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Neural Pathway Therapy:

A Multimodal Neuromodulation Protocol to Enhance Neuroplasticity and Treat Behavioral Health Disorders

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Abstract

Mental and behavioral health disorders are significant societal and healthcare burdens, with treatment options suffering from limited success and difficulty obtaining objective outcome measurements. A 2022 survey found that 90% of adults believe the United States is in a mental health crisis [1], and the CDC reports that 23% of adults in the United States suffer from a mental health disorder [2]. There are millions of people in need of alternative therapeutic options for mental wellbeing.

The brain is capable of altering its neuronal circuitry - adding, removing, or tuning the strength of synaptic connections - through a suite of mechanisms collectively termed *neuroplasticity*. This capacity to change the brain's structural connectivity, thereby persistently changing the resulting thoughts and behaviors, has significant therapeutic potential for the treatment of mental and behavioral disorders [3].

Despite a wealth of research on its induction of neuroplasticity and the considerable clinical efficacy of transcranial magnetic stimulation (TMS), the arduous task of attending many dozens of sessions at specialized treatment centers has hampered its widespread adoption.

Alternatively, psychedelic and psychedelic-derived pharmaceuticals are beginning to show meaningful clinical benefits for the treatment of numerous mental health disorders, but face increased scrutiny due to Drug Enforcement Agency scheduling and the enormous cost of FDA clinical trial approval, as well as hesitance from the general public due to associations with the hallucinogenic experience.

Despite the significant resources being invested into promoting neuroplasticity in the human adult, few treatment options are actually available or utilized at scale.

This paper briefly describes the history of treatments to improve neuroplasticity with an emphasis on neurofeedback modalities. It then highlights the successful, measurable, and evidence based method developed by the Neural Science Institute to promote neuroplasticity and persistent mental wellbeing: Neural Pathway Therapy.

Background

Luigi Galvani discovered "animal electricity" in 1780 - the observation that muscle and neurological tissues utilize and respond to electrical signals. Various forms of assays and treatment applications have evolved since, including the beginnings of Electroencephalography (EEG) in 1924. Electroencephalography measures changes in the electric potential of bundles of cortical neurons, thus permitting sensors attached to the scalp to detect changes in cellular activity within the brain. This led to

the discovery of “brain waves,” which are brain-wide rhythmic oscillations of neuronal activity. The natural oscillations of the brain are in the frequency range of 1 to 40 Hz and are understood to be composed of both competing and compounding patterns of Delta, Theta, Alpha, Beta, and Gamma wave patterns. Electroencephalograms can detect task-specific changes in brain activity, and use band pass filters to isolate contributions from Delta (0.5-3.5 Hz), Theta (4-7.5 Hz), Alpha (8-12 Hz), Beta (13-30 Hz), and Gamma (>30 Hz) frequencies. Each of these brain waves are associated with specific states of cognition.

The revolution in electronics and computers over the last 100 years has resulted in sophisticated methods of measuring, comparing, and externally influencing these oscillations, providing insight into a multitude of cognitive functions. *Neurofeedback* is a method of effecting the relationship of these oscillations, and is typically divided into two categories: *active* and *passive* [4].

Active neurofeedback is through the 5 senses, in which a participant receives some sort of “reward” when their brain waves are in a desired state. A clinical example of the application of this could begin with measuring and analyzing brain states and making a determination on the client’s deviation from the norm. There are multiple sensory methods available, a common practice is to watch a movie which appears in black and white. The participant is connected to a live EEG, and as their brain patterns approach the clinically desired normal state, the movie they are watching appears increasingly in color. In this way, the participant’s internal brainwave state is rewarded with an external state, training the participant to alter their brainwave oscillations.

Active neurofeedback thereby changes brain architecture through the senses by providing rewards (color, sound, tactile, etc) when the brain shifts from its current baseline to a new, more desirable state. Active neurofeedback has had considerable success in treating a variety of behavioral and neurological conditions. In general, success rates vary based on the specific issue being addressed, as well as the individual's commitment to the therapy [5].

Passive neurofeedback typically bypasses the senses and focuses on the neural pathways by direct external stimulation [6]. Two key examples of this are Transcranial Magnetic Stimulation (TMS) and Transcranial Direct Current Stimulation (tDCS).

Transcranial Magnetic Stimulation is relatively new and was approved as a Class II medical device by the FDA in 2008, meaning it is subject to special controls to ensure safety and efficacy. Initially approved only for Treatment Resistant Depression, it has received additional approval for treatment of some types of pain associated with migraines as well as for Obsessive Compulsive Disorder (OCD). It involves

expensive, technical machinery to direct magnetic pulses into specific regions of the brain, typically over the course of multiple months and dozens of sessions. While TMS therefore requires significant costs in the form of time, expertise, and equipment, it demonstrates the tremendous potential of passive neurofeedback therapies - as many as 50% of clients experience full remission of symptoms [7].

Transcranial Direct Current Stimulation (tDCS) is a low cost, noninvasive treatment modality for stimulating neuroplasticity, with most devices being FDA Class II exempt for clinical applications [8]. Instead of the magnetic stimulation provided by TMS, tDCS applies low electrical current via sensors attached to the scalp. Due to the low current ($\leq$2mA) provided in tDCS treatment, the electrical effect is localized primarily to the cortical area underneath the electrode connection with limited penetration to deeper brain regions. While the limited area of effect of this stimulation is a commonly cited concern for the clinical application of tDCS [9], for disorders with major contributions from cortical regions, this apparent limitation can actually serve to minimize potential offtarget effects in regions below or outside the boundary of the sensors effective range.

Transcranial Direct Current Stimulation arguably has an ancient history - the first known use was 4,775 years ago when Egyptians were putting electric catfish on their heads to treat a variety of neurological afflictions [10]. Over the past few decades, tDCS has been embraced due to its quick, noninvasive results and demonstrable clinical benefit. Large-scale and meta-analytic studies show tDCS's efficacy in numerous domains, including enhancing cognitive performance, reducing depressive symptoms, and aiding anxiety disorders, by directly facilitating large-scale neuroplastic changes [11-14].

Neural Pathway Therapy

Neural Pathway Therapy (NPT) was developed by the scientists at the Neural Science Institute to integrate the successful, evidence-based components from numerous fields of neurofeedback science, psychotherapy, and traditional medicine. It is a sequence of 10 components, buil**t** around a precise, measurable, and proprietary method of tDCS application. It engages all 5 senses in order to achieve exceptional results. Unlike active neurofeedback, which provides a reward through the 5 senses, NPT engages the 5 senses with a form of somatic psychotherapy as a method of cognitive priming, anchoring, and creating greater neuroplasticity.

The underlying premise of somatic psychotherapy is that our relationship to ourselves, others and the world is rooted not only in the mind and thoughts, but also in the body. Body-oriented psychotherapy has shown to be effective on subjectively experienced

depressive and anxiety symptoms, and PTSD symptoms remained lower for over a year. It has no negative side effects and has been shown to produce a significant increase in prefrontal activation [15]. Cognitive and behavioural sciences recognize that the embodiment of cognition in clinical models is a therapeutic asset [16].

Targeted tDCS stimulations disrupt existing connections in the cortex and promote synaptogenesis - the formation of new neural connections. A shortcoming of generically inducing plasticity with techniques like psychedelics, TMS, or tDCS, is a lack of precision over *which* synapses are lost or gained. How do we guide the brain's endogenous systems towards clearance of pathological circuitry and formation of new, beneficial circuitry?

Neural Pathway Therapy was developed to leverage the principle of *synaptic priming* (also known as *metaplasticity* [17]), in which the environment actively shapes the activity, and thus the downstream plasticity, of the participant's brain circuitry [18]. Through nutritional supplementation; grounding, psychotherapy, mindfulness practices, and audible guidance; we instigate a clear mind, relaxed and therapeutic affective state for our clients. Guided by Hebb's law - *neurons that fire together wire together* - by inducing neuroplasticity in this context our Neural Pathway Therapy paradigm actively biases tDCS-induced synaptic remodeling towards a therapeutic and persistent architecture. Greater neuroplasticity is directly correlated with adherence to healthy lifestyle changes while simultaneously enhancing vigorous longevity, health, happiness, and wellness [19].

At the Neural Science Institute, we believe in taking precise measurements first and constantly using precision measurements and evidence based methodology to guide and individualize the treatment. We are equipment agnostic and are constantly upgrading and utilizing the latest empirically validated technology to instantiate desired outcomes. Importantly, every client is presented with clear information and the option to consent to each of the ten individual components. Participation in every step is entirely voluntary and tailored to individual preferences, ensuring the therapy respects autonomy and client choice.

These 10 components engage all 5 senses as part of a strategy to ground the client in the present moment, instigating a relaxed and adaptive cognitive state before and during tDCS stimulation. The 10 steps are:

Standard Psychological Assessments (*Qualitative Measurement*)
Brain Mapping (*Quantitative Measurement*)
Hydration & Brain Nutrition (Gustatory)
Somatic Vagus Nerve Exercise (Kinesthetic)

Vibroacoustic Therapy(Kinesthetic & Aural)
Mindfulness Psychotherapy (Aural & Kinesthetic)
Contemplative Gazing (Visual)
Neuro Language Modeling (Kinesthetic & Aural)
Olfactory Training (Olfactory)
EEG Measurement and Neuromodulation (*tDCS Stimulation*)

Descriptions of each of the 10 steps of Neural Pathway Therapy follow in order, with an emphasis on our quantitative brain mapping and tDCS stimulation protocols.

Standard Psychological Assessments
Appendix A provides a list of some of the standard, self-reported assessments used. These metrics are shown in the dashboard section of the sample client brain map in Appendix B. Frequency of assessments is based upon the judgement and observations of the therapist. The positive feedback from clients seeing their measurement move out of the red zones strengthens their desire to continue with regular treatments.

Brain Mapping
A comprehensive quantitative EEG (qEEG) brain map involves a full-cap assessment across multiple electrode sites and requires significant time; often over an hour for recording and additional time for technical processing and downstream expert analysis. This complexity and cost frequently poses barriers to access for behavioral health clients. In contrast, the Neural Science Institute employs a streamlined qEEG-derived technology, to rapidly generate a targeted brain map focused on the frontal brain regions linked to habits, decision making, and belief systems [20]. By utilizing this simple, effective approach, our practitioners can deliver actionable insights in a fraction of the time and cost, vastly improving the accessibility of qEEG's insights for ourselves and our clients.

The EEG assessment can be done in as little as 3 to 15 minutes (depending on symptoms presenting) and provides immediate results via a modern computational modeling infrastructure. It instantly generates easy to understand visualizations of the client's personal brainwave activity. Seeing the simple, color-coded image of their brain waves and simple dashboard metrics helps them to shift the abstract concept of behaviors and habits into tangible biology. It is easy for them to understand they have the capacity and agency to change that image, and through regular treatments, see that progress through time. The AI analysis of the data provides clarity to its meaning and cognitively primes towards positive change.

Follow up brain maps are taken every 10 sessions to measure results and guide treatment protocols. *See Appendix B: Sample Client Assessment and Brain Map.*

Depending upon the client's symptoms it is sometimes useful to take a '3 minute brain snapshot' before and after each session.

Hydration & Brain Nutrition

Every Neural Pathway Therapy session begins with the option for the client to enjoy a glass of CLARITY, our proprietary and carefully formulated nutritional beverage, rich in vitamins, minerals, electrolytes, and clinically validated nootropic supplements. Optimal brain function requires adequate nutrition and hydration, and vitamins and minerals play crucial roles in neurotransmitter synthesis, release, and synaptic plasticity.

CLARITY was developed in collaboration with Dr. James Matiada, a distinguished member of our scientific team, who brings over 30 years of experience as the owner of a natural pharmacy; and Dr Jaroslav Boublik, a Director at the Neural Science Institute. Dr Boublik has published widely on the subjects of performance nutrition, hydration and water quality, holds the patent for an optimum hydration drink, and has been a nutritional adviser to elite athletes, including Olympic medalists.

Some of the clients we serve - veterans, people facing economic hardship, or persons struggling with substance use disorders - are at high risk for nutritional deficiencies. Deficiencies in specific micronutrients have been linked to worsened mental health outcomes, treatment resistance, and reduced neuroplasticity; the very biological adaptability that Neural Pathway Therapy is designed to enhance.

CLARITY was specifically formulated to enhance nervous system homeostatic function, facilitating adaptive synaptic plasticity both during tDCS stimulation and in the synaptic remodeling phase following treatment. In this way, it buffers against critical obstacles posed by the lifestyle circumstances experienced by many clients, often those who stand to benefit most from transformative neuroplasticity therapies.

Providing clients with CLARITY as part of each session also serves a unique role in supporting client retention. This enjoyable and distinctive element contributes to higher return rates and stronger engagement with the treatment process - with many clients requesting to purchase CLARITY for daily consumption - reinforcing consistent participation and maximizing therapeutic outcomes.

All of the ingredients are Generally Regarded As Safe (GRAS) and are commercially available over the counter. A detailed list of the ingredients and their effects is available and is beyond the scope of this paper.

Somatic Vagus Exercise

More than 130 years ago, William James and Carl Lange placed interoceptive signaling at the center of emotional regulation and motivated behavior[21]. Awareness of one's own bodily feelings and vagal activation seem to be of central importance for the effective regulation of emotional responses[22]. A study of active duty, combat trained military personnel under high stress conditions showed a significant relationship between vagal tone and superior performance and was associated with greater emotional regulation and cognitive functioning [23].

This simple exercise, detailed in Appendix C, is a method to improve vagal tone and shift into a more parasympathetic state within 3 minutes. The exercise measurably increases mobility in the neck, and improves blood flow to the brainstem where the 5 cranial nerves necessary for social engagement originate. This can have a positive effect on the ventral branch of the vagus nerve as well as on cranial nerves V, VII, Ix, and XI [24]. Observationally, clients become noticeably more calm and relaxed.

Vibroacoustic Therapy

A wide variety of mental health problems are strongly associated with persistent insomnia [25]. Vibroacoustic therapy has been shown to produce significant improvements in measured sleep minutes as well as in scores on the Insomnia Severity Index questionnaire, as well as significant changes in functional connectivity [26]. More specifically changes in the left prefrontal cortex [27][28] the area associated with impulse control, emotional regulation, and higher level cognitive functions. Substance use disorders clients treated with vibroacoustic therapy showed improvements in sleep measures, stress levels, cravings, anxiety, fear, and anger [29].

Vibroacoustic Therapy has been used for over 30 years and enables clients to become naturally aware of their body-mind connection [30]. Prior to tDCS treatment, clients sit upon a vibration cushion equipped with multiple low-frequency transducers, combined with headphones (and an optional eye mask). They are instructed to focus on the feelings in their body. This interoceptive state has been correlated with greater neuroplasticity [31].

Our vibroacoustic therapy creates a truly immersive somatic and auditory experience: the stereo and binaural tracks are synchronized to the cushion’s vibrations and engineered to induce calm, deeply relaxed states, engaging the body and mind through a blend of vibro-tactile stimulation and therapeutic sound.

Current studies in the field highlight that vibroacoustic therapy can produce measurable reductions in psychological stress, improve mood, and support meditative

or mindful awareness by synchronizing brain wave patterns and activating the body's parasympathetic relaxation response [32].

These benefits make vibroacoustic therapy a valuable adjunct within comprehensive neuromodulation protocols, as it passively guides users towards heightened states of well-being and directly helps address symptoms connected to stress, anxiety, and emotional regulation. Every client has always viewed this as a pleasurable, relaxing experience and it effectively primes them for more efficacious outcomes.

Mindfulness Psychotherapy

Psychotherapy has long been a cornerstone of effective behavioral health treatment, providing invaluable support for individuals navigating a wide range of challenges. Its benefits, such as fostering insight, resilience, and emotional growth are well established through extensive research, including over $100 million in NIH-funded studies focused on mindfulness approaches [33]. There is evidence that mindfulness skills combined with cognitive and behavioural models of therapy can generate greater therapeutic benefits than applying these models alone [34]. Mindfulness training showed significant increases of activation in the left prefrontal region at post-treatment which lasted up to four months following treatment [35].

Neural Pathway Therapy integrates these proven therapeutic elements while enhancing treatment evaluation through objective metrics [36]. By leveraging quantitative EEG data, we are able to track neurological changes with precision, offering a clear, data-driven complement to the subjective experience. This dual approach ensures that both the subjective and neurobiological underpinnings of healing are recognized and measured effectively, elevating the standard of care provided to each client.

Contemplative Gazing

During this component of the protocol the client is instructed to keep eyes open at all times with a soft gaze into the distance. Studies have shown that this can have a profound effect on psychological states through parasympathetic resonance and the Reticular Activating System [37-41].

Neuro Language Modeling

Much of human behavior involves subconscious cognition that can be manipulated through "priming"—the presentation of a stimulus designed to subconsciously implant a concept in working memory that alters subsequent behavior. Priming is a well-known phenomenon for individual behavior [42]. Cognitive studies have

provided a plethora of useful knowledge about the behavioral and psychological properties of priming [43].

One of the most pervasive influences on human judgement is the anchoring effect [44]. Over 50 years of research on the anchoring effect has proven its ability to bias values and judgements is remarkably ubiquitous and extremely robust [45][46]. Anchoring effects can persist over fairly long periods of time and even experienced, impartial judges with over 10 years experience, are consistently unconsciously influenced [47].

Neuro Language Modeling is a proprietary method developed by the Neural Science Institute to aid with specific behavioral health issues and brain performance. Informed by principles of mindfulness based psychotherapy, somatic psychotherapy, anchoring, and cognitive priming, we have developed tailored scripts which guide the participants during Neural Pathway Therapy. These pre-recorded tracks are played during the treatment to anchor in specific resourceful beliefs and thought patterns during the period of induced neuroplasticity.

Olfactory Therapy

Neural pathways important for olfactory processing overlap extensively with pathways important for cognitive functioning, and especially those important for executive functioning, many of which are concentrated in the frontal lobes [48]. Olfactory perception, due to its intensity, rate of perception, and the breadth of stimuli, plays a pivotal role in cognitive efficiency [49].

A systematic review of studies on olfactory training (OT) provided evidence that OT is associated with improved global cognition, verbal fluency, learning, memory, and changed functional connectivity [50]. Olfactory Therapy is used with specific words from the pre-recorded Neuro Language Modeling tracks. Studies have shown that when olfaction is combined with positive words it produces activations in frontal areas of the brain [51], the areas associated with pleasure, habits and impulse control. National Institute of Health studies show that clinical OT can be beneficial for symptom management for a wide variety of conditions including: pain, well-being, anxiety, depression, stress, and insomnia [52]. OT effectively improves olfaction, cognition, and brain health, particularly in cognitively-normal populations [53].

The Neural Science Institute has researched a multitude of commercially available products and identified a manufacturer able to meet our exacting specifications. Specific blends of essential oils are diffused into the air during the Neural Pathway Therapy session at regular intervals, instilling a sense of calm comfort, and providing

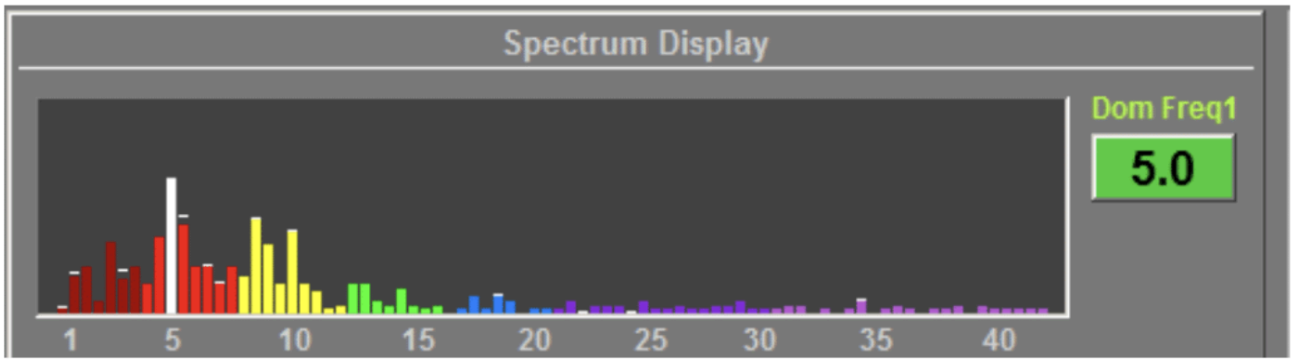
a strong olfactory cue to anchor people into the relaxing cognitive states associated with our treatment protocols.

EEG Measurements & Neuromodulation

At the heart of Neural Pathway Therapy is our Pathfinder Platform. It measures brain wave activity at homologous EEG sites and delivers feedback by reflecting the predominant brain wave frequency back into the brain with a calibrated offset. This process slightly depolarizes local neurons, encouraging mild local hyperexcitability and recruitment of additional neurons to sustain the region's prevailing wave activity pattern, thereby promoting neuroplasticity.

In this approach, a montage refers to a specific, serial sequence of EEG sensors placed on a pair of homologous EEG locations (e.g., F1 and F2) to record the brain's natural oscillations of electrical activity.

The EEG sensors measure brain waves 10 times a second, our software computationally isolates wave-like oscillations in neuronal activity, and the Pathfinder responds by reflecting back the predominant frequency with a slight offset. To illustrate, the following is a spectral analysis of a typical measurement showing frequency bands ranging from <1 to 45Hz, with a predominant frequency of 5 Hz. There are proprietary technical offset parameters and patterns that are preset on the Pathfinder. These presets include variations in the duration of sequencing, amount of offset, wave form, response pattern, and intensity reflected back into the brain via the EEG sensors. The choice of these patterns, and the montages applied, are determined by our highly trained and licensed therapists, technicians and psychologists, based upon their understanding of the brain map and the client's reported symptoms.



In general terms the signals provided during stimulation are:

- Voltage applied across the scalp: 1–2 volts (V).
- Current (amperage): 1–2 milliamps (mA).
- Power: 1–4 milliwatts (mW) total.

This power is extremely small - for instance, an iPhone typically operates at approximately 2 watts (2,000 milliwatts) during typical usage.

This neuromodulation power is sufficient to influence cortical excitability while remaining orders of magnitude lower than everyday consumer electronics. This applied current does not "zap" the brain, and most participants are unable to consciously detect when stimulation has begun or concluded. The low power simply provides a gentle bias in the resting membrane potential of neurons so that underactive circuits become more excitable, or overactive circuits can be inhibited by local interneurons. The therapeutic stimulation is safe, non-invasive, well below the threshold of tissue damage, and is spatially restricted by the intrinsic resistance of both skeletal and neurological tissues.

There are numerous studies on the efficacy of this methodology of neuromodulation for a wide variety of behavioral health afflictions such as anxiety, depression, substance use disorder, insomnia, attention deficit and hyperactivity disorder, obsessive compulsive disorder, gambling, and over eating [54-83]. Slight modifications to our protocol, such as sensor placement and topics covered during psychotherapy or our pre-recorded Neuro Language Modeling scripts, help individualize which circuits are biased by tDCS stimulation to each client's specific desired outcomes.

Experiential Outcome

"*Stop thinking and end all your problems*." - Lao Tzu

The Default Mode Network (DMN) is active with eyes closed, daydreaming, self-referential thinking, rumination, and memory-based introspection. The Reticular Activating System (RAS) is engaged with eyes open and regulates arousal, wakefulness, vigilance, and attentional filtering. Therapeutic neuroplasticity is often about regulating the transitions between these networks; building RAS engagement capacity while also modulating DMN overactivity seen in trauma rumination or craving cycles. Balancing the DMN and RAS creates a state that is awake but unguarded, alert but not searching, conscious but quiet.

Existing neurology becomes more entrenched with habitual firing through self-referencing, worry loops, efforting, vigilance, and identity confirmation. Contemplative gazing and passive neurofeedback together create a moment where the brain can drop the old practiced filters, loosen the narrative machinery, receive micro-reset signals without pushback, and reorganize toward efficiency and reduced

suffering. It is the feeling of "turning down the volume on you" so the nervous system can update itself. Most people don't need more stimulation, they need less narrative interference.

Contemplative gazing (soft-focus, steady visual attention) naturally shifts the brain out of high-effort, high-narrative mode. When the eyes stop scanning and the visual system relaxes, the whole nervous system gets a signal there is nothing to solve and nothing to defend. This sets off a cascade involving the DMS and RAS networks.

Contemplative gazing quiets the DMN by suspending the mental storylines that reinforce identity and prediction. The brain becomes less busy being self referential which opens space for change. Soft-focus gazing reduces sensory novelty and vigilance, causing the RAS to downshift its alertness. This lowers cortical arousal and nudges the system toward parasympathetic grounding.

The lowered DMN activity and softened RAS gating produce the exact neurological conditions for passive neurofeedback to do its job efficiently. Passive neurofeedback doesn't push the brain into a target state, it subtly interrupts inefficient patterns so the brain can reorganize itself. For that to work best, the brain must be: non-defensive, quiet enough to notice the micro-resets, not locked inside identity loops, and not scanning the environment for threat or meaning.

This state is so completely novel for most people that it produces a deeply meaningful and profoundly impactful effect.

Conclusion

The United States Centers for Disease Control estimates 23% of U.S. adults live with mental health afflictions each year. Neural Pathway Therapy, as developed by the Neural Science Institute, is a turning point for effective treatment in the behavioral health landscape. By leveraging advanced and evidence-based neuromodulation, and integrating modalities such as:

- Standard psychological assessments
- Precise brain mapping
- Targeted hydration and nutrition
- Somatic psychotherapy
- Vibroacoustic therapy
- Mindfulness psychotherapy
- Neuro language modeling
- Contemplative gazing
- Olfactory therapy, and

- EEG-driven interventions

Neural Pathway Therapy establishes a robust, measurable, and replicable therapeutic protocol.

Conventional interventions for addiction, depression, anxiety, insomnia, OCD, PTSD, and ADHD have historically produced low rates of lasting improvement. Neural Pathway Therapy stands apart by directly enhancing neuroplasticity: the brain's natural capacity to adapt and reorganize. Neural Pathway Therapy empowers both the mind and body to break free of rigid, maladaptive patterns and foster lasting change. This protocol not only accelerates symptom relief but also lays the biological groundwork necessary for other gold standard therapies (MAT, CBT, DBT) to exert their effects more fully and durably.

Crucially, Neural Pathway Therapy is accessible and safe, utilizing only non-invasive procedures and drug-free interventions. Its integration with nutritional and sensory elements ensures that the broadest spectrum of individuals, including those most vulnerable, underserved, or uninterested in current treatment mainstays, can benefit from state of the art care. Measurable results and client feedback underscore both the efficacy and the positive, even enjoyable, experience most have during treatment, fostering better engagement and better outcomes.

As public awareness grows regarding the neurobiological underpinnings of behavioral health disorders and the potential for true recovery, the Neural Science Institute's commitment to rigorous measurement, scientific innovation, and client centered care positions Neural Pathway Therapy as a transformative tool for combating the global mental health crisis. With partnerships across leading academic and clinical institutions and an unwavering commitment to advancing client care, the Neural Science Institute brings rigorous, evidence based innovation to the behavioral health field, helping individuals access meaningful, measurable improvement.

The Neural Science Institute, giving you the freedom to change your Mind.

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Appendix A: Assessment Questionnaires

Addiction Scale SPQ
ADHD Rating Scale IV ADHD-RS-IV
ADHD Rating Scale for Adults ASRS
Agression Questionnaire BPAQ
Anxiety Scale GAD-7
Challenging Child Behaviors for Parents IOWA Conners Rating Scale
Child Functional Impairments for Parents IRS
Depression Scale PHQ-9
General Health Questionnaire GHQ-12
Insomnia Severity Index ISI
Obsessive-Compulsive Inventory for Adults OCI
Obsessive-Compulsive Inventory for Children ChOCI-R-S
Pain Questionnaire SF-MPQ-2
Parenting Sense of Competence Scale PSOC
Perceived Stress Scale PSS
Post Traumatic Stress Disorder Scale PSSI-5

Appendix B: Sample Client Assessment and Brain Map

myndlift

Sample Client

Female, 35 years old

demo.john@lifeattunement.com

15 Jan 2022

6:49 AM

Assessment #2

Summary

Based on your questionnaires, CPT results, and EEG measurements, your brain health reflects unique characteristics.

Beginning with the questionnaires, I gathered valuable insights into how you perceive things. Your CPT results underscore your impressive ability to maintain and focus your attention. Specifically, your extremely low omission error score indicates a high degree of attentiveness. You also showcase low commission errors, implying well-regulated impulsivity. With a low reaction time, you respond to stimuli quickly – a sign of sharp cognition.

Your EEG results reveal certain yet fascinating nuances. You exhibit average alpha brainwaves in most regions, both when your eyes are open and closed. However, slightly below-average alpha activity in central and left regions when your eyes are closed may point to active cognitive engagement. This also corroborates well with your CPT results indicating attentive behavior.

Beta brainwaves show a different pattern. You have higher beta activity in the back region with both open and closed eyes, hinting that even during relaxation, your mind stays alert and actively processes information. Slightly elevated beta in the frontal and left regions suggests active thinking and perhaps an overriding internal tension or anxiety.

Your low beta activity is average, reflecting typical brain function, except in the case of slightly increased activity in the left region when your eyes are closed.

Theta brainwaves, tied to relaxation, creativity, and internal focus, are slightly above average in the frontal region when your eyes are closed. This indicates a possible inclination toward focused ideation or enhanced creativity.

In summation, your brain activity suggests an alert and attentive state with potential for creative thinking and active problem-solving. Keep in mind, brain wave patterns are unique to each individual, and these observations simply offer insights into your cognitive profile.

Questionnaires

100%

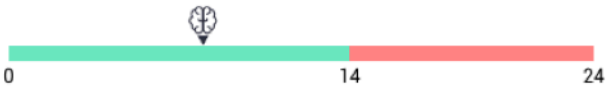
General Health Questionnaire (GHQ-12)

10

The 12-item General Health Questionnaire (GHQ-12) is intended to identify psychiatric issues in community settings. It is widely used in clinical practice and research. Suitable for adolescents and adults.

ADHD Rating Scale for Adults (ASRS)

8



The Adult ADHD Self-Report Scale (ASRS) – DSM-V is a 6-item screening questionnaire intended as a diagnostic aid for adults with attention deficit hyperactivity disorder (ADHD) in community settings.

Anxiety Scale (GAD-7)

5

The Generalized Anxiety Disorder Assessment (GAD-7) contains 7 items that assesses symptoms of anxiety during the last two weeks. It is widely used in clinical and research settings.

Task Performance

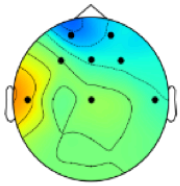
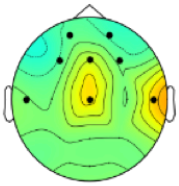
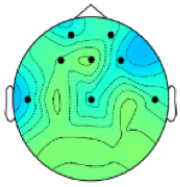
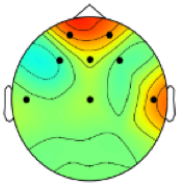
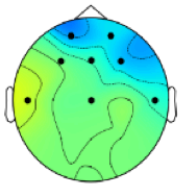
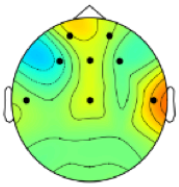
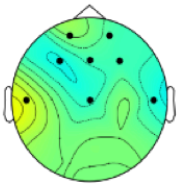
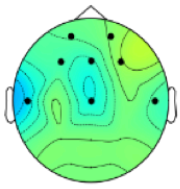
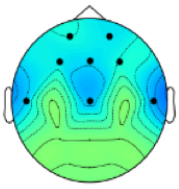
Scores from the continuous performance task of response inhibition.

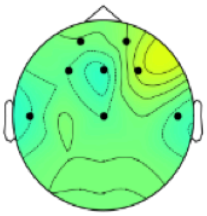
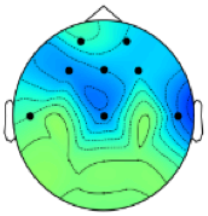
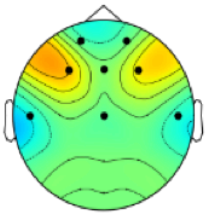
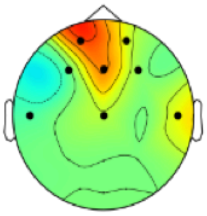
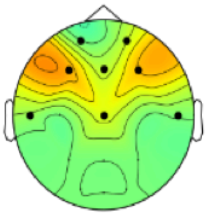
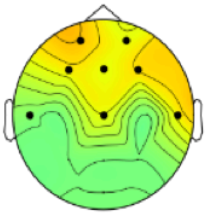
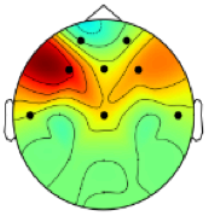
100%

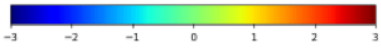
	Accuracy	Commission Errors	Omission Errors	Reaction Time	Reaction Time Variability
Raw	99%	1	0	399ms	38ms
Standardized	Very High (0.51)	Superior (0.51)	Very Superior (0.31)	Very High (0.65)	Very Superior (0.92)

Brain Maps

A comparison of your EEG activity to a normative population. Blue represents lower than normal activity, while red represents a higher than normal activity. Done via a sequential quantitative EEG measurement (sqEEG).

	Eyes Open	Eyes Closed
Delta (1 - 3 Hz)		
Theta (4 - 7 Hz)		
Slow Waves (1 - 8 Hz)		
Low Alpha (8 - 9 Hz)		
High Alpha (11 - 12 Hz)		

Alpha (8 - 12 Hz)		
Low Beta (12 - 15 Hz)		
Beta (16 - 20 Hz)		
High Beta (21 - 30 Hz)		



Isocontour lines represent increments of the standardized (z-score) units. Black dots represent electrode locations, which include: AF7, AF8, F3, FZ, F4, CZ, TP9, TP10, and O1. Voltage for the current assessment is standardized relative to the mean voltage for the normative population in the same age group as of the date of the client's first assessment.

Central

Alpha Response

Central (Cz) · Eyes open, then eyes closed

-6%

A measure of the increase in alpha brainwave over the central brain region when closing the eyes. Normally, central alpha increases by 30% or more when closing the eyes, but the increase may be attenuated by stress.

Alpha Recovery

Central (Cz) · Eyes open

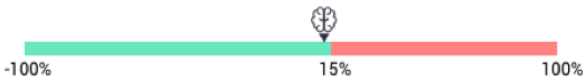
4%

In a sequence of: eyes open → eyes closed → eyes open, the alpha brainwave will increase from its initial state when closing the eyes and then decrease when reopening them. Alpha recovery is measured as the difference between the initial alpha state and the last. Normally, the difference over the central brain region is 25% or less, but the difference may be affected by age or sleep disturbances.

Theta/Beta Ratio Response While Counting

Central (Cz) · Eyes closed

12%

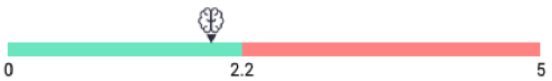


A measure of the decrease in central theta/beta ratio when switching from a resting state to performing a cognitive task while the eyes remain closed. Normally, the ratio decreases or may increase up to 15%. Otherwise, it may be an indication of difficulty with focus.

Theta/Beta Ratio

Central (Cz) · Eyes open

1.91

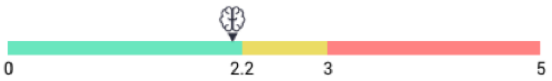


This measures the ratio between theta and beta (theta/beta ratio) over the central brain region while the eyes are open. Normally, the ratio is 2.2 or less and is associated with focus.

Theta/Beta Ratio While Counting

Central (Cz) · Eyes closed

2.1

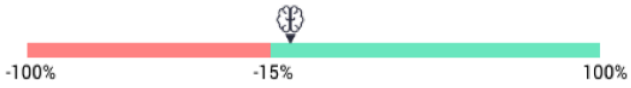


This measures the ratio between theta and beta (theta/beta ratio) over the central brain region when performing a cognitive task (eyes closed). Normally, the ratio is 2.2 or less, but may be higher with difficulty focusing; a ratio above 3.0 may be associated with impulsivity.

Beta Response While Counting

Central (Cz) - Eyes closed

-8%



A measure of the increase in central beta brainwave when switching from a resting state to performing a cognitive task while the eyes remain closed. Normally, central beta increases or may decrease by as much as 15%. Otherwise, it may be an indication of tiredness when reading or problem solving

Peak Alpha

Central (Cz) - Eyes closed

8Hz

Associated with: Memory and concentration, and can slow down with age.
How: This measures how fast the peak alpha brainwave is over the central brain region while the eyes remain closed.

Theta/Low-Beta Ratio

Central (Cz) - Eyes closed

1.76

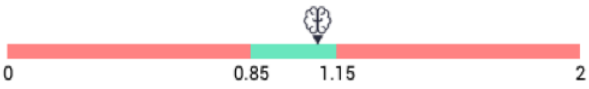
This measures the ratio between central theta and low-beta (SMR) while the eyes remain closed. Normally, the ratio is 3.0 or less but may be higher with difficulty relaxing (e.g., sitting still, falling asleep) or pain symptoms.

Frontal

Alpha Symmetry

Frontal Left and Right (F3, F4) - Eyes closed

1.08

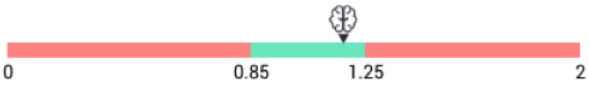


This measures the ratio between frontal left and right alpha brainwave while the eyes remain closed. Normally, the ratio is between 0.85 and 1.15 and is associated with mood volatility or impulse control.

Beta Symmetry

Frontal Left and Right (F3, F4) - Eyes closed

1.17



This measures the ratio between frontal left and right beta brainwave while the eyes remain closed. Normally, the ratio is between 0.85 and 1.25 and is associated with stress tolerance, mood volatility or impulse control.

Theta Symmetry

Frontal Left and Right (F3, F4) - Eyes closed

1.14

This measures the ratio between frontal left and right theta brainwave while the eyes remain closed. Normally, the ratio is between 0.85 and 1.25 and is associated with mood/emotional volatility or impulse control.

Theta/Beta Ratio Symmetry

Frontal Left and Right (F3, F4) - Eyes closed

0.97

This measures the ratio between frontal left and right theta/beta ratio (TBR) while the eyes remain closed. Normally, the ratio is 0.8 or higher, but it may be lower with emotional volatility.

Beta Balance

Frontal (Fz) - Eyes closed

0.62

This measures the ratio between fast (high) beta and beta over the frontal brain region while the eyes remain closed. Normally, this ratio is between 0.4 and 0.75, and it may be affected by stress.

Theta/Alpha Ratio

Frontal Left (F3) - Eyes closed

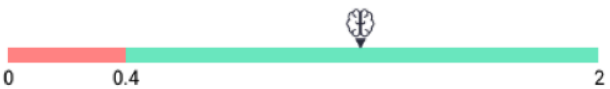
1.25

This measures the ratio between frontal left theta and alpha while the eyes remain closed. Normally, the ratio is at least 0.4 and may be affected by sleep disturbance or pain.

Theta/Alpha Ratio

Frontal Right (F4) - Eyes closed

1.19

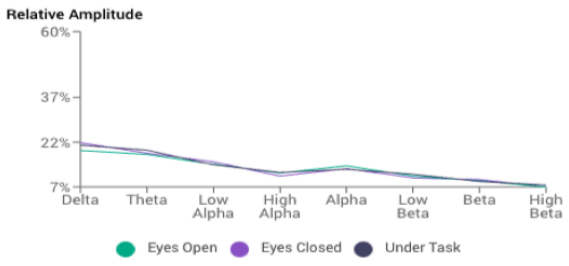


This measures the ratio between frontal right theta and alpha while the eyes remain closed. Normally, the ratio is at least 0.4 and may be affected by sleep disturbance or pain.

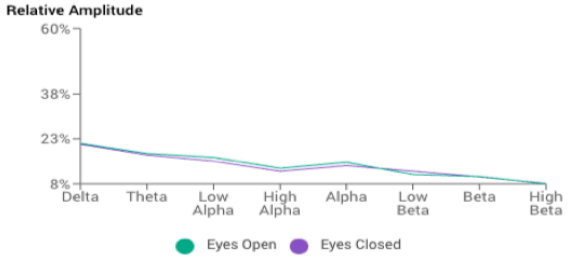
EEG Distribution

Distribution of EEG amplitudes across frequency bands per electrode.

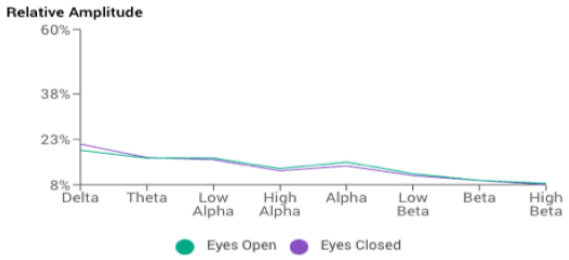
Central (Cz)



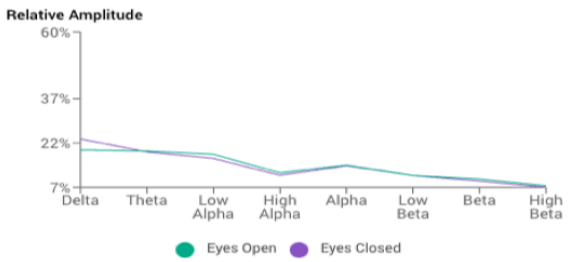
Frontal Left (F3)



Frontal Right (F4)



Frontal (Fz)



Appendix C: Somatic Vagus Nerve Exercise

Here's a fast and simple way to relax and recalibrate your body by resetting your vagal tone. In addition to feeling less stress and anxiety, this reset can also help to feel more focused and motivated.

- Sit in a comfortable position on the vibroacoustic cushion.
- Before and after the exercise rotate your head to each side, noticing how far it goes and if there is any pain. Typically rotation is greater after, often with diminished pain.
- Clasp the fingers of your hands together and place them on the back of your head just above the ears on the round part of your skull.
- Keep your head facing forward and your whole body still for the entire exercise.
- Close your eyes and look all the way to one side. Keep your eyes in that position until you either yawn, sigh, or swallow.
- Now look to the other side until you either yawn, sigh, or swallow.
- It usually takes about 30-60 seconds to get a response on each side. Sometimes one side can take a little longer than the other.
- Be patient, if you're feeling anxious or stressed it might take a little longer.
- When complete, focus on the feelings of your body, your breath, your belly, and your internal feelings while you relax comfortably, feeling the vibrations and hearing the music.