Neuroscience & Learning: A BTFA™ Informed, Neuroinclusive Perspective

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Executive Summary

This whitepaper distils key insights from my recent talk at the University of Buckingham's Dyslexia Hub and weaves them together with current research on the neuroscience of learning, neurodiversity, and practical design for inclusion. It integrates a down-to-earth, applied neuroscience lens, rooted in the BTFA™ framework (Brain → Triggers → Firing → Chemistry → Output; shorthand: Wiring → Firing → Chemistry → Output or to use familiar words all brains can readily identify with … **B**elieve → **T**hink → **F**eel → **A**ct™), with peer-reviewed findings on dyslexia, dyscalculia, dyspraxia (DCD), and ADHD.

The throughline is simple: when we design learning and work environments that reduce threat and shame, cultivate psychological safety, and let people reach the same destination by different routes we unlock more learning for more people (acknowledging this excellent explanation from Professor Dionysius Kyropolous at the event organised by Sarah Myhill from Buckingham University's Dyslexia Hub).

The paper closes with practical, neuroinclusive design principles for higher education and workplaces, linking the science to everyday practice.

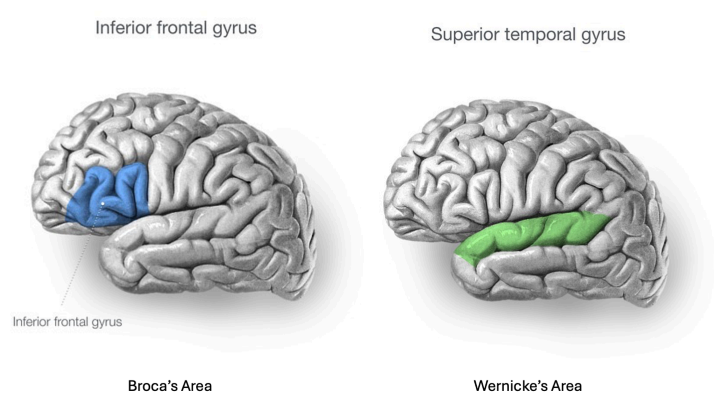
1. Introduction: Why the Brain Lens Matters

I come to this topic as a precision engineer / injection mould-maker, turned applied neuroscience practitioner teaching leaders about the neuroscience of change in industry around the world. The work surrounding dyslexia is new to me, but very personal. My late father told me, even in his seventies, about writing to a local farmer at age 14 to ask for a job on a tractor.

However, spelling 'job' with a 'G' he inadvertently asked for a 'gob' on a tractor and was ridiculed by the prospective employer and family members when he confided in them. *The shame stuck for over 60 years.* The strength of that memory reminds us that social judgement leaves neurological scars, that we might now think of as electro-chemical traces in the brain. It also helps us understand why, when brains are imprinted to respond to the fear of failure / rejection (via inhibitive and compulsive destructive criticism / imposed parental control, in early years) social disapproval in later life elevates stress hormones, learning narrows, and curiosity shrinks. Now we have the verifiable facts from neuroscience to explain this, we can, and arguably, must, *do better*.

Simply put, by understanding how brains wire, fire, and change with experience we can improve conduct and conditions to ensure brains can perform at their best in families, workplaces and classrooms.

My mother told me as I was growing up, that I was naturally left-handed but my father trained me to use my right hand (for reasons unknown). That has left me left-footed and right-handed, a fascinating combination when we consider how the left hemisphere of the brain controls the right body and vice versa (I will expand on this shortly). Also, when we consider the wiring differences between ADHD and 'typical' brain function with DTI (Diffusion Tensor Imaging), which shows how 'ADHD'ers' process language, more through the right hemisphere than the **left,** where 'geographically' we find the two primary regions associated to language processing and production (Wernick's and Broca's areas respectively).



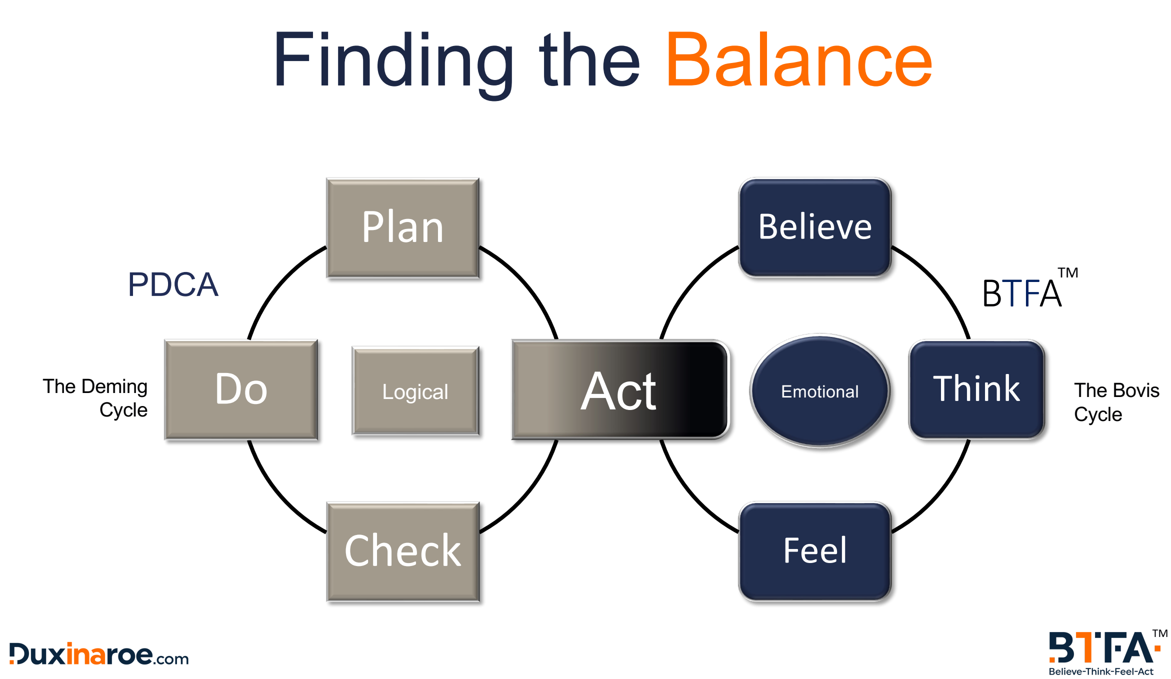
My own school years were marked by the behavioural patterns that today might attract an ADHD label. Categorised 'disruptive' from 1980 onwards, I can testify now, that I felt lost in the absence of a relationship with teachers, once I was moved from the primary school model (a teacher a year, covering different subjects) to the secondary school model (6 different teachers per day to cover their specialist subjects). I was also bored to tears as I was far from engaged with the subject matter, in the absence of a working relationship with the adults around me, seeing 150-200 students per day in classes of 30.

Later in life, i.e. in industry and leadership work, I found that the same neurobiological principles that explain classroom struggles

- poor quality relationships,
- variable brain function and
- associated psychological profiles, often linked to deep seated issues linked to fear-based responses

also explain why organisations get stuck when trying to get change / performance improvement from shifts in assumptions and behaviours.

The BTFA™ lens became a practical bridge: if you change triggers and context (Wiring/Firing), you change neurochemistry, and you get different behavioural outputs. This demands we look beyond the assumptions that follow a logical worldview, upon which we've based so much of our education and leadership design and look more toward a working model of human brain function, recognising emotional response as intrinsic to the behaviours that follow.



2. BTFA™ in a Page: Wiring → Firing → Chemistry → Output

BTFA™ reduces the complexity of brain-based behaviour change to a simple chain. Wiring (the current network state) plus contextual triggers, lead to Firing (patterns of neuronal activity). Firing shapes Chemistry (neurotransmitters, neuromodulators, hormones such as noradrenaline, dopamine, cortisol). Chemistry gates plasticity, supported by substances like BDNF (Brain Derived Neurotrophic Factor), LTP/LTD*, and neurogenesis … so the outputs you see today become the inputs to tomorrow's wiring.

In short: context sets the cocktail; the cocktail sets the learning.

** **LTP (Long-Term Potentiation):***
*A long-lasting strengthening of synaptic connections between neurons. It occurs when two neurons are repeatedly activated together (Hebbian learning: "cells that fire together, wire together"). LTP increases the efficiency of synaptic transmission, often by adding more neurotransmitter receptors to the postsynaptic membrane or increasing neurotransmitter release. This process is widely considered one of the main cellular mechanisms underlying **learning and memory**.*

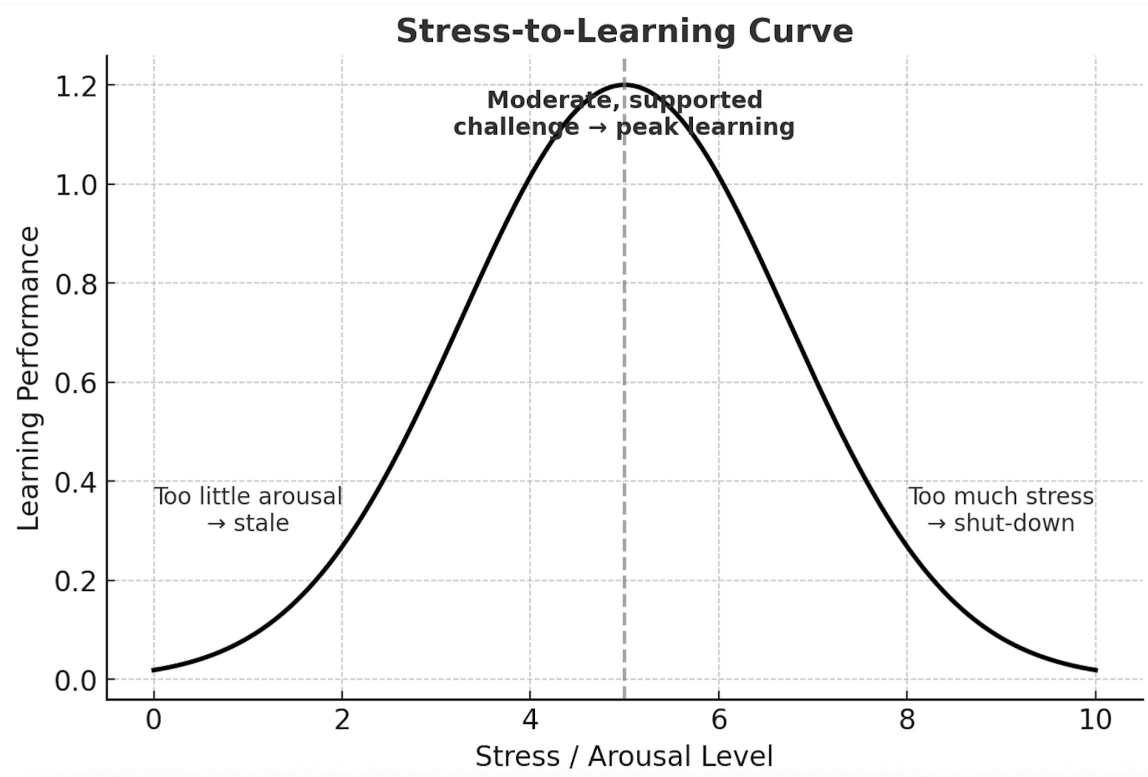
LTD (Long-Term Depression):
*A long-lasting weakening of synaptic connections. It occurs when neurons are activated out of sync or when synaptic activity is low for extended periods. LTD reduces synaptic strength by removing receptors from the postsynaptic surface or decreasing neurotransmitter release. LTD is important for **forgetting, error correction, and fine-tuning neural circuits**, preventing networks from becoming overexcited.*

*Together, **LTP and LTD** are the brain's "volume knobs" for synapses, balancing stability with flexibility. They are fundamental to **neuroplasticity**, the brain's ability to adapt through experience.*

Two practical corollaries follow. First, threat chemistry (social evaluation, shame, fear) raises cortisol and impairs hippocampal plasticity; sustained threat reduces BDNF and thus neurogenesis, (for which BDNF is essential) and blunts learning.

Second, supportive challenge and movement (exercise, rhythm, breath) increase BDNF and primes synapses for change. In learning / adaptation (change management) design terms:

1. reduce unnecessary threat
2. create meaningful challenge
3. add movement
4. leave more than one route to a learning outcome so the individual brain can find the solution that works best (avoid prescribed learning methods based on supported assumption in the educator / institution).



Like the PDCA-BTFA diagram, the key to optimal learning and memory formation, is in ***"finding the balance"*** between too little and too much arousal for each brain.

3. Why this is important - Dyslexia and the Brain: Different Wiring, Not Defect

Dyslexia is a common learning difference, affecting an estimated 7–10% of people, characterised by difficulties in accurate, fluent reading and spelling despite normal intelligence magazine.hms.harvard.edu. Modern neuroscience confirms that dyslexic brains *process language and print differently*. For example, brain imaging shows people with dyslexia often have **less grey matter** in left hemisphere language regions (like the left parieto-temporal area) which could hinder processing the sound structure of words readingrockets.org. They may also have **less white matter** (the brain's wiring) in those regions, meaning weaker connectivity for moving information between reading circuits readingrockets.org.

But how do we get here? Some context:

'Axial Twist Theory' 'Brain torsion' (a fundamental morphogenetic event that has no known exceptions throughout the 500 million years of vertebrate evolution) and decussation (crossing over), wiki_contralateral_brain are terms that help to describe the process of the embryonic brain separating from the initial 3 vesicles to 5 vesicles and 'twisting' as the embryo forms. The theory is that this process helps the brain 'fit in' to the available space as we humans develop in the womb which also helps to re-balance initial imbalance that occurs as the embryo forms with its left toward the yolk and right away from the yolk in the fertilised egg.

- Three-vesicle stage: The developing neural tube first forms three primary vesicles: the **prosencephalon** (forebrain), the mesencephalon (midbrain), and the rhombencephalon (hindbrain).

- Five-vesicle stage: The prosencephalon then subdivides into the **telencephalon** and the diencephalon.

- Cerebral hemispheres: The **telencephalon** is the part of the brain that ultimately forms the cerebrum, which includes the **left** and right cerebral **hemispheres** *and their cerebral cortex.*

- **Broca's and Wernicke's areas:** Both Broca's area, located in the frontal lobe, and Wernicke's area, found in the temporal lobe, are regions of the cerebral cortex. Therefore, they are direct derivatives of the telencephalon.

Contralateral control of the body is caused by the crossing of motor and sensory nerves to the opposite side of the brain, happens in the lower brainstem (the medulla), which develops from the embryonic rhombencephalon.

- **Corticospinal tract:** The motor pathway from the cortex to the spinal cord, responsible for voluntary movement, decussates in the medulla. **Approximately 90% of these fibres** cross to the opposite side, which is why the left brain controls the right side of the body and vice versa.

- **Sensory pathways:** Similarly, ascending sensory pathways (transmitting touch, pressure, and pain) also cross to the opposite side of the brain in the brainstem.

As a result of this process, there can be structural differences in the wiring we're each left with as a fully formed individual. Typical right-handed readers' brains are asymmetrical (left language areas larger), but dyslexic individuals often show a more symmetrical brain or even a larger right hemisphere than left readingrockets.org. This hints that the dyslexic / ADHD brain is *not* "broken", it's simply wired in a more bilateral way.

Functionally, when dyslexics try to read, their brain activation patterns diverge from those of typical readers. Normally, efficient reading relies on a network of left-brain regions toward the back of the head, in the **left temporo-parietal** and **left occipito-temporal** areas (often called the "rear reading systems"), which handle mapping print to sound and recognising word forms pmc.ncbi.nlm.nih.gov. In dyslexic readers, these left posterior regions **under-activate** during reading tasks readingrockets.orgpmc.ncbi.nlm.nih.gov.

Instead, dyslexic brains often compensate by recruiting other areas: for instance, the **right hemisphere and frontal regions** come to the rescue readingrockets.org. Studies by Yale researchers Sally Shaywitz and colleagues found that children with dyslexia show weaker activity in left word-processing areas, but *more* activity in parts of the **right hemisphere and lower frontal lobes**, as if the brain is finding alternate routes readingrockets.org.

Considering the contralateral developmental theories, it's more likely the brain doesn't seek alternative routes, but are already wired to operate this way from a genetic level, which, if an assumption that can be demonstrated in future research, may help to explain the heritable nature of ADHD and similar thinking, that is, neural processing differences.

An interesting aspect of language processing warrants note here.

Abstract: *Functional magnetic resonance imaging (fMRI) was used to compare brain activation from Japanese readers reading hiragana (syllabic) and kanji (logographic) sentences, and English as a second language (L2). Kanji showed more activation than hiragana in right-hemisphere occipito-temporal lobe areas associated with visuospatial processing; hiragana, in turn, showed more activation than kanji in areas of the brain associated with phonological processing. L1 results underscore the difference in visuospatial and phonological processing demands between the systems. Reading in English as compared to either of the Japanese systems showed more activation in inferior frontal gyrus, medial frontal gyrus, and angular gyrus. The additional activation in English in these areas may have been associated with an increased cognitive demand for phonological processing and verbal working memory. More generally, L2 results suggest more effortful reading comprehension processes. The study contributes to the understanding of differential brain responses to different writing systems and to reading comprehension in a second language.*

Such findings help us recognise, the degree to which a language, which embodies semantic meaning in ideograms / pictograms places different processing demands on the brain, engaging more right processing, where meaning is associated to the images used (e.g. Kaizen 改 (kai) and 善 (zen) depict self-flagellation at an altar, self-sacrifice, yet it has been translated to 'continuous improvement' often associated to the improvement of processes in the west – this provides a good example of how the deeper and broader meaning a brain can connect to across a more complex, far reaching neural net can fail to be included in a more logical language processing method) … and less demand for phonological processing in the left hemisphere.

This is of interest, as some scholars have used the metaphor of a wide-angle lens on a camera to describe 'Japanese thinking', compared to 'western thinking' being akin to using a zoom lens. i.e. Right hemispherical processing of image-based language lends itself to 'Big picture' thinking where phonological processing may encourage brain processing to be more specialist.

A principle we often consider in the 'dyslexia discussion' is that we humans (brains) all have processing capabilities along a continuum of variable brain function. This can be provided a negative connotation through language, when described as 'on the spectrum' (considering

Autistic behavioural tendencies), that we might now consider a highly developed neural capacity for detailed focus … analogously, a 600mm fixed length telephoto lens built into such brains.

It may be in time, we find out that ADHD westerners, whose brains have formed to engage right hemispherical processing at a genetic level, would have been served much better by a language based on ideograms than the syllabic language they inherited by default of the culture they were born into (this is no more than my pet theory, but it poses an interesting 'big picture' thought).

In adults who overcame dyslexia, PET and fMRI scans likewise reveal a shift – **non-dyslexics** who read well show strong left-brain activation (e.g. in the left angular gyrus), but **dyslexic individuals who read well rely on right-brain pathways** dyslexia.comdyslexia.com. In fact, one study showed that among dyslexic readers, *greater right-hemisphere activity correlated with better reading skill*, whereas more left-hemisphere activation correlated with worse reading (the opposite of typical readers) dyslexia.comdyslexia.com. In other words, the dyslexic brain 'develops' (?) an **alternative network** for reading, engaging "whole-brain" strategies rather than the usual left-centric route. This is a powerful reframing: dyslexia is not a simple deficit, but a different pattern of brain organisation.

As one expert puts it, the brains of people with dyslexia are ***"different, not defective,"*** often excelling in areas outside of reading dyslexiaida.org.

Notably, these brain differences exist from an early age, even before reading instruction. Research shows kids with familial risk of dyslexia have subtle differences in brain structure and connectivity as early as infancy and preschool (for example, differences in the **arcuate fasciculus** white matter tract that connects language regions) pmc.ncbi.nlm.nih.gov. Such awareness supports the observations made above about embryonic formation and the fact Dyslexia is highly heritable and linked to complex genetic factors, making it part of the *natural spectrum* of human neurodiversity.

In fact, (I'd say, *fortunately*), some researchers argue dyslexia reflects **normal variation** in how brains learn to read, rather than a "disease."

It's important to acknowledge here, that the act of 'reading' is **a *culturally invented skill*** - there is no single "reading gene" or brain module pre-wired for literacy. Thus, brains have to repurpose other circuits (vision, language, memory) to read magazine.hms.harvard.edu. From this perspective, it's unsurprising that a significant portion of the population struggles. Reading proficiency varies along a continuum, and dyslexia may simply lie at one end of normal variability frontiersin.orgfrontiersin.org. The sheer number of people with reading difficulties (by some accounts, only ~35% of US students read at grade level frontiersin.org) argues against dyslexia being a rare brain "abnormality", it's more likely an extreme in the wide distribution of reading ability in our species. And importantly, **dyslexia is independent of general intelligence** pmc.ncbi.nlm.nih.gov. Individuals with dyslexia often have average or superior strengths in other cognitive domains.

4. The Learning Biology: Plasticity, Stress, and BDNF

The Role of Emotion and Chemical Soup in Learning

Let's zoom in on one critical aspect mentioned above: **the impact of emotions and stress chemicals on learning**. This is especially relevant to understanding why a supportive culture (at home, in school, or at work) can "unlock" someone's potential, whereas a harsh culture can lock it up. When we feel safe and motivated, the brain releases neurotransmitters like **dopamine**, which reward us for exploration, and it maintains higher levels of **BDNF**, which, as noted, facilitates synaptic plasticity. BDNF has been called a *key molecule for memory* – it helps neurons form the connections needed to store new informationpmc.ncbi.nlm.nih.gov. High BDNF is like having fertile soil for neurogenesis (the growth of new neurons) and neural connectivity. On the other hand, when we feel threatened, ashamed, or stressed, our body releases **cortisol** and other stress hormones. These have an evolutionary purpose (preparing us to fight or flee) but in a classroom or learning context, they are *counterproductive*. Elevated cortisol over time can actually shrink neurons in the hippocampus (the brain's memory center) and **lower BDNF levels**, stunting the brain's ability to rewirepmc.ncbi.nlm.nih.gov. In dyslexic children, researchers have intriguingly found irregular stress responses – some studies show dyslexic kids tend to have either blunted or excessive cortisol responses to stresssciencedirect.com. It suggests that battling with reading daily is itself a significant stressor on the child's system. Moreover, dyslexic and other LD kids have higher incidence of **anxiety** disorderspmc.ncbi.nlm.nih.gov and other "internalizing" problems (like depression) by adolescence, likely as a result of repeated negative learning experiencespmc.ncbi.nlm.nih.gov. It becomes a vicious cycle: struggling with reading causes stress and anxiety, which in turn impair the very brain plasticity needed to improve reading, which then causes more failure and stress. Breaking this cycle requires *intervening on the emotional level* as much as the cognitive.

One helpful concept here is the **Yerkes-Dodson law**, a classic idea in psychology that performance on tasks is related to arousal in an *inverted U-curve*. Too little arousal (boredom, low motivation) can impair performance, but so can too much arousal (anxiety, fear)frontiersin.org. There's an optimal middle zone of "alert but not alarmed" where we learn best. For a child with dyslexia, imagine how often they are pushed out of that optimal zone – maybe a teacher calls on them to read aloud and they haven't yet decoded the text, their heart rate spikes, palms sweat (far right of the curve – panic). Or conversely, if they're given material way below their ability out of pity, they might be under-stimulated (far left of curve – disengaged). **Great teaching aims for the sweet spot**: challenging enough to be interesting, but with *support and encouragement* so the student stays confident and calm. From a neuroscience view, this sweet spot is where **norepinephrine** and **dopamine** levels in the brain are balanced – attention is focused, but the amygdala (fear center) is in check.

A practical example is guided reading at the student's level with constructive feedback. Instead of throwing a dyslexic 10-year-old into reading Shakespeare (overwhelming), or giving them baby books (insulting, under-stimulating), we might use age-appropriate content at their decoding level, pre-teach difficult words to reduce anxiety, and let them take turns reading with a partner. This keeps them engaged (not bored) but minimizes panic. Over time, successful experiences will reduce their fear response. As their fear goes down, their **BDNF and plasticity** can go up, enabling real improvement.

Decades of research show that stress hormones remodel learning circuits. The hippocampus, central to episodic memory and the consolidation that underpins academic learning, is highly sensitive to glucocorticoids (Cortisol is the body's main glucocorticoid hormone, released via the **HPA axis** during stress). Chronic stress (extended exposure to cortisol) suppresses neurogenesis in the **dentate gyrus*** and alters the dendritic structure, while supportive environments permit plasticity and recovery.

*The Dentate Gyrus in Learning and Memory

- The **dentate gyrus** is part of the hippocampal formation, a critical hub for **episodic memory** (remembering events, contexts, and sequences).
- Functionally, the DG acts as a **"pattern separator."** Imagine you park your car in a big lot on Monday, and again on Tuesday but in a slightly different spot. The DG helps you encode those as *two distinct memories* rather than blurring them together. It allows us to **differentiate similar experiences,** so they don't overwrite one another.
- This is especially important in **learning new information** that is similar to what we already know, the DG ensures we can form a new, separate trace instead of confusion.

Neurogenesis in the Dentate Gyrus

- The DG is one of the areas where **adult neurogenesis** (the birth of new neurons) continues throughout life.
- These new granule cells are highly **plastic**: they are more excitable and adaptable than older neurons, making them perfect candidates for encoding **new experiences** and supporting learning.
- Neurogenesis here is strongly linked to **memory flexibility, mood regulation, and adaptability**.

Stress, Cortisol, and Suppression of Neurogenesis

- **Chronic stress and elevated cortisol** can significantly **suppress neurogenesis in the DG**.
- When neurogenesis is reduced, the hippocampus loses part of its ability to encode new experiences flexibly. This means:
  - Harder to distinguish new events from old ones (impaired pattern separation).
  - Reduced adaptability in learning.
  - Greater likelihood of repetitive, rigid thought patterns, which we often see in anxiety and depression.

- For dyslexia, ADHD, dyspraxia, or other neurodivergent learners, who may already face working-memory and attentional challenges, a stress-rich environment compounds the difficulty. The **very brain mechanism needed for flexible learning (new DG neurons)** is dialled down

On the other hand, exercise reliably elevates circulating BDNF and is associated with improved memory performance, suggesting practical levers we can use in classrooms and organisations.

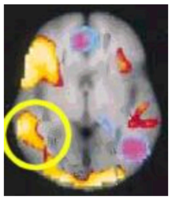
Selected evidence:

- Stress and hippocampal plasticity; glucocorticoids suppress neurogenesis and remodel dendrites (McEwen, 1999; 2001; 2012).
- Exercise increases circulating BDNF across ages and conditions; BDNF is a key mediator of plasticity (Shao et al., 2024; Rico-González et al., 2025).
- Moderate-to-vigorous activity and rhythmic movement can be built into learning sessions to prime plasticity (Cefis et al., 2023).

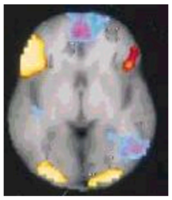
UK consensus definitions (Rose, 2009; BDA/SASC) emphasise a continuum view: no sharp cut-offs, and wide variability in profiles. Neuroimaging converges on under-activation of left posterior reading systems (temporoparietal and occipitotemporal), with compensatory recruitment of inferior frontal and right-hemisphere regions. White-matter connectivity differences further implicate left-hemisphere language pathways.

Selected evidence:

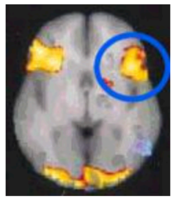
- Definitions and consensus: difficulties in phonological awareness, verbal memory, and processing speed; dimensional view (Rose, 2009; BDA/SASC).
- fMRI meta-analyses: reduced activation in left temporoparietal/occipitotemporal; compensatory inferior frontal/right-hemisphere activity (Shaywitz et al., 2002; Richlan, 2009, 2011).
- Connectivity: differences in left-hemisphere language networks and reading circuits (Pugh, 2000; Raschle et al., 2012; Finn et al., 2014; Yan et al., 2021).
- Behaviour: robust deficits in phonological processing, working memory, rapid automatized naming (RAN), and often processing speed (Snowling, 2016; Araújo et al., 2019; Gray et al., 2019).



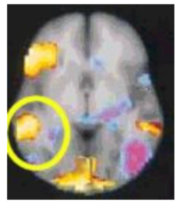
Ordinary readers use the left temporal area for sounding out words.



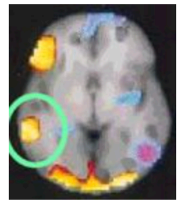
Poor readers do not use the left temporal area to find the sounds of words.



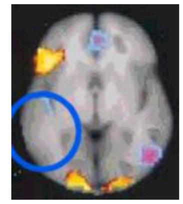
Capable dyslexic readers show greater reliance on right brain areas.



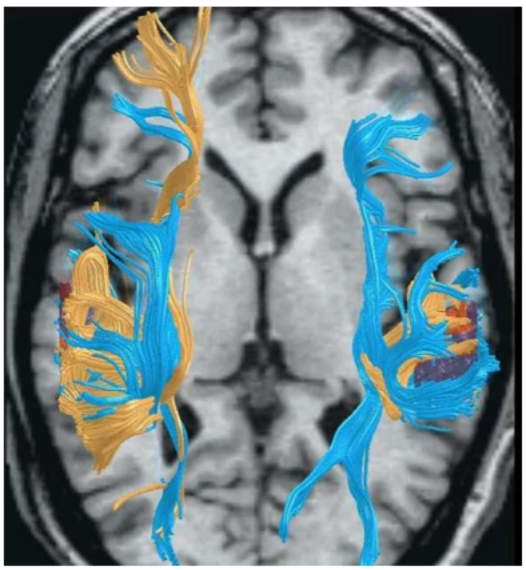
Ordinary readers also use the left temporal area when reading for meaning.



Persistently poor readers show brain activity like non-dyslexic readers.



Dyslexics who are capable readers do not activate the left temporal region.



This image combines a DTI (diffusion tensor image) showing white matter pathways in the brain of a dyslexic man (in blue) overlaid on an image of the brain pathways of a person with more typical brain architecture (in gold).

The image shows that while the dyslexic man has somewhat less well-developed left-brain connections, his right brain connections are far more extensive than his non-dyslexic counterpart. (From Leonard & Ekhert, *Assymetry and Dyslexia*). Images from …

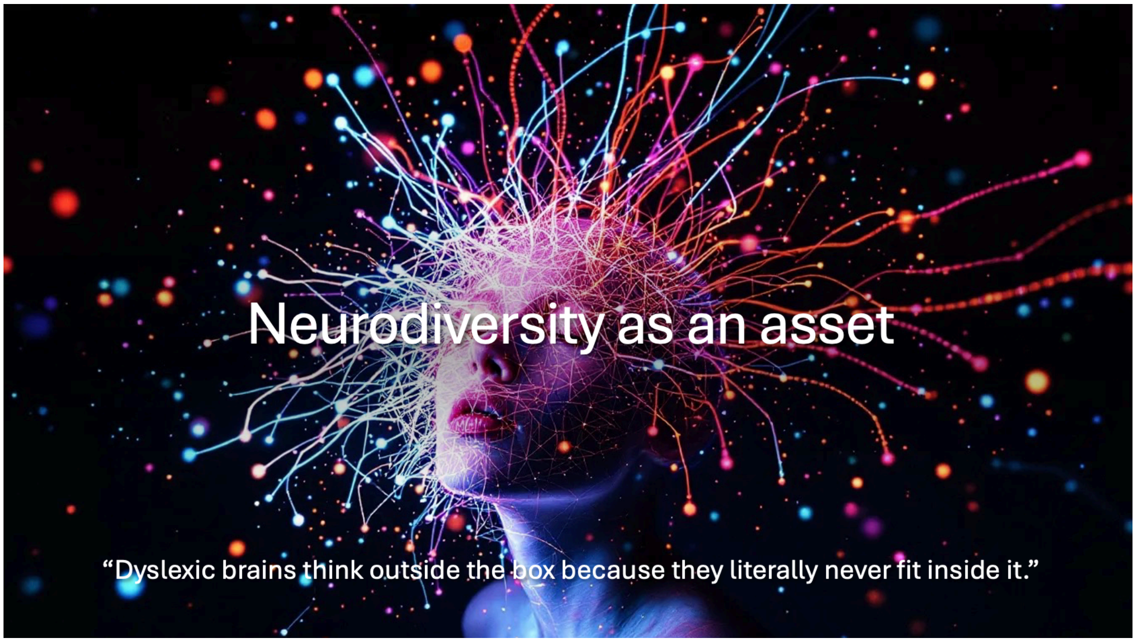
https://www.dyslexia.com/research/articles/alternative-brain-pathways/#:~:text=Research%20correlating%20brain%20activity%20with,on%20the%20right%20hemispheric%20systems

Dyslexia’s Upside: Neurodiversity as an Asset

In this discussion, it’s important to balance the challenges of dyslexia with the **strengths and advantages** that often come with neurodivergent minds. My fellow speakers at this event exemplify this: highly educated, creative individuals who have succeeded not in spite of their dyslexia/ADHD but in many ways *because* of the unique perspectives these differences afforded them.

There’s a saying in the dyslexia community: *“Dyslexic brains think outside the box because they literally never fit inside it.”* We see this in the disproportionate number of dyslexic people in entrepreneurship, arts, engineering, and other fields requiring creativity and big-picture thinking. For instance, a well-known survey by Julie Logan found about 35% of entrepreneurs in the USA identified as dyslexic dyslexiaida.org, far above the population rate.

While not every dyslexic individual has a genius-level gift (and we must be careful not to overgeneralise), there is growing research investigating **specific cognitive advantages**.



We already touched on the visuospatial processing advantage demonstrated in some studies – where dyslexic adolescents were faster at analysing 3D impossible figures dyslexiaida.org.

Researchers like Dr. Gordon Sherman have floated the **“cerebrodiversity hypothesis,”** suggesting that brain circuits preserved through evolution (even if they cause a weakness in a modern skill like reading) likely carry **hidden strengths in other areas** dyslexiaida.orgdyslexiaida.org. For example, a brain that doesn’t constrain itself to left-hemisphere language dominance might be more **integrated across hemispheres**, possibly enabling more holistic thinking or creativity. There is evidence that dyslexic thinkers tend to be more **visual and story-oriented**, often excelling at tasks like imagining how a system works, spotting patterns, or coming up with innovative solutions. Dr. Manuel Casanova’s work on cortical Mini columns even implies that dyslexic brains have micro-architectural differences that could underlie a more “diffuse” style of thinking, not as laser-focused on small details, but excellent at grasping the gist or seeing connections (which is a valued skill in many domains).

In my own life, while I may not carry a dyslexia diagnosis, I relate to feeling “wired differently.” Being *forced to write right-handed* perhaps gave me a peculiar ambidexterity and perspective; having an unconventional learning path (where standard methods didn’t always work for me) made me more **open-minded and persistent** in problem-solving. I suspect many neurodivergent individuals develop a kind of *metacognitive savvy*, they have to learn how to learn, which ultimately becomes an asset.

They often become **leaders and change-makers** because they challenge the status quo by necessity. This ties directly to my work in leadership and culture change: I've seen organizations benefit immensely from neurodiverse teams. People who think differently can spot risks others miss or dream up products others couldn't imagine.

For example, one of the speakers, Dr. Ian Iceton, focuses on autism in the workplace – companies are discovering that accommodating neurodiversity unlocks talents (like extreme pattern recognition in some autistic individuals) that give them competitive advantage. The same re-framing is happening for dyslexia: rather than viewing it only as a disability to be pitied, forward-thinking educators and employers are *celebrating the dyslexic advantage*. Renowned dyslexia researchers Brock and Fernette Eide even wrote **"The Dyslexic Advantage"** book highlighting four domains (MIND: Material, Interconnected, Narrative, Dynamic reasoning) where dyslexics often shine.

This doesn't diminish the real struggles with reading; it simply reminds us that a **person is more than their deficit**.

6. Working Memory & Executive Load: A Cross-Cutting Limiter

Across dyslexia, ADHD, and often dyspraxia (DCD - Developmental Coordination Disorder), working memory (WM) limitations are a recurring bottleneck. In dyslexia, phonological WM and verbal short-term memory are commonly reduced; in ADHD, central executive WM deficits are large and pervasive. If educators and managers unknowingly design for high extraneous load, long verbal instructions, rapid context switching, social evaluation, performance collapses despite high potential.

Selected evidence:

- Dyslexia WM: deficits across verbal and visuospatial spans; phonological loop weaknesses are common (Gray et al., 2019; de Assis Leão et al., 2023).
- ADHD WM: large-magnitude central executive deficits; WM deficits predict academic/reading problems (Kasper et al., 2012; Kofler et al., 2018; 2020).
- Instructional design must reduce extraneous load and scaffold WM (link to Cognitive Load Theory and expertise reversal below).

7. Gist, Detail, and 'Routes Up the Mountain'

Conversation at the Dyslexia Hub surfaced the idea that ADHD often skews toward 'gist' or big-picture thinking, while autism often presents with detail-focused processing. Fuzzy-Trace Theory (Reyna & Brainerd) provides a useful language: people encode both verbatim details and gist meaning, with developmental shifts toward gist-based reasoning. The take-home for design is not to essentialise people into types, but to offer both routes: start with meaning and story (gist) and provide structured access to detail when needed; or vice-versa.

This also aligns with differences in local vs. long-range connectivity reported in autism and dyslexia, and with reports of slower processing speed in dyslexia.

Selected evidence:

- Fuzzy-Trace Theory: parallel gist and verbatim representations; developmental increase in gist reliance (Reyna & Brainerd, 2015; 2016; 2021).
- Autism often shows local-processing bias; dyslexia often shows slowed processing and altered long-range language connectivity (Van der Hallen et al., 2015; Richlan, 2011; Finn et al., 2014).
- Practical implication: teach by 'two doors'—meaning first/then detail, or detail first/then meaning—letting learners choose the easier ascent.

[Figure placeholder: Two routes to the learning summit: over the mountain (sequential detail) vs. across the lake (gist → flexible paths).]

8. Mini-columns, Distances, and a Useful Analogy

Discussion also touched on mini-column theory: in autism, studies report narrower mini-columns and altered inhibitory surrounds; in dyslexia, classic histological work points to cortical malformations (microgyria, ectopias) in language cortex. It is tempting—and sometimes useful—to explain subjective processing speed as a 'distance' issue (active regions further apart versus closer together). Strictly, the empirical picture is more nuanced: we can confidently say that cortical micro-architecture and connectivity differ across conditions, and that these differences can influence timing and integration. As a teaching metaphor for lay audiences, the 'distance' framing can land; as scientists, we should note it as an intuition pump rather than a settled mechanism.

Selected evidence:

- Autism: mini-columnar alterations (Casanova et al., 2006).
- Dyslexia: cortical micro-anomalies in perisylvian regions (Galaburda & Kemper, 1979; Galaburda et al., 1985).
- Network-level connectivity differences and processing speed variability are well documented (Richlan, 2011; Yan et al., 2021).

[Figure placeholder: Schematic: Mini-columns (autism vs neurotypical) and cortical malformations (dyslexia) — conceptual, not literal anatomy.]

9. Dyscalculia in Brief (Linking to Prof. Ann Dowker's Work)

Developmental dyscalculia involves persistent difficulties in learning or retrieving arithmetic facts, performing calculation, and understanding number magnitude. Research highlights deficits in symbolic number processing, fact retrieval, and often working memory. Ann Dowker's extensive work has emphasised individual differences and targeted interventions. For mixed neurodivergent profiles, mathematics anxiety and shame are critical environmental modulators that can throttle performance regardless of underlying potential.

Selected evidence:

- Reviews and texts on dyscalculia and arithmetic learning differences (Dowker; Butterworth, 2011; Szűcs & Goswami).
- WM and attention contribute importantly to math outcomes; targeted, scaffolded teaching outperforms one-size-fits-all.

10. Dyspraxia (DCD): Motor Coordination, Cognition, and Load

Developmental Coordination Disorder affects motor planning and coordination and frequently co-occurs with other learning differences. Motor demands add cognitive load; handwriting, note-taking, and sequencing can tax working memory and attention, degrading learning performance. Environmental design—time, tools (speech-to-text; keyboards), and assessment flexibility—can be decisive.

Selected evidence:

- Reviews underline motor learning and executive differences in DCD (Wilson et al., 2017; Blank et al., 2019).

11. Shame, Stereotype Threat, and the Chemistry of Learning

Shame and social evaluation trigger stress responses that compete with learning. Stereotype threat literature shows that simply being aware of a negative stereotype can impair performance via cognitive, affective, and physiological channels—including cortisol reactivity. Conversely, psychologically safe climates promote voice, error-disclosure, and learning behaviour. The implication is clear: to get better outputs, design for chemistry first—minimise gratuitous threat; maximise respectful challenge.

Selected evidence:

- Trait shame correlates with stronger cortisol stress responses (Lupis et al., 2015).
- Stereotype threat impairs learning; integrated models include physiological arousal (Schmader et al., 2008; Casad, 2016).
- Psychological safety predicts team learning behaviour and performance (Edmondson, 1999; HBR/related resources).

[Figure placeholder: Diagram: Social-evaluative threat → ↑Cortisol → ↓BDNF/hippocampal plasticity → ↓Learning; Psychological safety does the opposite.]

12. Cognitive Load & The Expertise Reversal Effect

Cognitive Load Theory (CLT) distinguishes intrinsic, extraneous, and germane load. Novices benefit from highly guided instruction; as expertise grows, the same guidance can become redundant or even harmful—the expertise reversal effect. For neurodivergent learners, 'expertise' can reside in self-knowledge: knowing what routes and tools work for their brain. Non-directive coaching practices—co-creating goals, asking permission before advice, inviting critique, and promoting experimentation over perfection—fit both the neuroscience and the lived experience shared at the Dyslexia Hub.

Selected evidence:

- Expertise reversal effect within CLT (Kalyuga, Ayres, Chandler & Sweller, 2003; 2007).
- Autonomy-supportive practice aligns with Self-Determination Theory and reduces defensive threat responses.

[Figure placeholder: Graphic: Guidance intensity vs. learner expertise showing the reversal point.]

13. Tools & Tech: Let People Choose Their Route

Assistive technologies increasingly reshape the 'route over the mountain.' For example, Emboldened, a free app showcased by an ADHD-qualified lawyer at the event, offers interaction tweaks that reduce cognitive friction. The principle is not one tool, but a toolbox: text-to-speech, speech-to-text, distraction blockers, alternative note-capture, and visual planning boards. The litmus test is simple: does it reduce extraneous load and social-evaluative threat while preserving meaningful challenge?

[Figure placeholder: Screenshot placeholder: Emboldened app (with permission).]

14. From Lecture Hall to Shop Floor: Translating to Organisations

The same brains walk into universities and employers. Psychological safety, clarity of outcomes (not just methods), multiple modalities, and room for experimentation create better learning cultures in both settings. Dr Ian Iceton's work on autism in the workplace and PASSHE's efforts to improve higher-education support reflect a broader movement: design systems around how brains actually learn and perform, not around legacy assumptions.

Practical cross-over moves:

1. Describe the destination (learning/role outcomes) and let people co-design routes.

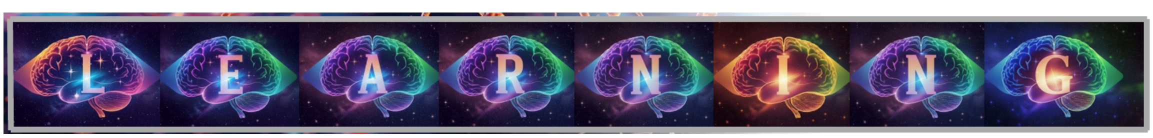
2. Reduce extraneous load (chunking, white space, slower pace; fewer concurrent demands).
3. Build safety signals: normalise questions, surface errors as data, ask permission before advice.
4. Prime plasticity: movement breaks, rhythm, breathing; design for restorative cycles.
5. Offer tool choice and accommodations by default; measure outcomes, not conformity of method.

15. Breaking Down 'LEARNING': A Practical Heuristic

Borrowing from my 'Comfortably Numb' notes (another 'book' project I have running in the background), here's a practical mnemonic that maps to the science. Use it as a checklist to tune environments.

L — Limbic awareness - Low threat, high respect: Safety first
E — Environment – create the conditions brains need to learn: Safety first
A — Attention = Awareness and Acetylcholine.
R — Repetition (and Reward): practice makes perfect = myelinated axons.
N — Neuroplasticity: if you don't change the brain, you don't change anything.
I — Individualisation: One size does not fit all - multiple modalities; scaffold / tool choice.
N — No Shame / No Fear = low cortisol high BDNF
G — Growth Mindset – initial framing significantly impacts brain function.

What Is "Learning"? – Breaking It Down



Let's clarify what we mean by **learning**, especially from a brain perspective. Learning isn't just cramming facts; it's a *biological process* of the brain changing itself in response to experience. In honour of the Dyslexia Hub's theme, we can break down the word **LEARNING** into key elements that make learning possible (and relate them to the dyslexic experience):

L – Limbic Engagement (Emotion): Emotions drive attention and memory. The limbic system (emotional brain) must be engaged – not alarmed – for optimal learning. If a student feels fear or shame, the emotional brain sounds a stress alarm that can block new learning. On the flip side, positive emotion (interest, curiosity, confidence) acts as a "fertilizer" for memory formation. Neurologically, emotional arousal influences memory centres; for example, the amygdala tagging an experience as meaningful can boost recall. We intuitively know this – think how you remember vividly the things that made you *feel* something. For a dyslexic learner, who may have faced repeated frustration, restoring positive emotion is key. When learning becomes associated with embarrassment or anxiety, the brain will try to avoid it. As one education expert observed, early reading struggles often get "so imbued with ... shame" that children develop *"an aversion to everything that is education"*childrenofthecode.org. We must remove that emotional roadblock by creating a safe, encouraging climate.

E – Environment: The learning environment should be **safe, supportive, and rich in feedback**, not punitive. Environment here means both the physical setting and the social-emotional context. A learner's brain is constantly monitoring: *"Is it safe to take risks and make mistakes here?"* If yes, the brain's higher reasoning can stay online; if not, the primitive fight-or-flight response takes over. Stressful or judgmental environments flood the brain with *cortisol* (the stress hormone), which in excess can impair memory and neuroplasticity. In fact, research suggests that even mild but chronic stress can disrupt the delicate brain networks needed for reading. One study proposed that **early-life stress may contribute to dyslexia**, in part by over activating the stress (HPA) axis and altering brain developmentpmc.ncbi.nlm.nih.govpmc.ncbi.nlm.nih.gov. High stress levels were found to **reduce BDNF** (Brain-Derived Neurotrophic Factor) – a crucial growth protein for neurons – and to interfere with the function of areas like the insula, amygdala, and hippocampus that coordinate cognitive performancepmc.ncbi.nlm.nih.gov. In plainer terms: a hostile environment can chemically *poison* the soil in which learning grows. Conversely, a nurturing environment – one with patience, positive reinforcement, and understanding – creates the optimal neurochemical conditions (lower cortisol, higher BDNF) for the brain to adapt and learn. This is especially true for dyslexic students, who thrive when instruction is *multisensory, structured,* and delivered without judgement. A great environment replaces fear with curiosity and gives permission to fail forward.

A – Attention: No learning happens without attention. In brain terms, attention is the **gatekeeper of neuroplasticity** – what we pay attention to repeatedly is what our brain wires itself to do (unfortunately this includes watching 'click bait' cats on YouTube via Smartphones). As with all brain function, being able to 'pay attention' requires the chemicals involved in the process are available and sufficient – in this case, Acetylcholine plays a significant part. Science Direct.

Aspects of modern life that can reduce acetylcholine (ACh) levels include anticholinergic drugs (like many antihistamines), exposure to organophosphate pesticides that inhibit ACh breakdown, **chronic stress**, and aging.

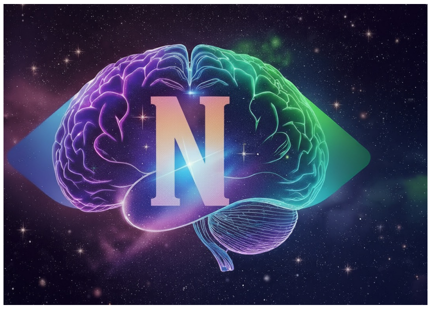
Choline can be *enhanced* by eating a healthy balanced diet. Choline is an essential nutrient that humans must obtain from their diet because the body's own synthesis is insufficient. While the body makes some choline, dietary sources like broccoli, meat, eggs, fish, and soy are necessary to meet daily requirements. It becomes obvious that a poor diet can also contribute to lower

ACh production, because the body synthesises Ach from Choline in a reaction catalysed by the enzyme choline acetyltransferase (CAT). While not directly reducing levels, conditions like Alzheimer's disease directly damage ACh-producing cells, and nicotine use can interfere with the balance of ACh.

Many dyslexic learners develop incredible attention for **creative, 3D, or storytelling tasks** but have trouble focusing on text, especially if it's presented in a boring or stressful way. When we capture a student's interest through engaging methods (like games, visuals, hands-on activities), we secure their attention. Biologically, this aligns the frontal "executive" networks with the sensory areas processing the content. Interestingly, the brain's attention networks also tie into those right-hemisphere circuits that dyslexic readers often use. Studies note that dyslexic children tend to engage more **frontal-striatal circuits** (attention/executive pathways) when doing visuospatial tasks or reading, showing "expert-like" brain patterns when they excel in something dyslexiaida.orgdyslexiaida.org. By leveraging strengths (say, letting a student build a model or act out a story), we harness their **attentional spotlight** and facilitate learning in a way that suits their brain. In short, attention is the front door to learning – and we must invite it in with creativity and relevance.

R – Repetition (and Reward): The old adage "practice makes perfect" has a neurological basis. Each time we practice a skill or recall information, the neural pathways for that task get stronger (often by adding myelin insulation or strengthening synapses). **Repetition** is especially critical for reading, which builds automatic word recognition through repeated exposure. Dyslexic learners typically need *more* repetition to achieve fluency – but rote drills done in frustration won't help. We need *quality* repetition, ideally paired with **reward**. When a student practices and sees progress (even small wins), their brain's reward system (dopamine release) kicks in, reinforcing the neural circuit. With effective intervention, dyslexic readers *do* rewire their brains. In fact, brain imaging before-and-after studies show that intensive reading instruction can **normalize brain activity** in dyslexic childrenreadingrockets.orgreadingrockets.org. After a 28-hour specialized training, one study saw previously underactive left-language areas in dyslexic kids light up almost like those of typical readersreadingrockets.orgreadingrockets.org. Other research has found that evidence-based phonics programs lead to **increased neural connectivity and activity** in dyslexic brainspmc.ncbi.nlm.nih.gov. In some cases, entirely new pathways are recruited, demonstrating the brain's capacity to *adapt* with practicepmc.ncbi.nlm.nih.gov.

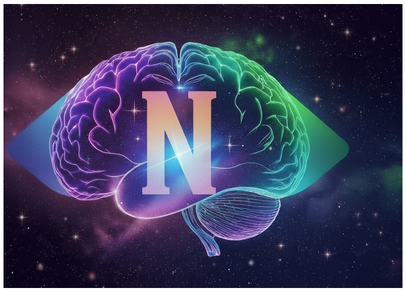
The lesson is clear: given the right kind of practice and positive reinforcement, the dyslexic brain can literally rewire itself to read. Thus, repetition + reward (in a supportive setting) is a formula for neural change.



N – Neuroplasticity: This is the cornerstone of the neuroscience of learning – the brain's ability to **change its structure and function** in response to experience. When we learn, we aren't just absorbing information; we are **physically remodeling the brain**. New synapses form; existing connections strengthen or weaken; sometimes new neurons even grow (notably in the hippocampus, a memory hub). Neuroplasticity is what allows a dyslexic person to improve their reading, or an adult to overcome years of negative self-talk and thrive. Crucially, neuroplasticity is *experience-dependent* – it's driven by what we do and in what environment we do it. Studies reinforce that the brain has a "vast potential to undergo functional and morphological adaptations in response to environmental circumstances" throughout lifepmc.ncbi.nlm.nih.gov. Even in adulthood, with effort and the right supports, people with dyslexia can continue to make reading gains and develop compensatory strategies. However, neuroplasticity can be a double-edged sword: a brain will also adapt to **not** do something if it's consistently avoided. This is why early intervention is emphasized – the young brain is highly plastic and can normalize reading circuits more easily. But lifelong learning is possible; the key is to **keep the brain engaged**. In this context, an exciting area of research is the role of **BDNF (brain-derived neurotrophic factor)**. BDNF is often dubbed "Miracle-Gro for the brain" – it's a protein that supports synaptic plasticity, helping neurons wire together during learningpmc.ncbi.nlm.nih.govlibd.org. High levels of BDNF enhance learning and memory, whereas stress and cortisol can lower BDNF (and thus impede plasticity). Exercise, positive experiences, and even certain diets can boost BDNF production. Knowing this, we can intentionally incorporate activities that promote BDNF – for example, physical exercise or playful movement before a tough learning task (exercise is known to significantly increase BDNF levels, aiding learningpmc.ncbi.nlm.nih.gov).

I – Individualization: Every brain is unique, and **one size does not fit all** in learning. This is especially pertinent for neurodivergent learners (dyslexic, ADHD, autistic, etc.). An approach that works wonders for one student might fall flat for another. For dyslexia, this means we must be ready to personalize teaching methods – whether it's using audiobooks, speech-to-text technology, multi-sensory phonics programs, or creative arts integration. Individualization is not coddling; it's aligning with how a person's brain processes best. Research acknowledges that dyslexia has multiple subtypes and a range of severity, each possibly involving slightly different neural quirkspmc.ncbi.nlm.nih.govpmc.ncbi.nlm.nih.gov. Some dyslexic students might also have attention deficits, others might have working memory challenges – tailoring support is key. Importantly, **individualization also means focusing on the person's strengths**. For example, a dyslexic student might have extraordinary **spatial reasoning or creativity**. Indeed, some studies suggest that people with dyslexia, on average, show superior ability in certain visuospatial tasks or creative problem-solvingdyslexiaida.orgdyslexiaida.org.

In one Haskins Laboratories study, adolescents with dyslexia performed faster (with equal accuracy) than typical readers on a complex spatial puzzle task, and their brain scans indicated a *trade-off* – they processed visuals with more efficiency than peers, even though those peers had an easier time with printdyslexiaida.org. This highlights that a dyslexic brain may be **optimized for different tasks**. In practice, I've seen dyslexic individuals excel in fields like design, engineering, entrepreneurship, and storytelling once they find their groove. So in any learning context, we should personalize not just to remediate weaknesses but to **leverage talents**. This boosts confidence and often creates a backdoor to improving the weaker areas (for instance, a student might hate reading but love building – giving them LEGO instructions or engineering manuals taps their interest and sneaks in literacy practice).



N – No Shame, No Fear: This second "N" underscores a non-negotiable: **learning flourishes in the absence of shame and fear**. We've touched on emotion and environment, but it bears repeating because it's often overlooked in academic settings. Shame is a toxic force in education. The moment a learner feels ashamed of their difficulty, a cascade of negative effects ensues – motivation plunges, anxiety rises, and the brain literally diverts resources away from the cortex (thinking brain) to the limbic system (survival mode). Chronic shame in learning can lead to a state researchers call "academic trauma," where a person might avoid challenges or sabotage their own efforts to protect what little self-esteem remains. Unfortunately, dyslexic and other learning-different students are at high risk of experiencing shame, especially if their struggles were misunderstood as laziness or lack of effort. As we heard earlier, my father's entire life outlook was colored by the shame of one spelling error. And he's not alone. Quotes from the **Children of the Code** project – which interviewed adults who struggled to read – reveal that even successful grown-ups often carry scars from being labeled "slow" or feeling stupid in schoolchildrenofthecode.orgchildrenofthecode.org. Many say they "withered on the vine" as their confidence collapsed in the face of reading failurechildrenofthecode.org. Therefore, in any discussion of unlocking potential, we **must create a shame-free zone**. This means celebrating progress (no matter how small), framing mistakes as learning opportunities, and never equating a person's reading ability with their intellect or worth. Practically, it could involve things like allowing a dyslexic student to demonstrate knowledge orally instead of in writing (thus decoupling their grade from their reading challenge), or openly discussing famous dyslexics and their achievements to destigmatize the condition. When learners feel safe – that they won't be ridiculed or diminished – they can redirect all that mental energy from worrying into actually learning.

G – Growth Mindset: Finally, lasting learning requires a belief in change – a **growth mindset**. Coined by psychologist Carol Dweck, a growth mindset is the belief that abilities can be developed through effort and good strategies, as opposed to a fixed mindset ("I'm just dumb, I'll never get it"). This concept dovetails perfectly with neuroscience: once you understand *neuroplasticity*, you realize the brain is designed to change. For dyslexic individuals, adopting a growth mindset can be liberating. Instead of "I can't read well because I'm dyslexic," it becomes "I'm dyslexic, so I need to learn differently and practice more – but I *can* improve."

There's real evidence that such an attitude improves outcomes. Interventions that combine skill-building with mindset coaching often see better engagement. Students start to attribute success to their own efforts ("I nailed that essay because I put in the work and tried new strategies") and view setbacks as temporary.

In my practice, I introduce the **BTFA framework** (**Beliefs -> Thoughts -> Feelings -> Actions),** to illustrate how a belief (like "I'll never be a good reader") can generate negative thoughts, which fuel discouraging feelings, leading to self-defeating actions (or inaction). But if we change that initial belief to something more positive ("I can get better at reading with the right help"), the whole chain reaction shifts towards empowerment. In essence, nurturing a growth mindset sets the stage for all the other elements (effort, persistence, openness to help) to come into play. It turns the brain's plastic potential into reality because the learner *chooses* to keep trying rather than giving up.

The focus here, using this mnemonic for Learning, is of course to help improve the opportunities for learning in those with Dyslexia, ADHD and other non-typical brain functioning processing methods, however, it would be remiss of me not to highlight the same knowledge about the neuroscience of learning can inform our approach to education in its entirety. Not just in school, college or university, but also in the workplace. Despite their differences, typical and atypical brains can all 'learn' (i.e. wire neural connections) more effectively, when the suggestions made here inform the design of our approaches to education in all walks of life. The 'brain' advice is not explicit to neurodivergent individuals, so perhaps, the task at hand, for policy makers is to embed this knowledge into the assumptions they make about learning, so the 'solution' suits all brains … at that point, we would no longer need to categorise typical / Atypical, because all brains could flourish.

This is what I try to convey with my favourite phrase and strong recommendation to leaders in business **"Create the conditions in which brains can perform at their best".**

16. Conclusion: Design for Chemistry, Honour Different Routes

Brains learn when the chemistry is right and the route makes sense. For dyslexia and related differences, the findings are not a call for lower standards but for smarter design: protect dignity; scaffold working memory; provide multiple routes; and use movement and safety to prime plasticity. BTFA™ gives us a simple way to hold it all in mind: change the triggers and context; change the firing and chemistry; change the output—over time, that's culture change.

Putting It All Together – From "Gob" to Gold

To conclude, I want to circle back to my father's story – that 14-year-old boy who spelled "job" with a G and was laughed at. What if, instead of ridicule, he had received *guidance*? What if someone had recognized that his mistake was not stupidity but perhaps a sign of an unsupported learner – maybe even a dyslexic mind at work? I can't change the past for my dad, but today we have knowledge that didn't exist in his youth.

We know about dyslexia; we know about neuroplasticity; we know how vital it is to create learning environments free of fear.

This talk has covered a lot of ground: from how dyslexic brains function, to the chemistry of stress and learning, to the importance of emotional safety, to the incredible potential that lies in neurodivergent individuals when given the right opportunities. My aim was to provide a *"brain-based clarity"* on the complex world of human behavior, learning, and change – a phrase echoing my BTFA framework and Dux Model work. And the clarity is this: **Human potential is astonishingly malleable.** The brain can adapt and overcome even the most challenging obstacles – but it needs the right conditions. Those conditions include science-based interventions *and* a compassionate culture. They include hard work *and* heartfelt encouragement.

As leaders, educators, or peers, we are all part of the "environment" in someone's learning journey. We can choose to be like that farmer – responding to errors with scorn – or we can be the mentor who says, "It's okay, mistakes are how we grow. Let's figure this out together." One path shuts down the brain; the other path lights it up. Modern neuroscience validates this: a child sheltered from shame and guided with patience will literally develop a more resilient, capable brain childrenofthecode.orgchildrenofthecode.org.

I often think: if my dad had been born a few decades later, maybe a teacher would have recognized his dyslexia or learning difficulty and intervened. He might have discovered a passion for learning rather than carrying a fear of words. While I can't give him that experience retroactively, I dedicate this small piece of work to ensuring **today's learners** don't have to endure that same trauma.

So, whether you're a dyslexic student, a parent, a teacher, or just someone interested in unlocking human potential, remember these takeaways: **the dyslexic brain is uniquely wired and eminently capable** – different pathways, yes, but pathways that can lead to brilliance; **learning is biological** – our brains grow with practice and positive experience, especially when nourished by BDNF (so take care of your brain with exercise, sleep, and healthy stress management!); and **emotions are not a soft side issue, they are central** – removing fear and shame from the learning equation is as important as teaching the ABCs. As we champion these principles, we'll not only help dyslexic individuals read and learn better, we'll also foster innovators, artists, and leaders who might just change the world.

Finally, let me leave you with an image: the word "LEARNING" itself. Earlier I broke it into components; now see it as a whole. It's a word that implies progress, moving from one state to another. Notice that "learning" contains the word **"earn"** – nothing worthwhile is truly free; effort is required. But it also contains **"lean"** – we don't do it alone; we lean on others, on supports, on prior knowledge. And interestingly, it ends in **"ing"**, a present continuous tense – signaling that learning is *ongoing*. We are all, always, works in progress. Dyslexic or not, young or old, our brains are continuously learning.

My hope is that we all continue this journey with a bit more *knowledge* of how our brains work and a lot more *compassion* for the marvelous diversity of learners among us.

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The Brain: Our Adaptive Engine for Learning

One of the most important lessons from modern neuroscience is that the brain is **adaptable**. It's not a fixed machine; it's more like a living, changing network that rewires itself with experience. This property, known as **neuroplasticity**, means the brain can reorganize its pathways, forge new connections, and even alter its physical structure as a result of learningverywellmind.com. In practical terms, **we are all capable of growth** – our brains can learn new skills, adopt new behaviors, and unlearn old habits at any age.

This is incredibly hopeful news for both education and organizational change. It tells us that a struggling student isn't "stuck" with a certain ability level – with the right approach, their brain can form new connections and improve. It tells us that a team ingrained in old ways **can** learn new processes or mindsets if we tap into how the brain learns. Today, it's understood that the adult brain still retains remarkable plasticity: neural connections that are used frequently get stronger, and those that aren't used get pruned awayverywellmind.comtd.org. In essence, *"neurons that fire together, wire together,"* reinforcing our habits and knowledge each time we use them.

However, the flip side is that **change can be hard** – not because people are lazy or stubborn, but because the brain by default likes to conserve energy and stick with familiar patterns. Doing something new requires the brain to literally rewire itself, which can feel uncomfortable. Large-scale changes (whether learning a complex concept or adopting a new workflow at work) often trigger mental resistance. Why? Because the brain is wired to treat **uncertainty or change as a potential threat**, and it craves predictabilitybusiness.com. Thus, part of our job in leading change or facilitating learning is to help the brain *feel safe and motivated* on the journey. We do this by aligning with some key brain principles.

Believe – The Power of Mindset and Belief Systems

Everything starts with **beliefs** – the mental models and mindsets we hold, often unconsciously. In the BTFA framework, *"Believe"* comes first for good reason. What we believe sets the stage for how we interpret any learning experience or change effort. If you believe you're "just not a math person," for instance, your brain will filter your experiences to confirm that belief – you'll feel anxious in math class, maybe avoid challenging problems, and reinforce the notion that you can't improve. On the other hand, if you believe that abilities can grow, you prime your brain to be more curious and resilient when facing difficulties.

Psychology calls this the **fixed vs. growth mindset**, and neuroscience has shed light on why it matters so much. A fixed mindset (believing your talent or intelligence is static) can become a self-fulfilling prophecy: the belief "I can't do this" repeats like a mantra in the brain, strengthening a neural pathway of doubt and discouragementtd.org. In fact, researchers have noted that a limiting belief, repeated often enough, literally creates a strongly enforced network in the brain that affects many areas of one's lifetd.org. In contrast, a growth mindset – the belief that you can learn and improve – **encourages the growth of new neural pathways** to handle new skills or ideastd.org. When you adopt a growth mindset, your brain responds by forming new connections instead of just running over the same old ones, and as a result you tend to learn new information fastertd.org. In short, *beliefs prime the brain* for either stagnation or development.

This applies as much in the workplace as in the classroom. If a leader believes **"people hate change"** and that employees are inherently resistant, that mindset will color how they introduce a new initiative – likely with fear and skepticism – and employees' brains will pick up on that fear, in turn resisting the change. But if instead a leader believes people can and will embrace change if it's meaningful and they are supported, that positive expectation sets a very different tone. When managers understand how employees' attitudes, beliefs and perceptions affect their thinking and behavior, they can learn to get their people on board with necessary changebusiness.com. It starts by checking our own beliefs and mindsets. As an educational example, teachers who believe that *every student can learn* (with the right support) tend to see far better outcomes than those who—often unintentionally—convey a belief that only the "smart kids" will get it. Our beliefs influence our approach, our tone, our persistence – and students or team members pick up on those cues. Cultivating a genuine growth mindset and positive belief in others' potential creates a foundation for success. It opens the brain's capacity to form new connections, rather than closing it off.

Think – Harnessing How the Brain Processes Information

While beliefs form the backdrop, the next link in the chain is **thinking** – the cognitive processes of attention, focus, and reasoning. In any learning situation, understanding some basics of how the brain **thinks** can make a huge difference. Cognitive science tells us, for example, that our **working memory** (the mental scratchpad we use to hold information in mind) has a limited capacity – often only a few items at once. If we overload it, learning collapses. Educators have noted that simply pausing during a lesson to let students process, or breaking instructions into smaller steps, can help those with limited working memory succeed where they otherwise struggleedutopia.orgedutopia.org. In business contexts, this translates to not dumping a 100-slide PowerPoint on employees in one sitting or not expecting mastery after one training session. Our brains need **structured, digestible bites** of information to really absorb and encode knowledge.

Neuroscience also reveals that learning is **active**, not passive. The old view of education was that you pour facts into someone's head and hope they stick. Now we know the brain must *construct* knowledge actively to retain it. Learning literally means forming new neural connections, and that happens best when learners engage with material repeatedly and meaningfully. Three evidence-based strategies stand out:

- **Spaced repetition:** The brain retains information better when we review it over spaced intervals, rather than cramming in one sitting. Each revisit strengthens the neural pathways, countering the tendency to forget (often called the "forgetting curve").
- **Active engagement:** We form stronger memories by doing, discussing, or teaching, rather than just listening. Problem-solving, hands-on practice, or dialogue forces our brain to work with the information, making more connections.
- **Emotional connection:** Content that triggers emotion is far more memorable. That's because emotions spark the release of neurotransmitters that literally **help encode memories**clarityconsultants.com – think of lessons tied to personal stories or real-world impact, which we recall years later, versus dry facts that fade quickly.

In essence, to optimize learning we should **work with how the brain naturally operates**: give it information in manageable chunks, keep it active, and make it meaningful. One recent review put it succinctly: when learning is **interactive, iterative (repetitive), and emotionally engaging, the brain strengthens neural connections and retention soarsclarityconsultants.com**. On the job, this might mean designing training that includes interactive simulations or real-world scenarios rather than just manuals. In higher education, it might mean using project-based learning or group discussions so students aren't just passive note-takers. These approaches align with our neural wiring. By understanding cognitive limits and capabilities, we can dramatically increase the effectiveness of both teaching and training.

Feel – Emotions at the Heart of Learning and Change

Human beings are not robots; emotion and cognition in the brain are deeply intertwined. In fact, the parts of the brain that process emotion (like the limbic system) are intimately connected with the parts that handle memory and decision-making. That's why the **"Feel"** component follows Think in the BTFA model – because even the best ideas can be derailed if emotions aren't addressed. When we talk about behavior change or learning, we must talk about **how people feel**: Are they anxious? Excited? Do they feel safe and supported, or threatened and stressed?

Neuroscience has illuminated a critical principle: **a brain in threat or high stress is a poor learner**. Stress kicks on our "fight or flight" circuits – an ancient biological response to danger. In a modern context, a harsh scolding from a boss or the fear of failing an exam can trigger this same circuit. When that happens, stress hormones like cortisol flood the brain and actually **impair higher cognitive functions** like memory and reasoningbusiness.com. Chronic stress can even risk actual physical harm to brain cells over timebusiness.com. We've all experienced moments of panic when we *couldn't think straight* – that is the neurobiology of stress shutting down our prefrontal cortex (the rational, thinking brain). So if we want people to learn new things or embrace change, we have to manage and minimize unnecessary threat responses.

The good news is, understanding the brain's emotional drivers lets us intentionally create a positive climate for learning. Research shows that workplaces (or classrooms) that **foster a sense of safety, belonging, and autonomy** see much better engagement and adaptabilitybusiness.com. Why? Because these conditions satisfy the brain's social and emotional needs, keeping the limbic system calm and the prefrontal cortex online. As Dr. Mary Poffenroth, a biopsychologist, explained, *"By learning about the brain's fear and reward systems, leaders can find ways to make their workers less stressed and more engaged and motivated"*business.com. Leaders who grasp these concepts start focusing on **psychological safety**: they communicate more clearly, they involve people in the process (giving a sense of control), and they highlight positive rewards and meaning in the change. This kind of environment actually **activates the brain's reward circuitry (like dopamine pathways)** instead of its threat circuitrybusiness.com. When dopamine and other reward chemicals are present, people feel energized and curious, not defensive. In practical terms, a psychologically safe, positive environment "activates" the smarter parts of the brain – making it easier to solve problems and reducing resistance to changebusiness.com.

In educational terms, consider a classroom where mistakes are punished with ridicule versus one where mistakes are seen as part of learning. In the punitive classroom, students feel threatened and will likely withdraw or become anxious – their brains associate learning with fear. In the supportive classroom, students feel emotionally safe; their brains associate learning with positive feelings or at least manageable challenges. The latter is where real learning thrives. Indeed, emotional resonance isn't just touchy-feely stuff – it has a biological basis in memory. When learning experiences carry positive emotion or personal relevance, the brain tags those memories as important. Thus, educators often find that incorporating stories, hands-on activities, or elements that spark curiosity leads to better retention than sterile rote learning. *"Content that resonates emotionally is more likely to be remembered, as emotions trigger the release of neurotransmitters that aid memory formation,"* as one training design expert notedclarityconsultants.com. So if we care about outcomes – test scores, skill mastery, creative problem-solving – we must care about how our learners or team members feel.

A key takeaway here is that **reducing fear and increasing positive emotion is not a soft bonus; it's a hard requirement for brain-friendly learning**. Practical steps in an organization might include recognizing and reducing unnecessary stressors (unclear expectations, public shaming of failures, etc.) and actively celebrating progress (which gives that dopamine hit for motivation). In schools, it might include social-emotional learning practices that help students manage anxiety and build confidence. By making people *feel* part of a supportive "tribe" – whether that tribe is a classroom, a company department, or an entire culture – we tap into a primal brain wiring that says *"it's OK to lower my guard here; I can grow with these people."* Only then can we move to the final step: turning all this understanding into action.

Act – Turning Insight into Lasting Change

Ultimately, the goal of understanding the brain is to **change behavior and improve performance** – the *"Act"* in BTFA. Insight alone isn't enough; we have to translate knowledge into new actions and habits. But the previous steps (beliefs, thoughts, feelings) strongly determine whether our actions will really change. When those elements are aligned – when people believe in the purpose, understand it cognitively, and feel positively engaged – taking action becomes much more natural. Absent that alignment, attempts to force new behaviors often fizzle out. How many New Year's resolutions fail because deep down we didn't change our mindset or emotions around the habit? The same goes for organizational initiatives that die on the vine because employees **"went through the motions"** without internal buy-in.

So, how can we solidify change at the action level? One crucial factor is **practice and reinforcement**. Recall that the brain strengthens connections that are used frequentlyverywellmind.com. That means we need to provide opportunities to practice the desired behaviors or skills repeatedly until they become the new default. In an educational context, this might be through regular low-stakes quizzes, group exercises, or practical projects that reinforce what was taught (rather than one high-stakes exam then dropping the topic). In a business context, if you're trying to instill a new way of working, you might start with pilot projects, hands-on workshops, and on-the-job coaching so that people get to *live* the new behavior, not just hear about it once. Continuous feedback is also key – both the brain and motivation benefit from seeing progress. Celebrating small wins triggers the reward circuitry and motivates further actionbusiness.com, while feedback on mistakes (given in a constructive way) helps the brain correct course and not repeat old habits.

Another factor is **leadership alignment**. Leaders and educators must walk the talk. Our brains are highly attuned to **social learning** – we watch others (especially authority figures) to gauge what's really expected. If a teacher encourages curiosity but shuts down questions, students quickly learn it's not safe to ask – the action of asking questions will stop. If a CEO preaches innovation but punishes any failure, employees learn that the safe action is to stick to the old ways. Therefore, aligning **actions with the neuroscience insights** has to start at the top. When leaders model the change – demonstrating transparency, showing openness to new ideas, handling setbacks with resilience – it creates a powerful signal that others' brains pick up. It essentially gives permission for everyone to act differently, because they see it in practice.

Finally, sustaining action means embedding the new behaviors into the environment and culture, so that they are **supported and normalized**. The Dux Model we use expands on this idea by providing steps like *"Survive"* (removing stress threats from the environment) and *"Adapt"* (helping people feel part of something positive so they want to progress together). By sequentially removing fear and building willingness, we create fertile ground for new actions to take root. In fact, our five-step process (BTFA plus Survive, Adapt, Align, Deploy) has been applied in various industries to create lasting culture changebouncewatch.com. In one case, a senior executive in aerospace described this neuroscience-informed approach as a *"game-changer,"* after seeing how it improved employee engagement and performancebouncewatch.com. The reason it works is not magic – it's biology. We simply ensured the brain's prerequisites for change were met at each stage, and once they were, people could genuinely adopt new ways of working without constant push.

Whether you are a teacher or a team leader, the lesson here is to **design the path for action**: make the desired behaviors clear, make sure people have the ability and knowledge (training) to do them, and most importantly, use what we know about the brain to create the conditions that encourage those behaviors. When the whole system – from beliefs and mindset, through knowledge and emotion, to everyday practice – is aligned with how our brains operate, change no longer feels like a daunting uphill battle. Instead, it gains a natural momentum.

From Classroom to Boardroom: Applying Brain Science for Better Outcomes

We've covered a lot of ground, from neural pathways to mindsets to emotional safety. But how do we bring it all together for real-world impact? The beauty of these neuroscience insights is that they apply universally – human brains have the same basic needs and tendencies whether we're at work, at school, or at home. The context might differ, but the principles remain. Let's briefly consider how understanding the brain can transform both **educational** and **organizational** outcomes:

- **Education:** Teachers armed with even a little brain science can significantly improve their practice. As one education expert put it, *"A deeper understanding of how the brain works can help teachers plan lessons that reach every student."*edutopia.org When teachers know, for example, that attention is limited, they might break lectures into shorter segments with reflection breaks. Knowing that emotion aids memory, they might connect lessons to students' interests or use storytelling. Recognizing that stress impedes learning, schools might implement mindfulness breaks or foster a more supportive classroom climate. There's a growing field of **educational neuroscience** dedicated to bridging research and teaching methods, and it's yielding strategies such as using multisensory learning (to engage multiple brain regions), spaced practice, and growth mindset interventions in curricula. The result? Students not only **learn more effectively**, but they also become more engaged and confident learners. They gain the meta-cognitive realization that *"struggling at first is okay – it's my brain growing."* That shift in attitude can improve persistence and ultimately academic achievement. In short, when schools embrace how the brain naturally learns, they see better educational outcomes – from higher retention of material to improved critical thinking and creativity.

- **Organizations:** On the business side, applying neuroscience can dramatically improve how companies manage change, training, and leadership. We've seen that leaders who understand the brain's social needs build **trust and belonging** in their teams – and such teams consistently outperform othersbusiness.com. By designing workplaces that prioritize clarity, support, and meaningful communication, leaders create environments that optimize both performance and well-beingbusiness.com. Concrete examples include providing context and "the why" behind changes (to engage the prefrontal cortex with purpose rather than fear), encouraging incremental milestones and celebrating wins (to tap dopamine motivation), and giving employees some autonomy in *how* they meet new objectives (satisfying the brain's need for control). Companies are also rethinking training programs in light of neuroscience. Instead of one-off workshops that people soon forget, many are shifting to **continuous learning cultures**: micro-learning modules, on-the-job coaching, and e-learning platforms that adapt to the learner. By aligning training with how the brain actually retains information – interactive practice, spaced repetition, gamified challenges – organizations find employees remember and apply skills much more effectivelyclarityconsultants.comclarityconsultants.com. Furthermore, an understanding of brain chemistry and stress has put employee well-being at the forefront. Forward-thinking workplaces train managers to recognize signs of burnout or high stress and to intervene supportively, knowing that a burnt-out brain is neither productive nor innovative. The outcome of all this is tangible: higher employee engagement, lower turnover, more innovation, and greater agility in the face of change. In one survey of neuroscience-based leadership practices, experts noted that simply learning about the brain's fear and reward systems enabled leaders to make their teams *"less stressed and more engaged and motivated,"* creating a culture of psychological safety that reduced resistance and improved problem-solvingbusiness.com. In essence, happier brains = better business results.

Conclusion – Embracing the Brain for Transformational Change

In closing, whether you're trying to educate the next generation or transform an organization, the brain is the place to start. **Learning is fundamentally a brain process**, and so is every behavior change. When we ignore that, we often struggle – we see students tuning out, employees pushing back, changes not sticking. But when we embrace it, we unlock remarkable potential. By aligning belief systems (mindsets), thinking processes (cognitive strategies), and emotional conditions with what neuroscience tells us, we create the optimum environment for growth. We've seen that this approach can yield **transformative improvements** – classrooms where more students succeed, companies where change isn't a dirty word but a natural evolution.

The invitation I'll leave you with is to become curious about the brain in your context. You don't need to be a neuroscientist to apply these insights; even a basic understanding can spark new ideas. Ask yourself: *"How can I make this lesson more brain-friendly?" "How can I lead this change in a way that my team's brains will welcome, not resist?"* The answers might lead you to tweak your methods – perhaps chunking information differently, encouraging a new kind of dialogue, or simply listening with empathy to understand emotional undercurrents. These may sound like small adjustments, but they are powerful because they work in harmony with human nature and biology.

As someone who straddles the world of neuroscience and real-world practice, I have witnessed the **amazing transformations** that occur when we honor the way the brain works. When leaders learn the "language" of the brain and use it, employees become more engaged and teams thrive. When teachers apply brain-based strategies, students light up with understanding and retain their learning. And when individuals realize their own brains can change, it empowers a lifelong journey of growth. By making the brain our ally, we truly can *"make life better"* – improving not just performance metrics or test scores, but the human experience of learning and changing itself.

Thank you for listening, and I look forward to your questions on how we can continue to bridge neuroscience and learning in our efforts to drive positive change.

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Suggested Figures (placeholders)

- BTFA™ Framework schematic (Wiring → Firing → Chemistry → Output).
- Stress-to-Learning curve with BDNF as mediator (Yerkes–Dodson style).
- Reading circuitry: Typical vs. Dyslexic activation (left posterior underactivation; compensatory IFG/right).
- Connectivity schematic of left-hemisphere language networks (arcuate/superior longitudinal fasciculus).
- Mini-column schematic (autism) vs. cortical anomalies (dyslexia) – conceptual illustration.
- ‘Mountain vs. Lake’ route metaphor to common learning objective.
- LEARNING mnemonic infographic aligned to BTFA levers.
- Expertise reversal effect diagram (guidance helpful → harmful as expertise grows).
- Coaching flow: non-directive prompts (outcome → options → permission → experiment).
- Assistive tech screenshots (e.g., Emboldened) with permissions.