling like your struggles are not valid or worthy of help, especially when you know the hardships your family has survived. In addition, inherited parental attitudes of 'getting by' and 'never letting your guard down' may further discourage affected children from seeking help (Cherepanov, 2015). With this in mind, acknowledging the wide range of ways trauma affects future generations allows us to offer the appropriate support.

ADAPTATION, EVOLUTION AND COMPARATIVE PSYCHOLOGY

Much of our biology and behaviors come from adaptations that once helped our ancestors survive. When someone experiences trauma, their body will likely adapt to cope with the danger. These adjustments can be passed down, giving the next generation the traits that aided in their individual survival. This process is seen through epigenetics: the system where genes are turned on and off by environmental factors. Though theoretically helpful from an evolutionary standpoint, these adaptations may become redundant and potentially harmful outside of the traumatic experience. These changes can make the body react to everyday stress as if it's a threat, increasing susceptibility to PTSD.

Scientists have seen this generational effect in the lab. Van Steenwyk et al. (2018) modelled genetic changes in mice using controlled and repeatable conditions that would not have been feasible with humans. Childhood trauma was mimicked in the first generation of mice through unpredictable maternal separation, during which the child mouse was forced to swim or was constrained in a tube. Resultant depressive-like symptoms were passed on as far as the third generation. Changes in behaviors as well as glucose regulation were passed on to the fourth generation with similar severity across all generations. In other words, the stress responses in one generation shaped the behavior and biology of the descendants who never experienced the trauma.

However, generational trauma is not just observed in mice: these genetic changes can also be observed in rhesus monkeys. One study found a decreased level of FKBP5 methylation in the offspring of mistreated rhesus monkeys (Klengel et al., 2019). The FKBP5 gene instructs how the hypothalamic-pituitary-adrenal axis is built, which is the system that regulates stress responses by producing hormones. Methylation is the process by which a methyl group is added to a molecule (in this case, DNA) and can result in a gene being turned on or off (Menzo et al., 2020). Low methylation leads to a greater expression of the FKBP5 gene, which reduces glucocorticoid receptor activity, resulting in an increased release of stress hormones. This can lead to an overactive stress response and reduced recovery after such prolonged anxieties.

Author: Kirsty Diamond

GENETICALLY INHERITED TRAUMA

The aforementioned studies on mice and rhesus monkeys allow us to infer that humans may have a genetic response to stress, and this has influenced subsequent studies. Grasso et al. (2020) looked at the FKBP5 gene in expectant mothers and their newborns, studying how this gene was impacted by mothers' adverse childhood experiences (ACEs) and PTSD. The child's DNA was taken within 24 hours of their birth to ensure that the results reflected biological characteristics and not parenting influence. Specifically, the researchers studied alleles, (different versions of a gene) which determine how genetic traits are expressed based on the combination inherited from both parents. The impact of trauma on epigenetics depended on which version of the FKBP5 gene the mother and child carried. Among mothers with thymine (T) alleles, greater ACEs and PTSD symptoms correlated with lower methylation of their FKBP5 gene. Like in rhesus monkeys, this low methylation results in a greater expression of the FKBP5 gene, which results in an increased release of stress hormones. In other words, this leads to an overactive response to every day stress which would result in increased day to day anxiety. In mothers with no T alleles, there was no difference in genetic traits. For children, this pattern was reversed: those without a T allele exhibited higher methylation when their mothers reported more ACEs and PTSD symptoms. There was no effect on genetic traits for children with a T allele. In other words, children with no T allele have a dampened response to stress, which can in fact be protective. It can be unsettling to think that trauma – an unfortunate reality anyone could experience – may alter the very biology of your future children. However, this research provides hope showing that the genetic effect on children is not always harmful. In fact, in response to stress from the NICU infants with no T allele have shown increased methylation which has been linked with autonomic resilience, the ability to remain balanced and regulate stress which has been connected with improved outcomes for these infants (D'agata, et al., 2017). This study has important implications by showing that generational trauma does not impact everyone the same way, which is an important consideration when offering support and avoiding a one size fits all approach.

CHANGES TO BRAIN STRUCTURE

Trauma can also physically change our brains, especially when exposure to trauma occurs while the organ is still developing. In 1999, two traumatic earthquakes in Turkey killed over 20,000 people, destroyed tens of thousands of homes and led to many living in tent cities (Sahin & Tari, 2000; Kılıç & Ulusoy, 2003). Sarigedik et al. (2022) researched the effect of this trauma on the amygdala: the brain region that processes fear. They found that children whose mothers lived through these earthquakes had a significantly smaller amygdala volume. The theory is that interferences in the mothers' brain development were transferred to the cell nucleus and passed on to her child. Thus, the amygdala plays a crucial role in regulating anxiety responses, as a smaller amygdala has been linked to increased susceptibility to PTSD (Morey et al., 2013).

Interestingly, the mothers in this study were adolescents at the time of trauma. It is thought that the age at which the parent experiences the trauma, and whether their brain is still developing, is an important factor. More research is needed to fully understand this, as it could lead to potential preventative therapies to reverse these changes while the brain is still developing.

EFFECTS OF PSTD AND PARENTING STYLES

The Khmer Rouge Regime in Cambodia was a genocide that occurred from 1975 to 1979, during which over 1.5 million died. Today, around 60% of the present-day population is composed of children of these survivors, demonstrating the prevalent need to understand trauma's impact on future generations. Field, Muong and Sochanvimean (2013) researched the generational impacts of this trauma by looking at anxiety levels in the second generation. Mothers with high levels of PTSD were more likely to have children with increased anxiety. Notably, it was not purely the fact that these women were exposed to trauma during this genocide that predicted the children's anxiety levels. Instead it was the presence of PTSD, which was likely caused by the trauma. This distinction matters because there are effective therapies to reduce the severity of PTSD, so understanding this generational connection provides insight into treatments that could potentially reduce the impact on both survivors and their children.

Additionally, the researchers noted that high levels of PTSD led to role reversal parenting styles, where the child has increased responsibilities. This parenting style leads to increased anxiety in children. Understanding these patterns helps parents be aware of the impacts of their behavior and highlights how crucial PTSD therapies can be in breaking the cycle.

INHERITED BEHAVIOR

In addition to the inheritance of biological adaptations, parental behaviors can be picked up by children as well. One particularly detrimental example is children's adoption of parents' lack of trust in others and a mindset of 'never let your guard down', which may have protected parents during traumatic events (Cherepanov, 2015). However, out of context, this mantra can be harmful and may prevent children from seeking support. Additionally, even if the child does reach out, their parents' fear of sharing their perceived 'weaknesses' with others may prevent them from advocating for their child, limiting children from getting the support they need.

Professional guidance such as therapy can be expensive and hard to access, which introduces even more barriers when affected children are at an age where they are reliant on their parents for both advocacy and financial support. Thus, understanding generational trauma matters to make it easier for all affected children who are seeking support. Offering assistance can be as simple as reiterating that mental health problems are not a weakness, or increasing awareness of generational trauma to validate their feelings. This support system could be implemented in schools to increase accessibility to such knowledge amongst younger generations

THE GENOGRAM INTERVENTION

A genogram is a therapeutic tool where a multigenerational family map is used to provide insight into behavioral patterns across generations. Professionals may use this technique with survivors' children to reduce the impacts of generational trauma by helping patients recognise problematic messages and the context in which they were derived (Blatner, 2000, p.179). Children can then assess these behaviours' relevance in the present moment. This method allows children to understand their parents' atypical behaviours while also recognizing that, in their current environment, they are relevant or can even be potentially harmful. This tool demonstrates the importance of understanding generational trauma, as our knowledge of inherited behaviours has led to an effective intervention approach.

CONCLUSION

It is important that we are aware of generational trauma and all the different ways it can be passed on, as it allows for the most effective therapies to be discovered and further implemented. Understanding the science behind generational trauma can validate future generations' feelings, thus potentially encouraging affected individuals to seek professional help. While more research is required to develop effective early intervention therapies, modern understanding of generational trauma has led to the creation of multiple effective interventions, providing hope for future generations.

THE ART OF FOCUS

This section discusses the neuroscience behind focus, distraction, and how we can use scientifically-backed methods to improve concentration. Studies show that screens have "hijacked" our brain's reward pathway and ability to concentrate on mundane tasks. Why does the presence of devices, even if not in our hands, distract us from our work? From a neuroscientific perspective, is there a way to regain control of our brains without having to give up social media and other forms of digital entertainment? A popular focus technique includes listening to binaural beats at different frequencies, however, has it actually been proven to improve concentration? In this section, we look at popular study/ focus techniques and break them down to examine the neuroscience/ biology behind them.

EDITED BY: ALEYNA KASIM

GEN Z'S ATTENTION:

Deteriorating or Developing?

Mid 20th century. Revolutionary. Economy: Transformed. Society: Buzzing.

The digital revolution took over everything. From the invention of the first commercial mobile in 1984, to text messaging by 1992 and the launch of the smartphone in 2007, each invention changed communication completely. But perhaps no shift was more consequential than the rise of social media following Facebook's launch in 2004. From there, relationship building, public influence, and information sharing was accelerated (Reittinger, 2025).

During this techno-cultural shift, a new generation emerged– born between 1997 to 2012– Generation Z. As digital natives since birth, Gen Z's have never known a world without the internet. Social media and the internet had integrated into society, making the only world Gen Z's ever known to be saturated with constant connectivity, digital stimulation and rapid information flows. Unsurprisingly, Gen Z agrees they're dependent on technology, considering it to be essential to their daily lives (CTA, 2024). Over 63% admitting they spend over 6 hours daily on social media (Rajesh Namase, 2025), and over 83% owning a laptop (Dorsey, 2019). As a result, their hyperconnected environment has not only made them 'tech-savvy,' but has fundamentally shaped their attentional abilities.

The Attention Debate

Attention span describes the ability to sustain concentration and focus on a singular activity without distraction (HappyNeuron Pro, 2024). As the average person checks their mobile over 60 times daily, this is increasingly difficult. Each time they check their phones, they bombard themselves with information, which fragments attention (Golden Steps ABA, 2025). In fact, in the past 20 years, humans' average attention span has decreased from 12 to 8.25 seconds– shorter than that of a squirrel! (Endurance Learning, 2019)

At first glance, social media's rapid stimulation suggests Gen Z's attention is fragmented, and they're undergoing cognitive deterioration. However, neuroscientific evidence frames a different picture and suggests that Gen Z's brains are neuroadaptively reorganising– reshaping networks to optimise and prioritise speed efficiency, reward in their chaotic digital climate.

The 'Brain Rot' Cycle

A lot of Gen Z's cognitive landscape is reliant on the neurochemical feedback that drives constant digital engagement. Social media algorithms are intentionally developed to exploit the brain's dopamine reward system and keep social media users wanting more. During each consecutive scroll, the brain receives dopamine hits from the ventral tegmental area to the nucleus accumbens– regions involved in neural motivation systems. With that, individuals establish phone-checking patterns of variable reinforcement– seeking short-term gratification and essentially restructuring motivational priorities towards immediacy.

Over time, this evolves into the 'brain rot' phenomenon– a state describing the cognitive fatigue individuals experience due to excessive exposure to low-quality online stimulation (Oxford University Press, 2024). The accompanying mental fatigue, attentional fragmentation caused by overstimulation and densensitisation all indicate dopamine depletion (Perez-Oyola et al., 2023). Stimulation cycles perpetuate, bombarding Gen Z with overwhelming amounts of rapidly shifting content. Thus, a 'spiky' information overload curve grows and worsens as prolonged digital engagement reduces temporary abilities to sustain focus (Zhou and Ding, 2021, Yousef et al., 2025) .

The cognitive overload theory explains 'brain rot' in terms of intrinsic, extraneous and germane loads (Sweller, 2011, Firth et al., 2024). Intrinsic load: Difficulty of processing information based on the complexity and interacting elements in the task itself. Extraneous load: Information presentation- unnecessary presentation burdens cognitive systems, diverting mental resources from the core complexity. Germane load: The active mental effort of integrating information into existing schemas and understanding it.

Social media intensifies the extraneous load by providing multiple streams of excessive information that require rapid switching and surface-level engagement. As the brain adjusts to constant media multitasking, the ability to deeply process information with baseline cognitive control reduces. This produces a state called continuous partial attention that exhibits working memory deficits and superficial engagement. Ultimately, repeated distraction cycles cumulatively lead to a compromised cognitive flexibility and focus. Excessive media usage pushes the brain to rely

WRITTEN BY: Ananya Nayar

on instant gratification and dopamine rewards instead of the innate germane capacity of deeper, analytical thinking (Hitchcock et al., 2024). Over time, a neuroadaptive shift occurs– recalibrating the brain to new norms of constant media cycles demanding speed and multitasking over singular sustenance.

Rewiring and Growing Up

Periods of heightened neuroplasticity occur during childhood and adolescence. Structural functional changes exhibit prolonged functional effects into adulthood too- albeit less robust neuroplasticity continues then. Hence, the currently developing Gen Z brain exhibits heightened plasticity. During this peak developmental window, constant digital stimulation causes significant changes in sensory input and may cause cortical remapping. Evidence through fMRI and voxel-based morphometry (VBM) have shown that diminished attentional control and emotional regulation has caused cortical thinning and reduced neural volumes. For instance, thinning has occurred in the frontal lobe (particularly the prefrontal cortex) which manages executive control, working memory and filtering distractions (Giedd, 2012). Furthermore, increased screen time has been linked to reduced grey matter density in areas integral to memory and executive-functioning regions (Manwell et al., 2022). For example, social media use correlated with reduced thalamus volume, which is the brain's attentional relay station and related to alertness, information processing and attention (He et al., 2023). Research also showed the screen-media use reduces hippocampus and caudate volumes– both related to memory, learning and motor control. Reductions in the gray matter of the orbitofrontal cortex came as a result of social-media overuse– impairing reward evaluation, decision-making, motivation and attention. As the orbitofrontal cortex encodes the value of stimuli (relating it to motivation,) social media creates cycles of reward and anticipation which trigger addictive behaviors. These patterns of inattention, impairments in executive function and cognitive decline that are associated with excessive screen-media overlap with those seen in addiction and neurodegeneration. In turn, this suggests that extreme levels of screen exposure can significantly affect brain structure and development. It is important to emphasise that these neurological findings often reflect extreme or clinical cases only– not the average Gen Z in a broader population.

Not Exactly Deteriorating...?

Despite popular fears about shrinking attention spans, parallel research reveals that Gen Z is cognitively adapting, rather than declining. Their cognitive profile and social, cognitive and technological abilities have developed

much different from previous generations. These differences are rooted in their neural circuitry that are optimised for rapid task-switching, context-dependent focus and rapid processing (Merten et al., 2022). The demand for the brain to focus on multiple social media streams has led to it having increased capacity to rapidly and effectively switch between tasks– although surface level understanding dominates. Gen Z has trained themselves to separate and allocate attention during multitasking– which requires cognitive flexibility and adaptability, reliant on the prefrontal and parietal cortex. This shift suggests that the brain economically allocates resources to process information in higher volumes, in transient nature with efficiency. Repeated interactions with multitasking interfaces (from smartphones to split-screen studying) reestablish these circuits, enhancing the cognitive capacities for parallel attention (Naik et al., 2025). Research pointed out that moderated screen time provides opportunity for cognitive enrichment too, rather than signalling complete decline– contrary to popular notions. Merten et al., (2022) compared generations' cognitive abilities amidst lifestyle factors (including prevalence of technology and screen-based media) adjusting for sex, education and health-related mediator variables. Their age-adjusted findings found better performance in Gen Z's than other generations across cognitive domains including (but not limited to) executive function, attention, processing speed and verbal fluency.

Conclusion: Generation Rewired, NOT Ruined

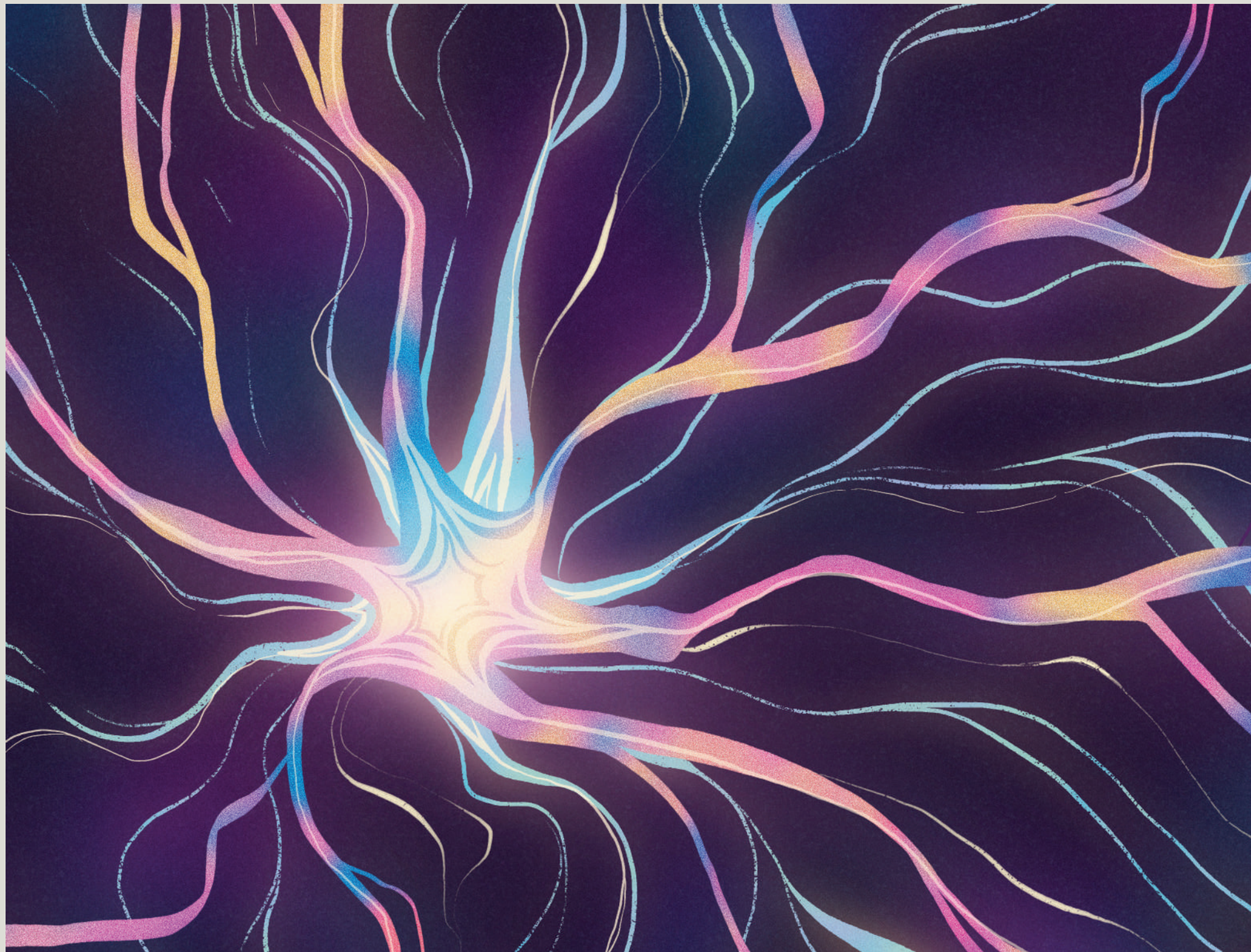
Yes, excessive, unregulated screen use may erode focus and disrupt reward pathways. However, at a population level, rather than signalling cognitive decline, Gen Z shows flexibility, responsiveness and contextual switching. Gen Z brains, shaped by constant interaction with digital stimuli represents the emergence of new attentional phenotypes, and cognitive recalibration to meet the demands of the hyper-connected modern digital world.

Instead of viewing Gen Z through the outdated lens of pre-digital attention standards, it's more accurate to recognise their attentional abilities reflect a broader cognitive evolution and adaptation to the modern realities of a hyperconnected world.

THE INTERDISCIPLINARY MIND: EXPLORING INNOVATION AT THE FRONTIERS OF NEUROSCIENCE

Editor: Lila Darmon

This section is where neuroscience meets the world. 'The interdisciplinary mind' explores how this field converges with diverse disciplines such as mathematics, pharmacology, artificial intelligence, and much more to advance our understanding of the brain. By highlighting groundbreaking cross-disciplinary research and emerging innovations, this section explores how interdisciplinary collaboration drives new treatments, technologies, and theoretical insights. Here, we uncover how scientific discovery at the boundaries of disciplines shapes the future of brain science and deepens our understanding of the human mind.



Liquid Biopsy: A Blood Test for Brain Cancer

Written by: Devika Panicker

Introduction

Diagnosing brain tumours remains one of medicine's toughest challenges. Their symptoms such as headaches, nausea, and seizures often mimic benign neurological disorders, which delays their detection. Despite having a relatively low incidence compared to other types of cancer, brain tumours have a significant impact due to their highly aggressive nature and poor prognosis. Early diagnosis is crucial for better patient health outcomes. Studies show that the smaller a brain tumour is at the time of diagnosis, the higher the survival rate, and earlier diagnosis could reduce brain tumour mortality by up to 28%. Currently, the diagnosis of brain tumours relies on imaging techniques such as MRI (an imaging tool that uses powerful magnets and radio waves to map the internal structure of the body) and tissue biopsies (a small sample of tissue taken from the body for analysis) for tumour categorisation. Obtaining a tissue biopsy from the brain can result in severe complications. Additionally, monitoring tumour evolution and measuring response to treatment would require multiple samples over time, which is not ideal given the invasive nature of the procedure. These limitations highlight the need for safer, more accessible diagnostic and monitoring methods. One exciting new alternative is liquid biopsy. A liquid biopsy is a minimally invasive procedure that involves taking a sample of blood or other bodily fluids, such as cerebrospinal fluid (CSF) or urine. Analysing the molecules present in the fluid can aid cancer diagnosis and monitor treatment response, thereby minimising the need for potentially harmful invasive procedures.

Circulating Tumour Cells & Cell-free DNA

One of the hallmarks of cancer is metastasis, where cancer cells break away from their original tumour and travel to other areas of the body to form new tumours. It is thought that the primary mechanism of metastasis is the release of circulating tumour cells from the primary tumour into the bloodstream or lymph (which is fluid from the blood plasma that delivers nutrients and collects waste from cells). They have a short half-life in the bloodstream—minutes to a few hours—due to the harsh environment; therefore, they can be used for real-time monitoring of disease status. Studies have shown that patients with cancer have higher levels of circulating tumour cells (CTCs) compared to the general population, and higher levels of CTCs in the blood correlate with poorer overall patient survival. However, the overall concentration of CTCs tends to be minuscule—normally less than 10 cells per millilitre. Consequently, the sample must be enriched by removing unwanted molecules and separating cells based on size for CTCs to increase their concentration sufficiently for analysis. CTC analysis can be used to detect cancer early, monitor response to treatment, and predict relapse. The blood-brain barrier is lined by a layer of specialised cells tightly packed together and sealed by tight junctions to prevent molecules such as CTCs from passively moving into the brain tissue from the blood. This makes brain tumours particularly difficult to detect using CTCs alone, therefore, improvements to enrichment techniques are needed to increase their concentration so they can be properly analysed.

In addition to CTCs, another promising biomarker is cell-free DNA (cfDNA). CfDNA consists of short DNA fragments that are released into the bloodstream and other bodily fluids by dying cells through apoptosis or necrosis. Higher-than-normal levels of cfDNA can be detected in patients with cancer. Due to uncontrolled cell division in cancer, rates of cellular renewal are much higher in cancer patients; therefore, the concentration of cfDNA is higher. Patients with higher levels of cfDNA in their bloodstream often have a higher tumour burden. The half-life of cfDNA is short, so any samples collected will reflect real-time tumour prognosis.

One way to potentially improve cfDNA yield is to collect samples from cerebrospinal fluid (CSF), which is fluid surrounding the brain and spinal cord. Studies involving patients with brain tumours have shown that the cfDNA fraction in CSF is higher compared to plasma. Following cfDNA sequencing, mutations such as IDH1 and TERT can be identified, allowing tumour classification and potentially impacting treatment options. However, doing a lumbar puncture to obtain a sample of CSF is often contraindicated due to the risk of part of the brain being squeezed out of the skull due to high pressure (brain herniation).

A potential limitation of using cfDNA alone is that it cannot determine which cell the DNA originated from. However, this can be overcome by analysing epigenetic modifications of the DNA, as different cell types have characteristic methylation patterns. DNA methylation is an epigenetic change in which a methyl group (CH3) is added to a DNA molecule. These methyl tags can regulate gene expression by turning the gene on or off. In cancer, abnormal methylation patterns alter gene expression, and these tumour-specific methylation signatures can be detected in cfDNA, making it a promising biomarker for early screening.

The length of the cfDNA fragment can also be used to determine which type of cell the DNA has originated from. The length of the fragment depends mostly on its methylation pattern. In cancer cells, the lengths of DNA fragments are altered, allowing them to be differentiated from normal cfDNA. Mathios et al. (2025) were able to develop a machine

learning programme that analysed the cfDNA fragment to create a non-invasive method to detect patients with brain tumours. This could be used in the future as a screening test for brain tumour detection in high-risk individuals.

A subtype of cfDNA is circulating tumour DNA (ctDNA), which specifically arises from cancer cells. CtDNA can be used not only for early cancer detection but also for monitoring treatment response. A study carried out by Yan. S et al. in 2020 showed that ctDNA concentrations can predict disease recurrence in neurobalstoma, a rare childhood cancer with high relapse rates. The average plasma ctDNA concentration at the time of recurrence was significantly higher than the concentration in patients who had no relapse. The increase in ctDNA concentration occurred approximately 1.5 months before their relapse diagnosis.

Extracellular vesicles

An underlying challenge to the biomarkers previously discussed (ctDNA and CTCs) is that they are present at very low concentrations in the bloodstream. However, a biomarker that can help avoid these problems is extracellular vesicles (EVs) which are ore abundant and better protected. The bloodstream maintains a hostile environment to protect itself against external threats such as microorganisms and other particles. It contains enzymes such as nucleases and other immune molecules that can break down unprotected molecules travelling through the bloodstream. EVs are lipid membrane-bound vesicles that safely transport molecules such as proteins and nucleic acids between cells, protecting them from the harsh bloodstream environment. They promote intercellular communication and are involved in several physiological processes.

Compared to CTCs and cfDNA, EVs are more prevalent in the bloodstream, and are therefore easier to obtain from a blood sample. Furthermore, EVs are released by living cells, unlike cfDNA, which is mainly released during cell death. At the same time, EVs can also promote cancer development by shaping a tumorigenic microenvironment. Cancer cells usually secrete a higher concentration of EVs compared to normal cells. EVs have the ability to reflect the current state of the cancer cell and its interactions with the tumour microenvironment in gliomas (which are tumours of the brain and spinal cord). This means that EVs can provide insight into tumour behaviour as well as its biological surroundings. EVs also have a short half-life, so they can be used to monitor the disease in real-time. A study carried out by Chandran et al. (2019) was able to identify a component of EVs called syndecan-1 (SDC1) that could differentiate between high-grade glioblastoma multiforme and low-grade glioma. SDC1 may also be used to monitor treatment response, as its level decreased following surgery. However, more large-scale studies are required to confirm this.

Another molecule that is transported within EVs is microRNA (miRNA). miRNAs are small RNA molecules that partly control gene expression by binding to messenger RNA molecules, leading to mRNA degradation or translation inhibition. miRNAs control cellular processes such as cell proliferation and programmed cell death, so when miRNAs are dysregulated, as seen in cancer, they can promote tumour development by either inhibiting tumour-suppressive processes or promoting cell proliferation. Several miRNA types have been found to regulate cell proliferation during glioblastoma progression. Because further studies have shown that exosomoes reflect the molecular content of the tumour they originate from, they are a promising biomarker for tumour subtype and grade.

Conclusion

Liquid biopsy is a promising non-invasive technique with several potential applications, including diagnosis, tumour monitoring, and risk of relapse prediction. Together, CTCs (which allow real-time monitoring of disease status), circulating and cell-free DNA (that reveal tumour-specific mutations and methylation patterns), and extracellular vesicles (which protect and transport molecules that reflect the tumour's state and response to treatment) provide complementary insights into tumour biology. However, liquid biopsy is currently a long way from being fully integrated into clinical practice due to a lack of standardisation in sample analysis and low sensitivity. More large-scale clinical trials are required to better understand different biomarkers and enhance sensitivity. A potential short-term use of liquid biopsy could be to combine it with tissue biopsy and imaging until the overall sensitivity and specificity of liquid biopsy is improved. In the long term, liquid biopsy has significant potential to overcome current barriers to diagnosis and improve long-term health outcomes for patients.

Psychology of Political Polarisation in a Post-Truth Era

Author: Ella Brown

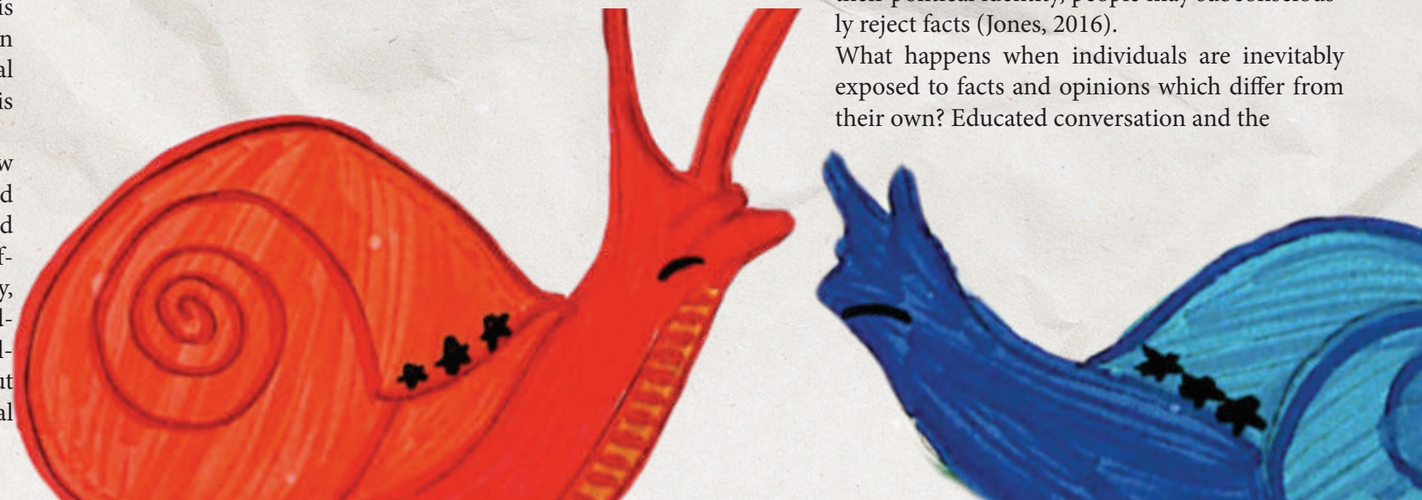
The modern political sphere is rife with polarisation. Conflicting groups are unable to hold civil, educated discussions, and parties often disagree on what is true and what is not. The term 'Fake News' is a hot topic, with opposing sides often believing the other has been brainwashed by the media. How, in an era where information is accessible like never before, is it so difficult to agree on what is true? Social media algorithms, confirmation bias, group identity, and emotional investments all contribute to this polarisation.

As social media allows access to near-limitless information, one might expect people today to know more than ever before. However, the reality is more complicated. Instead, information encountered online is often cherry-picked in favour of the viewer's preconceived ideas. Algorithms are designed to maximise user attention and screen time by collecting behavioural data and interpreting user preferences, allowing platforms to tailor content to show viewers what they want to see. Consequently, validating media activates the brain's reward centres, which researchers have warned can result in addictive behaviour (De et al., 2025). Additionally, algorithms create what has been termed by psychologists as a 'filter bubble,' in which individuals interact online with only like-minded people, without being exposed to alternative perspectives. This reinforces existing opinions and can promote political extremism (Douglas et al., 2017).

This raises the question: how important even are 'the facts' in determining political views? Modern political canvassing and fanatical candidate support have inspired the term 'post-truth politics'. It encapsulates a shift away from honesty and fact (Jones, 2016). Fact may actually have little influence at all in voter choice. Research suggests that candidate choice is based more on more emotional factors than factual information or honesty. A 2017 study found that Americans' candidate preference (Trump or Clinton) was not related to their perception of the candidates' honesty or factual accuracy (Swire et al). Thus, facts may be less relevant to our preferences than we might expect. Instead, emotion has been shown to play a large role in ongoing candidate support. An MRI study showed that when presented with imagined facts that represented their favoured political candidate unfavourably, participants experienced brain activations in areas associated with negative emotions, emotional regulation, and rationalisation. The activations were followed by an increase in dopamine levels, indicating activation of reward pathways. Outwardly, participants generated explanations to dismiss or reinterpret the evidence. Thus, not only is candidate information processed through emotion pathways, but the brain provides a neuro-chemical reward for finding an alternative explanation for facts (APA, 2022). It is no wonder then, that sides of political debates may refuse to entertain unpalatable facts.

This tendency can be explained in part by the importance of political views to personal identity. Political ideologies and group affiliations carry cultural meaning, and individuals may see them as integral to their sense of self. Therefore, processing contradictory political information can feel symbolically threatening and, in defense, of their political identity, people may subconsciously reject facts (Jones, 2016).

What happens when individuals are inevitably exposed to facts and opinions which differ from their own? Educated conversation and the



exchange of perspectives can help moderate political views and facilitate learning about how other groups think. Sometimes though, perspectives clash and individuals cannot agree on facts. Confirmation bias is defined as subconscious interpretation biasing when new information contradicts pre-existing beliefs (Nickerson, 1998). It explains how, when presented with facts, individuals may re-construct factual meaning to align with their beliefs. A Yale study found that, in general, when American liberals and conservatives were presented with statistical information related to the effects of gun control, each group tended to accept information that aligned with their beliefs, and dismiss data that did not (Jones, 2016). Another study investigating opinions surrounding climate change action found that political confirmation bias is not intelligence related. In fact, individuals with the most knowledge of climate science showed the strongest polarisation. For example, Republicans with the most scientific literacy were most likely to deny the existence of climate change (Kahan, 2015).

What can be done then about ever-growing political division? Psychological research suggests that changing the way information is presented can increase receptiveness to information which contradicts people's beliefs. Different wording for example, or even the type of graph of which data is presented, can significantly affect receptability. Dr. Drew Weston from Emory University found that using common wording instead of technical terms alters voter response: for example, asking voters whether they support abortion generated significantly more supportive responses than asking whether they are 'pro life' or 'pro choice' (APA, 2022). These results demonstrate potential for making facts more palatable to a wider range of people. Framing information in less polarising terms may reduce defensiveness and allow for more productive dialogue between opposing groups.

Overall, current findings suggest that social media contributes to polarisation by creating filter bubbles, political support is influenced by emotional and reward processes in the brain, and identity plays a key role in how people interpret facts. Confirmation bias further reinforces division by shaping how individuals process information. Luckily, people can be made more receptive to political facts through wording and presentation modifications, implying that there is hope for more widespread agreement on facts and a lessening of the political divide. The psychological research uncovers an unpleasant but fascinating aspect of human decision-making: we are often less rational than we might like to believe.

The Mosaic Advantage: Why Female Brains Age Better

Author: Addy Lyon

INTRODUCTION

Women's health research has taken a backseat since the beginning of the history of science. Women were excluded not only from conducting research but also from being represented within it. We have made progress but there is still a lot more of women's health that needs to be discovered and studied. The brain is no exception. However, female brains are now not only being studied but there's even research revealing that female brains age better than male brains. The reason? Genetics. The ageing female brain reactivates a silenced X chromosome (that males do not have), creating a mosaic that seems to hold all the answers to why women age better than men.

MEET THE X (CHROMOSOME)

Meet the X (Chromosome)! You may remember from biology that humans have two sex chromosomes: females are (XX) and males are (XY). In a twist of evolutionary fairness, in every cell (including in the brain) one X chromosome is randomly switched off (Raznahan and Disteche, 2020). This is believed to occur to balance the gene expression between females and males because of the different number of X chromosomes. The active chromosome is denoted as Xa and the inactive as Xi. The molecule in charge of silencing (inactivating) the X chromosome is Xist RNA which coats the chromosome to turn it off (Raznahan and Disteche, 2020). But here's where things get interesting: sometimes the X can't be kept silent…

THE MOSAIC MIND

So, what makes up the mosaic? The two X chromosomes in females are a maternal (Xm) and paternal (Xp) pair. In every cell, activation occurs at random with either the Xm or the Xp chromosome getting silenced (Gadek et al., 2025). The mosaic is built off this random pattern of activation. Just imagine that you're looking at the brain and the Xm are painted red and Xp are painted green. You would see a good mix of red and green all throughout the brain as in Figure 1. In contrast, a male's brain would only be red because they only have the Xm chromosome. The mosaic is not only visually striking, it has important implications. The different activation in the cells creates increased variability and diversity in the female brain (Raznahan and Disteche, 2020). For example, if one X carries a mutated gene, the other X can come in and save the day. This built-in backup system may help protect brain function, especially during ageing. But what happens when the silent X wakes up?

Figure 1. Illustration of the mosaic expression of the X chromosome in the female and male brain. (Left) The female brain expressing either Xm or the Xp chromosome represented by two different colours. (Right) The male brain shows only one colour, as it contains a single X chromosome (Xm). Figure adapted from Raznahan and Disteche (2020).

THE SILENT X, NOT ALWAYS SILENT?

The silent X does not always stay silent. Emerging research indicates that during the process of ageing, the inactive X escapes repression and becomes active again (Gadek et al., 2025). Unfortunately, this does not happen to every cell in every area of the brain. The Gadek et al. (2025) study found that a higher concentration of cells were reactivated in the dentate gyrus, an area important for learning and memory. Escaping repression occurs randomly across cells throughout the body, and its frequency varies by cell type; notably, the study reported a higher incidence of escape in glial cells compared with neurons. One explanation is age-related epigenetic changes, such as the loss of DNA methylation which normally keeps the inactive X silent (Lanata et al., 2018).

The study done by Abdulai-Saiku et al. (2025) explains how a balanced Xm/Xp mosaic is important for cognition and healthy ageing. Their main finding was that too much expression of the Xm chromosome could be deleterious to cognition and ageing. The study was done on female mice to discover what the effects of skew towards Xm would be. They found that this skew showed cognitive deficits in the mice as well as accelerated signs of ageing in the hippocampus, a region which is crucial for memory. Additionally, they found that the Xm silenced genes that were important for healthy ageing. However, much of this needs to be replicated and researched further. This leads us to question whether a skew toward the Xp would produce similar or distinct effects on cognition and ageing, a topic that has yet to be thoroughly researched.

A GENETIC EDGE

We've all heard women live longer than men, the X chromosome may be why. It may also be the answer to why female brains age better. A recent breakthrough study by Gadek et al. (2025) study found an escaped gene on the X chromosome – Plp1 – that might just explain why. Plp1 is mostly found in the oligodendrocytes in the parahippocampus of women. Oligodendrocytes are the glial cells that myelinate axons in the central nervous system (CNS), meaning Plp1 is crucial for the myelinating process. Myelin supports the quick transfer of information throughout the CNS which supports higher cognitive functions like memory (Nickel and Gu, 2018). To test whether the gene improved ageing, Gadek et al. (2025) experimentally increased the expression of the gene in both female and male mice. They found that increasing it led to improved cognition for both sexes. This finding indicates that its reactivation in ageing women could contribute to maintaining cognitive performance later in life. This could also have profound therapeutic implications. Increasing Plp1 or other silent genes like it could ameliorate dementia or even Alzheimer's Disease. So, this discovery is not only a triumph for women, but for ageing research as a whole.

Similarly, Grimm and Lee (2022) explored how reactivating a healthy copy of a gene on the Xi could help treat Rett's syndrome. Rett's syndrome is a neurodevelopmental condition caused by mutations in the Mecp2 gene. The study explores how Xi reactivation could be implemented as a treatment option and how it compares to other existing options. They stated a few advantages for this strategy including smaller treatment times and no immune response compared to other therapies. While the discovery of Xi reactivation is promising for many disorders, further clinical research in humans is needed before it can become a standardised treatment.

CONCLUSION

The secret's out– women not only live longer than men, we age better too! It's all thanks to the mosaic present only in female brains. The awakened X has so much potential to provide therapy for many diseases or disorders. This is a new and exciting area of research; however, more data needs to be collected, especially from humans. The data from the influential cases of Gadek et al. (2025) and Grim and Lee (2022) highlighting the therapeutic potential of reactivating Xi genes need to be replicated before human trials can be actualised. This is a big step forward for neuroscience but an even bigger step forward for women's health research. Women's health needs to keep being investigated and discovered. The female brain is unique, not just a scaled-down version of the male brain, and its special features are crucial to understand and advance treatments for ageing and neurodegenerative disease.

LEARNING TO SPEAK AGAIN

A Brief Introduction to Aphasias and Effective Therapy

Introduction:
The term aphasia, which originates from a- 'not' and the Greek root phanai meaning 'to speak', is used colloquially to mean the failure of speaking and understanding language (1). However, this is not the full picture. To better understand this disorder and the various ways it can manifest, we must first explore its basic biology and primary causes.
In the clinical setting, aphasia is a language disorder of varying severity usually predisposed by damage to the brain resulting from stroke, traumatic brain injury or tumour. A patient will generally present with difficulty forming or completing sentences, speaking with made up or incorrect words, struggling to understand a conversation and having reading difficulties. This article aims to provide a brief explanation on the physiology underlying aphasia, introduce some of the most common types, and inform you on the current therapies used to treat this neurological condition. It is important to note that clinical presentation of aphasia varies with each individual, as will their experiences and capabilities due to the condition. It is therefore encouraged to look into the experiences of as many patients as possible to gain a more in-depth understanding of the disease and its impact.

Note: All patient transcripts used in this article have been simulated.

The Pathophysiology:
Aphasia is caused by damage to the brain's language-processing centre located in the dominant hemisphere, most commonly the left hemisphere. The foundational model of aphasia was developed by Carl Wernicke and Lichtheim in the 19th century (4). It provided a basic neuroanatomical origin for communication disturbances as a result of head trauma, and allowed for both the classification of already observed aphasias and prediction of pathologies that can occur as a result of damage to the language functioning areas. With Norman Geishweide's further research in the 1960s, the areas of the brain responsible for language - Wernicke's and Broca's - were agreed upon. Although the Wernicke-Geshwind model has since been disproved by some and further developed by other neurologists, it still serves as a useful tool for understanding how language is processed in the brain (5). The language processing regions of the brain (Figure 1) are said to have a cumulative role in the production of normal fluent speech and are linked together by a region called the arcuate fasciculus. Speech comprehension first begins with a sound input interacting with a part of the inner ear called the cochlea. The sound will first be interpreted by the primary auditory area located in the temporal lobe called Heschl's gyrus where information on the character of the sound is first analysed. Wernicke's area will then take over to distinguish the sounds of spoken words from background noise. The actual meaning of the words and incorporation within the sentence is conducted by the areas around the temporal lobe and Broca's area. This will then further be spread across the cortex to integrate the current information with past memories, providing context, and allowing for consolidation of knowledge.

Figure 1: Broca's and Wernicke's area and related structures (3).

Broca's Aphasia (Expressive):
Broca's aphasia, also known as non-fluent aphasia, is characterised by the patient's inability to form fluent sentences and struggle to follow normal grammatical structure (8). Patients often speak in short, halting phrases, and appear to struggle remembering words and reproducing them. Despite this, their speech typically makes contextual sense when the patient has been given time to answer. Broca's aphasia patients have full awareness of their language difficulties.

Here is a model transcript of a patient with Broca's aphasia:
"Uh… summer… I… go… walk… wife… uh… dog… park… long walk… uh… warm… good.
Then… uh… coffee shop… me… she… drink… uh… latte… nice.
Later… home… watch… uh… movie… TV… tired… bed."

Wernicke's Aphasia (Receptive):
In contrast, Wernicke's aphasia is characterised by a seemingly normal fluency when talking, alongside a normal rate and voice intonation (6). When hearing a patient with Wernicke's aphasia speak, it will be clear that they are not struggling to speak or take notice of their incorrect language. However, they will often use incorrect (semantic paraphasia) or made-up (neologisms) words. This results in nonsensical speech where very little is understood about what they are trying to say despite them seeming to reply to a question. Patients with Wernicke's aphasia have impaired understanding of language as well as writing, and the severity of their condition is dependent on the size and damage to the respective area (7). This aphasia is commonly caused by damage to the posterior third of the superior temporal gyrus, and involvement of the middle/inferior temporal gyri or the inferior parietal lobule will make recovery unlikely.

Here is a model transcript of a patient with Wernicke's aphasia:
"Oh yes, in the summer, that was really… it was sort of shimmering, you know, with the grass things, the ones we used to… flinder about.
We had the nice one, with all the people talking, and everyone was doing the same — talking and the sun was bright, just really nice, really smarkle time.
I was helping with the… the cooking, the bowl thing, and the spoons were moving!"

Written by: Anastasia Giusca

Global Aphasia:
Global aphasia is considered one of the most severe forms, involving widespread damage to both language areas. This causes significant impairment in the patient's expressive and receptive abilities - greatly limiting speech production and comprehension (17).
Here is a transcript of a patient with Global Aphasia:
"Uh… no… day… uh… walk… no… uh… bed… sleep… uh… home.
Uh… food… nice… wife… help… me… uh… no… talk… uh…"
Anomic Aphasia:
Perhaps one of the milder forms, people with anomic aphasia will often struggle to find the correct word for an object, yet are still able to describe it or find a substitute. People with anomic aphasia are able to speak with correct grammar and maintain good comprehension (17). Here is a transcript of a patient with Anomic Aphasia:
"During the summer I went to… um… that place with the trees and people… uh… the park, yes.
I met a friend, we drank some… um… brown drink… iced coffee, that's it.
Then we went to see… uh… the movie, the one with the… uh… fast cars — can't remember the name — but it was funny, really good.
After that, just home, dinner, watched… uh… the show, the dancing one… relaxing."

Effective Therapy
While many cases of aphasia are temporary and improve without treatment, those that fall into the treatable category can expect various forms of interventions - both pharmacological and through speech therapy (9). A person's ability to have fully recovered speech will also be greatly influenced by the cause of the aphasia and the severity. Patients with mild impairment may even recover without treatment over time.

The most common method of aphasia recovery is by undergoing speech therapy (10). This is often a slow and difficult process, yet many people can make significant progress in their language development. Despite this, full recovery is very rare. A speech therapist will focus on the individual's needs and presentation, aiming to tailor each session to the patient. Examples of common speech therapy techniques include:
Constraint-Induced Aphasia Therapy (CIAT): This is a short term and intensive therapy method targeted to individuals with aphasia that have impaired speech yet are still able to express themselves through gestures or drawings (12). The aim is to utilise these techniques to aid speech, but also limiting a patient's reliance on them and encouraging verbal communication. This therapy is available for a wide range of individuals who may have suffered a stroke, traumatic brain injuries or dementia.

Melodic Intonation Therapy: Individuals with certain types of aphasia have a greater ability to sing rather than speak, which is the basis of this therapy strategy (13). This is based on how different areas in the brain are responsible for speech and music interpretation. Patients are encouraged to sing words or phrases to a melody, tap their fingers and speech slowly, and use changes in tone when expressing themselves. Over time, longer phrases are used and speaking will no longer require a musical melody alongside.
Semantic Feature Analysis: This will improve a patient's word retrieval, which is impaired in various forms of aphasia (14). Through the guidance of the therapist, pictures relevant to the patient will be used and asked to identify. Features associated with the object such as visual description, location, and function to improve understanding of the object and consolidate semantic mapping - the word association and its links to an area of the brain.
Script Training: This involves close work between the patient and their therapist in order to formulate scripts based on predictable conversations (15). Practicing pre-written conversations will aid the patient in day-to-day interactions, such as introducing themselves or ordering food at a restaurant. With frequent use, individuals improve in sentence formation and confidence, and are able to apply the scripts to other settings.
Visual Action Therapy (VAT): Patients with severe aphasia that struggle with speech, reading and writing will most likely be recommended VAT (16). It involves various ways of gesturing to achieve a specific goal, without pushing a focus on speech. The patient may begin by using finger tracing or hand movement to describe a near-by object, and eventually progress to communicating about more complex items. Patients with Global Aphasia will often benefit from this as well as improving their comprehension skills.

Pharmacological treatments for aphasia are a currently expanding field, therefore drug treatments have yet to become a commonly utilised approach. The basic principles behind such treatments are to support brain restoration by increasing blood flow and stabilising neurotransmitter levels. Medications such as memantine (Namenda), donepezil (Aricept, Adlarity), galantamine (Razadyne ER) and piracetam are some of the most researched medications today.

Conclusion
Losing one's ability to speak or understand language has an immense impact on patients that have experienced adverse health events. Being aware of the different manifestations of aphasia is essential in order to further their treatment through speech therapy or potential pharmacology. Raising awareness of speech disorders is crucial, as the first step for any aphasia patient seeking treatment is acceptance. Communication is a means to connection, and it begins with patience, empathy, and acceptance both from clinicians and those around patients.

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