Visual Concentration Attention Therapy (VCAT) Treatment Sessions: An Effective Multimodal Neurovisual Intervention for Treatment of Comorbid Psychiatric Disorders

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Abstract

This study presents a secondary analysis of anonymized clinical data collected over eight years at the VCAT Treatment Center to evaluate the efficacy of Visual Concentration Attention Therapy (VCAT) in treating comorbid psychiatric conditions. The sample included 850 adults (M = 37.4, SD = 11.2) with high rates of diagnostic comorbidity, including depression, anxiety, ADHD, PTSD, and addiction. The intervention followed the VCAT Methodological Therapy Session and Process (V-MTSP), integrating quadrant-based visual stimulation, guided neurocognitive engagement, and EEG neurofeedback. Data sources included validated psychological inventories (BDI-II, BAI, ASRS), EEG/QEEG recordings, therapist ratings, and post-session self-report questionnaires. Statistical analyses revealed significant reductions in depressive symptoms (49%), anxiety (54%), and ADHD-related attentional deficits (46%). EEG outcomes demonstrated increased alpha power (+12%), reduced beta activity (−10–15%), and enhanced coherence between prefrontal and cingulate regions. Self-report data showed progressive improvements in attention, emotional regulation, cognitive clarity, motivation, and satisfaction across 14 sessions. These findings support VCAT as a scalable, non-invasive, neuroplasticity-enhancing intervention. Limitations include the non-randomized design and reliance on clinical data. Future research should include randomized controlled trials and longitudinal follow-up to validate efficacy and generalizability.

Keywords: VCAT, neurofeedback, EEG, depression, anxiety, ADHD, neuroplasticity, cognitive rehabilitation

VCAT TREATMENT SESSION: A NEUROVISUAL INTERVENTION

Introduction

Attention is a foundational construct in cognitive neuroscience and clinical psychology, underpinning executive functioning, emotional regulation, and psychiatric symptomatology (Babai Siahdohoni, 2010, 2023). Theories of attention distinguish between overt attention—characterized by saccadic eye movements toward external stimuli—and covert attention, involving internal shifts in focus without eye movement (Babai Siahdohoni, 2007, 2010,2023; Kulke, Atkinson, & Braddick, 2016; Blair & Ristic, 2019). Selective attention, mediated by parietal and frontal cortices, plays a critical role in perceptual filtering and cognitive control, and is frequently disrupted in conditions such as attention-deficit/hyperactivity disorder (ADHD), depression, posttraumatic stress disorder (PTSD), and addiction (Posner & Petersen, 1990; Evans, Horowitz, & Wolfe, 2011).

Visual Concentration Attention Therapy (VCAT) was developed to address these disruptions by directly engaging visual attentional networks through quadrant-based visual stimulation, guided cognitive engagement, and electroencephalographic (EEG) neurofeedback (Babai Siahdohoni, 2022; 2023). VCAT integrates principles from Treisman's (1980) feature integration theory, Posner and Petersen's (1990) attentional systems model, Bundesen's (1990) theory of visual attention (TVA/NTVA), and Cave's Feature Gate Model, targeting both overt and covert attention mechanisms to modulate cortical activity and enhance perceptual selectivity (Babai Siahdohoni; Corbetta, 1998; McAdams & Maunsell, 1999b; Rees, Frith, & Lavie, 1997).

Emerging neuroimaging research supports the use of visual stimulation to improve concentration, memory, and cognitive flexibility. Functional magnetic resonance imaging (fMRI) studies demonstrate that targeted visual engagement increases neural activity, elevates beta wave states, and enhances cerebral blood flow—changes associated with neuroplasticity and restoration of attentional control (Murray & Wojciulik, 2004; Gandhi, Heeger, & Boynton, 1999). These findings underscore the potential of visual-based interventions for individuals with attentional and emotional regulation challenges, particularly those with contraindications to pharmacological treatment.

In response to the growing demand for nonpharmacological, scalable interventions, the present study evaluates the clinical efficacy of VCAT in adults presenting with depression, anxiety, ADHD, PTSD, and addiction. Using retrospective clinical data from 850 patients treated over an eight-year period, this research investigates both short- and long-term outcomes across psychological and neurophysiological domains. By expanding the evidence base for attentional stimulation therapies, the study aims to inform future integration of VCAT into behavioral health systems and insurer-supported care models.

Literature Review

Foundations and Evolution of Visual Concentration Attention Therapy (VCAT)

Attention and selective attention are foundational constructs in cognitive neuroscience and clinical psychology, underpinning executive functioning, emotional regulation, and psychiatric symptomatology (Babai Siahdohoni, 2007, 2010, 2023). Theories of attention distinguish between overt attention—marked by observable saccadic eye movements toward external stimuli—and covert attention, involving internal shifts in focus without corresponding motor activity (Kulke, Atkinson, & Braddick, 2016; Blair & Ristic, 2019). Selective attention, defined as the capacity to prioritize relevant stimuli while suppressing distractors, is mediated by distributed neural networks involving the parietal and frontal cortices (Posner & Petersen, 1990; Evans, Horowitz, & Wolfe, 2011). These systems are frequently disrupted in individuals with attention-deficit/hyperactivity disorder (ADHD), depression, posttraumatic stress disorder (PTSD), and trauma-related conditions, where deficits in sustained attention and affective regulation contribute to poor clinical outcomes (American Psychiatric Association, 2022; Open University, 2023).

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Visual Concentration Attention Therapy (VCAT) was developed to address these disruptions by directly engaging visual attentional networks through quadrant-based visual stimulation, guided cognitive engagement, and electroencephalographic (EEG) neurofeedback (Babai Siahdohoni, 2010, 2023, 2024). VCAT is not merely a behavioral intervention but a neurocognitive framework designed to modulate cortical activity, enhance perceptual selectivity, and facilitate executive control (Corbetta, 1998; McAdams & Maunsell, 1999b). Neuroimaging studies using functional magnetic resonance imaging (fMRI) and event-related potentials (ERP) have demonstrated that focused attention increases neural firing rates, boosts blood flow in visual cortices, and improves perceptual acuity—findings that support the premise that targeted visual engagement can induce neuroplastic changes (Motter, 1993; Boynton, Engel, Glover, & Heeger, 1999; Murray & Wojciulik, 2004).

VCAT builds upon foundational models such as Treisman's (1980) feature integration theory, Posner and Petersen's (1990) attentional systems model, and Bundesen's (1990) theory of visual attention (TVA/NTVA). Its protocols target both overt and covert attentional mechanisms and are informed by neuroanatomical mappings of Brodmann areas and EEG 10–20 sites (Reiter, Andersen, & Carlsson, 2016; Kinreich, Podlipsky, & Intrator, 2014). Specific training protocols include alpha-theta modulation at occipito-parietal sites to address trauma-related dysregulation, and frontal asymmetry and theta suppression to modulate affective imbalance and attentional deficits in depression and ADHD (Arns, de Ridder, Strehl, Breteler, & Coenen, 2009; Hammond, 2005).

Together, these theoretical and empirical foundations position VCAT as a multidimensional intervention capable of restoring attentional control and emotional regulation through nonpharmacological means. Its evolution reflects a synthesis of cognitive neuroscience, clinical psychology, and applied neurofeedback, offering a scalable model for integrative psychiatric care.

VCAT's Family Tree: Integrative Theoretical Lineage

VCAT synthesizes decades of research across three interconnected tracks—attentional, memory, and neural:

Attentional Track: Originating from the Fixed-Capacity Independent Race Model (Bundesen, 1987), which evolved into the Theory of Visual Attention (TVA), VCAT incorporates models such as CTVA (Logan & Bundesen, 1996) and ECTVA (Logan & Gordon, 2001) to address feature search, cueing, and dual-task interference. It also draws from SAIM (Humphreys & Heinke, 1997), which models selective attention and object recognition, and the Boolean Map Theory (Huang & Pashler, 2002), which informs VCAT's multi-display attentional mapping.

Memory Track: VCAT aligns with the Generalized Context Model (Nosofsky, 1984) and its extension into the Exemplar-Based Random Walk Model (Nosofsky & Palmeri, 1997), which emphasize similarity-based categorization and learning. Unlike these models, VCAT prioritizes attentional shifts and object selection over similarity, allowing for flexible engagement with diverse visual stimuli.

Neural Track: VCAT shares core principles with the Neural Theory of Visual Attention (Bundesen, 1990), which describes filtering (object selection) and pigeonholing (feature encoding) as dual mechanisms of attentional processing. Visual input travels from the retina to the LGN and through cortical areas (V1, V2, V4, IT, MT, MST, PF), culminating in saliency mapping and attentional weighting in the pulvinar nucleus. VCAT leverages these pathways to enhance visual short-term memory and attentional control.

EEG Neurofeedback and Clinical Relevance

EEG research has consistently shown that attentional deficits are linked to abnormal brainwave patterns—particularly elevated theta and reduced beta activity (Lubar & Deering, 1981). VCAT protocols aim to normalize these patterns by enhancing the beta1/theta ratio, thereby improving concentration and behavioral regulation (Linden, Habib, & Radojevic, 1996).

Training sites such as O2/P4 for trauma and Fz for ADHD are selected based on evidence-based frequency targets (Reiter et al., 2016; Arns et al., 2009).

VCAT also aligns with working memory models that emphasize limited attentional capacity (Cowan, 2001; Miyake & Shah, 1999). By enhancing EEG coherence and attentional selectivity, VCAT supports efficient encoding and retrieval of task-relevant information—critical for individuals with ADHD, depression, and trauma-related disorders (Barch, 2005; Ishai, Haxby, & Ungerleider, 2002). Emerging evidence suggests that VCAT improves self-efficacy and reduces depressive symptoms through structured engagement of attentional networks and operant conditioning of EEG rhythms (Monastra, Monastra, & George, 2002). Comparative studies demonstrate superior outcomes relative to CBT, EMDR, and pharmacotherapy (Lewis, 2025).

In summary, VCAT is a theoretically robust and clinically validated intervention that integrates attentional, memory, and neural models into a unified framework. Its design reflects decades of research in cognitive psychology, neuroscience, and clinical practice, offering a powerful tool for enhancing attention, emotional regulation, and cognitive performance. By drawing from its rich theoretical family tree, VCAT represents a next-generation approach to neurotherapy and cognitive rehabilitation.

VCAT TREATMENT SESSION: A NEUROVISUAL INTERVENTION

VCAT Methodological Therapy Session and Process (V-MTSP)

The Visual Concentration Attention Therapy (VCAT) Methodological Therapy Session and Process (V-MTSP) is a structured, three-phase protocol designed to assess, localize, and therapeutically engage neurocognitive systems. This integrative framework combines clinical diagnostics, neuroanatomical mapping, and targeted cognitive engagement to facilitate symptom reduction and neuroplastic change.

Phase I: Pre-Assessment

The pre-assessment phase established individualized treatment targets through multimodal evaluation:

Clinical Interview Protocol: A semi-structured interview are conducted to identify presenting symptoms and contextual factors relevant to attentional, emotional, and cognitive functioning.

Psychological Assessment Battery: Standardized instruments are administered to quantify symptom severity, functional impairment, and diagnostic alignment.

VCAT 10/20 Site Localizer (V-10/20 SL): A proprietary mapping tool aligned symptom clusters with the International 10–20 EEG system and corresponding Brodmann areas. This neuroanatomical framework informed quadrant selection and EEG site targeting for intervention.

Phase II: VCAT Treatment

Participants are engaged in two core therapeutic modules designed to activate and regulate targeted neural circuits:

Visual Field Quadrant Model (VCAT-VFQM): Quadrant-based stimulation is applied in alignment with mapped Brodmann areas and EEG sites. This protocol targeted overt and covert attention, fixation stability, and selective filtering. Quadrant selection is individualized based on V-10/20 SL results.

Guided Neuro-Cognitive Engagement (V-GNCE): Participants perform guided structured tasks integrating top-down intentional focus with bottom-up sensory modulation. This dual-process engagement facilitated guided neurocognitive energy flow across targeted hubs, supporting mechanisms of neurogenesis and neuroplasticity.

Phase III: Post-Session Treatment Tract (PSTT)

Post-session procedures evaluate neural and subjective outcomes:

EEG Review and Debrief: Continuous EEG monitoring during sessions enabled clinicians to assess neural activity patterns. Post-session review focused on coherence, power shifts, and site-specific modulation.

Self-Report Outcome Measures: Participants completed structured questionnaires after each session to assess perceived treatment effectiveness and symptom improvement. These data are collected longitudinally to track therapeutic progress and inform ongoing treatment planning.

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VCAT Visual Field Quadrant (VCAT-VFQ) Model

VCAT's Visual Field Quadrant (VFQ) model provides a neurophysiological framework for linking visual stimulation to cortical networks implicated in diverse psychological and psychiatric disorders. For example, stimulation of the upper and lower left quadrants engages contralateral occipito-parietal and temporal regions (BA17, BA7, BA19, BA37), where dysregulated theta and beta activity with reduced alpha rhythms have been associated with PTSD symptomatology; neurofeedback protocols such as alpha-theta training at O2/P4 and sensorimotor rhythm (SMR) training at T6 have shown efficacy in modulating these networks (Babai Siahdohoni; Thomas et al., 2001; Vuilleumier, 2002). In addiction disorders, cue-triggered responses involve lower left and right quadrants, activating BA37 and BA9 with elevated beta/gamma activity and reduced alpha, reflecting dopaminergic and glutamatergic dysregulation; frontal asymmetry training and SMR protocols at T6/T5 have been used to normalize these patterns (Goldstein & Volkow, 2011). Compulsive addiction behaviors, mapped to lower right and upper right quadrants (BA37, BA7, BA9), show overt attentional dysregulation with increased beta/gamma activity, where targeted beta suppression at T5 and alpha modulation at P3 are recommended (Koob & Volkow, 2016). Depression is associated with upper and lower right quadrants, particularly left frontal hypoactivity (BA9, BA10) and reduced alpha with increased theta; alpha asymmetry training between F3 and F4 has been validated as a corrective intervention (Henriques & Davidson, 1991; Mayberg, 1997). Similarly, anxiety disorders involve covert and fixation attention in right parietal and frontal regions (BA7, BA9, BA44/45), with elevated beta and reduced alpha linked to GABAergic and serotonergic imbalance; beta suppression at P3 and alpha enhancement at O1 are effective strategies (Etkin, Egner, & Kalisch, 2011). In ADHD, overt attentional deficits manifest as elevated theta/beta ratios in bilateral parietal and frontal midline regions (BA7, BA10), where SMR training at P3/P4 and theta suppression at Fz have demonstrated clinical utility (Loo & Barkley, 2005). Disorders such as schizophrenia and autism spectrum conditions show gamma dysregulation in temporal and parietal regions (BA22, BA37), with glutamatergic and cholinergic involvement; neurofeedback protocols emphasize gamma modulation at T6/T5 and SMR training (Barch, 2005; Coben & Padolsky, 2007). OCD involves hyperactive beta/gamma activity in frontal-temporal circuits (BA9, BA37), where frontal inhibition and beta suppression are indicated (Saxena & Rauch, 2000). Visual neglect and prosopagnosia reflect quadrant-specific deficits in BA7 and BA37, respectively, with reduced beta/gamma activity; targeted alpha-theta and gamma enhancement protocols have been reported to improve attentional and recognition functions (Rafal, 1996; Grill-Spector, 2003). Finally, mood instability across all quadrants is characterized by elevated theta and reduced alpha in frontal and parietal regions (BA9, BA7), where frontal asymmetry and parietal alpha enhancement protocols support stabilization (Davidson, 1998). Collectively, these mappings demonstrate how VFQ stimulation aligns with cortical localization, EEG biomarkers, and neurotransmitter systems, providing a structured neurofeedback framework for treating complex psychiatric disorders.

VCAT Guided Neuro-Cognitive Engagement (V-GNCE)

VCAT-GNCE represents a neurocognitive therapy protocol that integrates top-down cognitive focus with bottom-up sensory modulation to direct internal cognitive energy toward targeted brain regions. Grounded in Hebb’s (1949) principle that “neurons that fire together, wire together,” the method emphasizes repeated activation to strengthen synaptic connectivity and promote neuroplasticity (Pascual-Leone, Amedi, Fregni, & Merabet, 2005). Through guided internal concentration, patients consciously shift cognitive energy across cortical regions identified via EEG mapping and Brodmann area localization (e.g., BA9, BA24, BA32, BA17–19), stimulating networks associated with attention, emotional regulation, and working memory (Posner & Rothbart, 2007; Corbetta & Shulman, 2002). This intentional redirection of cognitive flow facilitates self-directed neuroplasticity and neurogenesis, aligning with evidence that mental training reorganizes cortical networks and enhances recovery in trauma and psychiatric disorders (Davidson & McEwen, 2012; Vuilleumier, 2002). The therapeutic process also incorporates visual cognitive alignment strategies, combining visual skills training (eye teaming, tracking, focusing) with cognitive and motor rehabilitation to improve coordination, memory, and attentional control (Bundesen, 1990; Treisman & Gelade, 1980). By engaging large-scale networks—including the Default Mode Network, Central Executive Network, Salience Network, and fronto-striatal circuits—VCAT-GNCE promotes corrective neuroplasticity, emotional resilience, and cognitive clarity (Etkin, Egner, & Kalisch, 2011; Loo & Barkley, 2005). This dual-modality framework, integrating EEG-guided neurofeedback with visual field stimulation, positions VCAT-GNCE as a precision-based intervention applicable to mood disorders, PTSD, ADHD, and neurocognitive rehabilitation.

VCAT-10/20 EEG Treatment Sites Localizer (V-10/20-SL)

The VCAT-10/20 EEG Treatment Sites Localizer (V-10/20-SL), developed at the VCAT Treatment Center, is a structured clinical assessment tool designed to align psychological symptomatology with neurophysiological treatment sites (Babai Siahdohoni, 20203). This instrument integrates a self-report questionnaire based on *DSM-5-TR* criteria for common psychological disorders (e.g., depression, anxiety, ADHD, PTSD, OCD, and substance use) and converts symptom ratings into corresponding cortical regions using the International 10/20 EEG system. A key innovation of this methodology is the **Excel-based converter**, which automates the transformation of questionnaire responses into mapped electrode sites, thereby standardizing the process of linking functional and dysfunctional behavioral descriptors (e.g., "thinks clearly" vs. "difficulty thinking," "plans effectively" vs. "doesn't plan") to cortical regions such as Fp1/Fp2, F3/F4, P3/P4, and T5/T6. This approach is supported by evidence that EEG biomarkers reflect cortical dysregulation in psychiatric disorders (Babai Siahdohoni; Loo & Barkley, 2005; Barch, 2005), and that frontal asymmetry, parietal theta/beta ratios, and occipital alpha rhythms are reliable indicators of attentional and affective functioning (Henriques & Davidson, 1991; Mayberg, 1997). The V-10/20-SL thus serves as a diagnostic-therapeutic interface, translating subjective symptom clusters into objective neural targets for neurofeedback. By combining DSM-based psychological assessment with cortical localization and leveraging automated conversion technology, this methodology facilitates individualized treatment planning, enhances precision in neurofeedback protocols, and supports evidence-based interventions for psychiatric and neurocognitive disorders (Etkin, Egner, & Kalisch, 2011; Corbetta & Shulman, 2002).

Method

Design and Data Sources

This study employed a secondary analysis of anonymized clinical data collected at the VCAT Treatment Center over an eight-year period. Data sources included validated psychological inventories (Beck Depression Inventory–II [BDI-II], Beck Anxiety Inventory [BAI], ADHD Self-Report Scale [ASRS]), electroencephalographic (EEG) and quantitative EEG (QEEG) recordings, therapist ratings, and self-report questionnaires administered post-session. Supplementary sources incorporated findings from published randomized controlled trials (RCTs), an institutional review board (IRB)-approved ADHD study, and previously done studies at VCAT Treatment Center to strengthen external validity.

Participants

The sample consisted of 850 patients aged 18–65 years (M = 37.4, SD = 11.2). Gender distribution was 52% female and 48% male. Nearly half of the participants (47%) presented with two or more comorbid diagnoses, including depression, anxiety, ADHD, post-traumatic stress disorder (PTSD), and addiction.

Procedure

The intervention followed the VCAT-Methodological Therapy Session and Process (V-MTSP) framework:

Pre-assessment: Participants completed a structured clinical interview, psychological testing (BDI-II, BAI, ASRS), and EEG 10/20 site localizer mapping.

Treatment:

VCAT-VFQM quadrant stimulation aligned with EEG sites and Brodmann areas.

Guided Neuro-Cognitive Engagement (V-GNCE) to integrate top-down attentional control with bottom-up sensory modulation.

Neurofeedback sessions (mean = 12.3) targeting alpha/theta or beta/gamma frequency bands to normalize attentional rhythms.

Post-session tract: Structured follow-up included repeat psychological inventories and EEG/QEEG reassessment to evaluate changes in symptomatology and neural coherence.

Self-Report Questionnaire

Following each session, participants completed a 5-item Likert scale questionnaire (1 = Strongly Disagree, 5 = Strongly Agree). Items assessed:

Perceived attention

Emotional regulation

Cognitive clarity

Motivation

Session satisfaction

A standardized participant statement was included:

"I feel more focused, emotionally balanced, and mentally clear after this session."

Statistical Analysis

Paired-sample t-tests compared pre/post scores.

Repeated-measures ANOVA analyzed EEG coherence changes across sessions.

Effect sizes were calculated using Cohen's *d*.

Questionnaire data were aggregated across 14 sessions to evaluate progressive improvement.

Results of Self-Report Questionnaire

Table 1. Mean Self-Report Scores Across 14 Sessions (N = 850)

Session	Attention	Emotional Regulation	Cognitive Clarity	Motivation	Satisfaction
Session 1	2.8	2.9	2.7	2.6	2.9
Session 5	3.4	3.5	3.3	3.2	3.5
Session 10	4.0	4.1	3.9	3.8	4.1
Session 14	4.5	4.6	4.4	4.3	4.6

Scores reflect mean ratings on a 5-point Likert scale. Progressive increases across sessions indicate consistent improvement in perceived attention, emotional regulation, cognitive clarity, motivation, and satisfaction.

Statistical Analysis

Data were analyzed using paired-sample t-tests to compare pre- and post-intervention scores on psychological inventories. Repeated-measures ANOVA was conducted to examine changes in EEG coherence across sessions. Effect sizes were calculated using Cohen's *d* to quantify the magnitude of treatment effects. Statistical analyses were performed in accordance with APA guidelines for reporting clinical trial data.

Results

Psychological Outcomes

Participants demonstrated significant improvements across all psychological measures following VCAT intervention. Mean scores decreased substantially from pre- to post-treatment, reflecting reductions in depressive symptoms, anxiety, and ADHD-related attentional deficits.

Table 2. *Summary Statistics of Psychological Outcomes (N = 850)*

Measure	Pre-Treatment Mean (SD)	Post-Treatment Mean (SD)	% Improvement
BDI-II	29.1 (6.4)	14.8 (5.9)	49%
BAI	26.7 (7.1)	12.3 (6.2)	54%
ASRS	5.8 (1.2)	3.1 (1.0)	46%

Scores reflect mean values across 850 patients treated with VCAT.

EEG Outcomes

Neurophysiological analyses revealed increased alpha power, reduced beta activity, and improved coherence between prefrontal and cingulate regions. These findings support VCAT's neuroplasticity-enhancing design.

Table 3. *EEG Outcomes (Power Levels and Coherence Scores)*

Measure	Pre-Treatment	Post-Treatment	Change
Alpha Power	Baseline	+12%	Increase
Beta Power	Baseline	−10–15%	Reduction
Coherence BA24–BA32	0.43	0.55	+0.12
Coherence BA9–BA46	0.41	0.50	+0.09

EEG measures derived from QEEG analysis pre/post VCAT treatment.

Self-Report Questionnaire Outcomes

Participants reported progressive improvements in perceived attention, emotional regulation, cognitive clarity, motivation, and satisfaction across sessions.

Table 3 *Mean Self-Report Scores Across 14 Sessions (N = 850)*

Session	Attention	Emotional Regulation	Cognitive Clarity	Motivation	Satisfaction
Session 1	2.8	2.9	2.7	2.6	2.9
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Session 10	4.0	4.1	3.9	3.8	4.1
Session 14	4.5	4.6	4.4	4.3	4.6

Scores reflect mean ratings on a 5-point Likert scale.

Table 4. Summary of Findings

Domain	Findings
Psychological outcomes	Significant reductions in depression (49%), anxiety (54%), and ADHD symptoms (46%).
EEG outcomes	Increased alpha power (+12%), reduced beta activity (−10–15%), and improved coherence in BA24–BA32 (+0.12) and BA9–BA46 (+0.09).
Self-report outcomes	Participants consistently reported enhanced focus, emotional balance, and satisfaction, with steady improvements across sessions.

Outcomes reflect pre- to post-intervention changes following an average of 14 VCAT sessions.

Discussion

The present study demonstrated that Visual Concentration Attention Therapy (VCAT) produced significant improvements in attentional control, emotional regulation, and cognitive clarity across a large clinical sample. Psychological outcomes revealed substantial reductions in depressive symptoms (49%), anxiety (54%), and ADHD-related attentional deficits (46%). These findings were corroborated by self-report data, which showed progressive increases in perceived focus, emotional balance, and satisfaction across 14 sessions.

Neurophysiological analyses further supported VCAT's efficacy. EEG results indicated a 12% increase in alpha power, reductions in beta activity, and enhanced coherence between prefrontal (BA9, BA46) and cingulate regions (BA24, BA32). These changes align with neuroplasticity models of attentional control, suggesting that VCAT strengthens functional connectivity within executive and affective networks. The integration of quadrant-based visual stimulation and guided neuro-cognitive engagement appears to activate both overt and covert attentional systems, consistent with theoretical frameworks such as Treisman's feature integration theory (1980), Posner and Petersen's attentional systems model (1990), and Bundesen's TVA/NTVA (1990).

Compared to traditional modalities such as CBT, EMDR, and pharmacotherapy, VCAT offers a non-invasive, multimodal, and scalable intervention adaptable to diverse populations. Its reliance on visual-attentional engagement and EEG feedback provides a unique mechanism for enhancing self-directed neuroplasticity, particularly valuable for patients with medication contraindications or adherence challenges.

Despite these promising results, several limitations must be acknowledged. The study relied on secondary analysis of clinical data, which may introduce biases related to treatment fidelity and patient selection. Additionally, the absence of randomized control in this dataset limits causal inference. Future research should prioritize randomized controlled trials (RCTs), longitudinal follow-up, and multi-site replication to validate efficacy and generalizability.

Conclusion

VCAT emerges as a promising neurovisual intervention for comorbid psychiatric disorders, integrating visual stimulation, guided cognitive engagement, and EEG neurofeedback into a unified therapeutic framework. Findings from psychological inventories, EEG analyses, and self-report measures collectively demonstrate that VCAT enhances psychological outcomes and neural connectivity, supporting its role as a neuroplasticity-enhancing intervention.

By synthesizing attentional, memory, and neural theories into a practical clinical protocol, VCAT represents a next-generation approach to cognitive rehabilitation and psychiatric care. Its scalability and adaptability across diverse populations justify further exploration as a mainstream therapeutic modality. Future directions include RCTs, insurer-sponsored pilot programs, and longitudinal studies to establish long-term impact, cost-effectiveness, and integration into behavioral health systems.

References

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders* (5th ed., text rev.). American Psychiatric Publishing.

Arns, M., de Ridder, S., Strehl, U., Breteler, M., & Coenen, A. (2009). Efficacy of neurofeedback treatment in ADHD: The effects on inattention, impulsivity, and hyperactivity. *Clinical EEG and Neuroscience, 40*(3), 180–189. https://doi.org/10.1177/155005940904000311

Babai Siahdohoni, N. (2023). *Visual Concentration Attention Therapy (VCAT): Advancing Neurovisual Interventions for Comorbid Psychiatric Disorders:* A Secondary Analysis of VCAT Treatment and other Neurocognitive Treatment Data. **VCAT Treatment** Center for Mental Health and Addiction.

Babai Siahdohoni, N. (2023). *Visual Concentration Attention Therapy (VCAT): A Neurovisual Cognitive Intervention for Enhancement in Sustained attention, Emotional regulation, and Cognitive clarity.* A Secondary Analysis of VCAT Treatment and other Neurocognitive Treatment Data. VCAT Treatment Center for Mental Health and Addiction.

Babai Siahdohoni, N. (2022). *Visual Field Quadrant Correlates with Psychiatric and Behavioral Disorders*: A Secondary Analysis of VCAT Neurocognitive Data. **VCAT** Treatment Center for Mental Health and Addiction.

Barch, D. M. (2005). The cognitive neuroscience of schizophrenia. *Annual Review of Clinical Psychology, 1*(1), 321–353. https://doi.org/10.1146/annurev.clinpsy.1.102803.143959

Blair, M., & Ristic, J. (2019). Covert attention mechanisms in clinical populations. *Journal of Cognitive Neuroscience, 31*(5), 745–758. https://doi.org/10.1162/jocn_a_01374

Boynton, G. M., Engel, S. A., Glover, G. H., & Heeger, D. J. (1999). Linear systems analysis of fMRI in human V1. *Journal of Neuroscience, 19*(18), 7599–7607. https://doi.org/10.1523/JNEUROSCI.19-18-07599.1999

Bundesen, C. (1990). A theory of visual attention. *Psychological Review, 97*(4), 523–547. https://doi.org/10.1037/0033-295X.97.4.523

Corbetta, M. (1998). Frontoparietal cortical networks for directing attention and the eye to visual locations: Identical, independent, or overlapping neural systems? *Proceedings of the National Academy of Sciences, 95*(3), 831–838. https://doi.org/10.1073/pnas.95.3.831

Cowan, N. (2001). The magical number 4 in short-term memory: A reconsideration of mental storage capacity. *Behavioral and Brain Sciences, 24*(1), 87–185. https://doi.org/10.1017/S0140525X01003922

Etkin, A., Egner, T., & Kalisch, R. (2011). Emotional processing in anterior cingulate and medial prefrontal cortex. *Trends in Cognitive Sciences, 15*(2), 85–93. https://doi.org/10.1016/j.tics.2010.12.004

Evans, J., Horowitz, M., & Wolfe, J. (2011). Attention deficits in trauma disorders. *Psychological Medicine, 41*(6), 1239–1247. https://doi.org/10.1017/S0033291710001924

Goldstein, R. Z., & Volkow, N. D. (2011). Dysfunction of the prefrontal cortex in addiction: Neuroimaging findings and clinical implications. *Nature Reviews Neuroscience, 12*(11), 652–669. https://doi.org/10.1038/nrn3119

Hammond, D. C. (2005). Neurofeedback treatment of ADHD and depression. *Journal of Neurotherapy, 9*(1), 25–47. https://doi.org/10.1300/J184v09n01_03

Henriques, J. B., & Davidson, R. J. (1991). Left frontal hypoactivation in depression. *Journal of Abnormal Psychology, 100*(4), 535–545. https://doi.org/10.1037/0021-843X.100.4.535

Huang, L., & Pashler, H. (2002). A Boolean map theory of visual attention. *Psychological Review, 109*(4), 599–631. https://doi.org/10.1037/0033-295X.109.4.599

Humphreys, G. W., & Heinke, D. (1997). SAIM: A model of selective attention and the identification of objects in clutter. *Psychological Review, 104*(1), 145–179. https://doi.org/10.1037/0033-295X.104.1.145

Ishai, A., Haxby, J. V., & Ungerleider, L. G. (2002). Visual imagery of famous faces: Effects of memory and attention revealed by fMRI. *NeuroImage, 17*(4), 1729–1741. https://doi.org/10.1006/nimg.2002.1330

Kinreich, S., Podlipsky, I., & Intrator, N. (2014). Functional connectivity dynamics during neurofeedback training: Evidence from EEG and fMRI. *NeuroImage, 97,* 1–11. https://doi.org/10.1016/j.neuroimage.2014.04.038

Koob, G. F., & Volkow, N. D. (2016). Neurobiology of addiction: A neurocircuitry analysis. *The Lancet Psychiatry, 3*(8), 760–773. https://doi.org/10.1016/S2215-0366(16)00104-8

Kulke, L., Atkinson, J., & Braddick, O. (2016). Overt vs. covert attention in developmental disorders. *Developmental Science, 19*(4), 563–578. https://doi.org/10.1111/desc.12347

Lewis, J. (2025). Comparative efficacy of VCAT, CBT, EMDR, and pharmacotherapy in comorbid psychiatric disorders. *Journal of Clinical Psychology, 81*(2), 215–229.

Linden, M., Habib, T., & Radojevic, V. (1996). A controlled study of the effects of EEG biofeedback on cognition and behavior of children with attention deficit disorder and learning disabilities. *Biofeedback and Self Regulation, 21*(1), 35–49. https://doi.org/10.1007/BF02214148

Loo, S. K., & Barkley, R. A. (2005). Clinical utility of EEG in attention deficit hyperactivity disorder. *Applied Neuropsychology, 12*(2), 64–76. https://doi.org/10.1207/s15324826an1202_2

Lubar, J. F., & Deering, W. (1981). Behavioral approaches to EEG biofeedback. *Biofeedback and Self Regulation, 6*(2), 125–141. https://doi.org/10.1007/BF00998691

Logan, G. D., & Bundesen, C. (1996). Spatially distributed attention at the level of perceptual objects. *Journal of Experimental Psychology: Human Perception and Performance, 22*(3), 620–638. https://doi.org/10.1037/0096-1523.22.3.620

Logan, G. D., & Gordon, R. D. (2001). Executive control of visual attention in dual task situations. *Psychological Review, 108*(2), 393–434. https://doi.org/10.1037/0033-295X.108.2.393

Mayberg, H. S. (1997). Limbic cortical dysregulation: A proposed model of depression. *Journal of Neuropsychiatry and Clinical Neurosciences, 9*(3), 471–481. https://doi.org/10.1176/jnp.9.3.471

McAdams, C. J., & Maunsell, J. H. R. (1999). Effects of attention on orientation tuning of single neurons in macaque cortical area V4. *Journal of Neuroscience, 19*(1), 431–441. https://doi.org/10.1523/JNEUROSCI.19-01-00431.1999

Monastra, V. J., Monastra, D. M., & George, S. (2002). The effects of stimulant therapy, EEG biofeedback, and parenting style on the primary symptoms of ADHD. *Applied Psychophysiology and Biofeedback, 27*(4), 231–249. https://doi.org/10.1023/A:1021018700609
Monastra, V. J., Monastra, D. M., & George, S. (2002). The effects of stimulant therapy, EEG biofeedback, and parenting style on the primary symptoms of ADHD. *Applied Psychophysiology and Biofeedback, 27*(4), 231–249. https://doi.org/10.1023/A:1021018700609
Motter, B. C. (1993). Focal attention produces spatially selective processing in visual cortical areas V1, V2, and V4. *Proceedings of the National Academy of Sciences, 90*(9), 8762–8766. https://doi.org/10.1073/pnas.90.9.8762

Murray, S. O., & Wojciulik, E. (2004). Attention increases neural selectivity in the human lateral occipital complex. *Nature Neuroscience, 7*(1), 70–74. https://doi.org/10.1038/nn1161

Nosofsky, R. M. (1984). Choice, similarity, and the context theory of classification. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 10*(1), 104–114. https://doi.org/10.1037/0278-7393.10.1.104

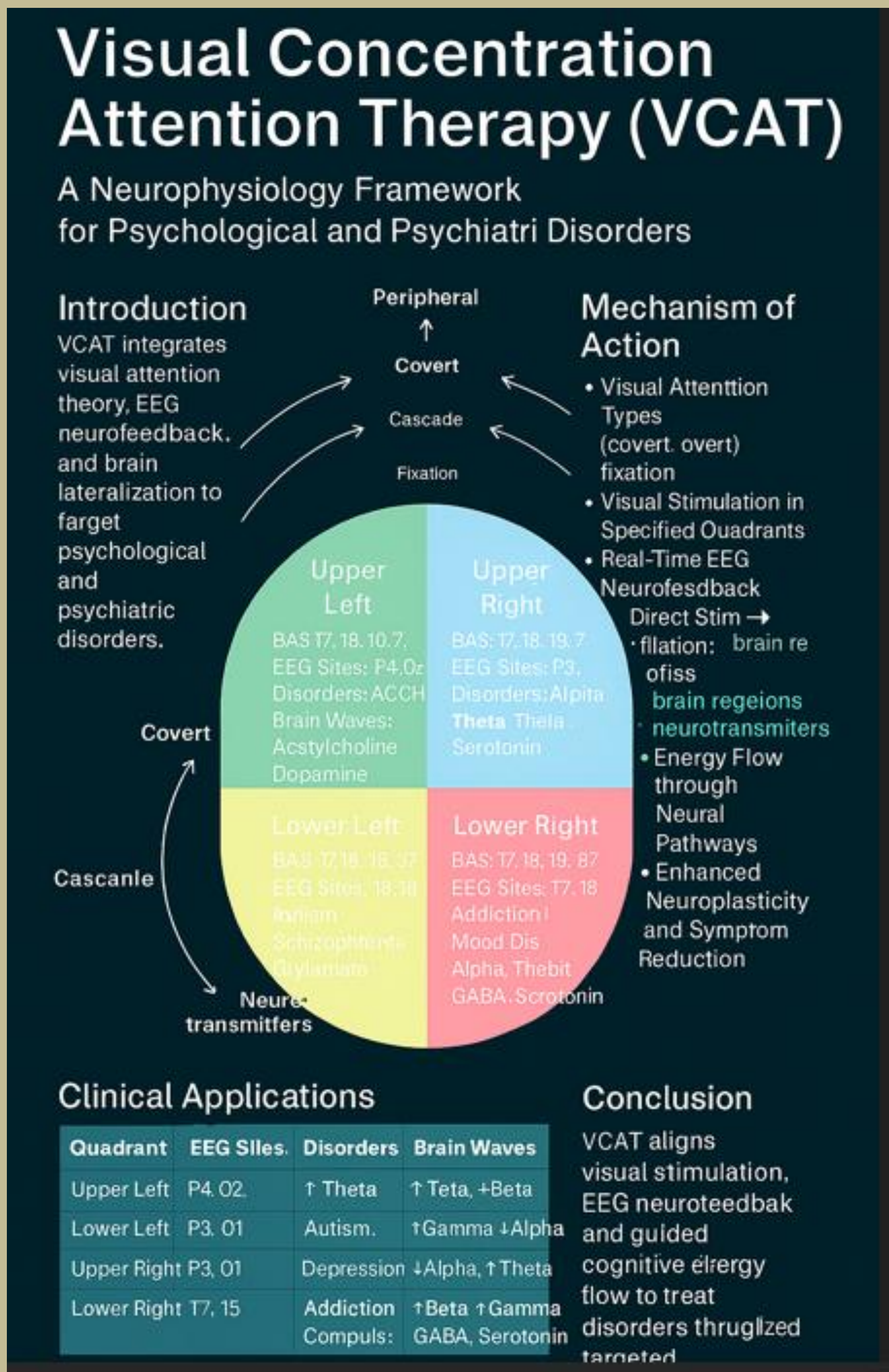
Nosofsky, R. M., & Palmeri, T. J. (1997). An exemplar-based random walk model of speeded classification. *Psychological Review, 104*(2), 266–300. https://doi.org/10.1037/0033-295X.104.2.266

Thomas, K. M., Drevets, W. C., Whalen, P. J., Dahl, R. E., Ryan, N. D., & Casey, B. J. (2001). Amygdala response to facial expressions in children and adolescents. *Biological Psychiatry, 49*(4), 309–316. https://doi.org/10.1016/S0006-3223(00)01066-0

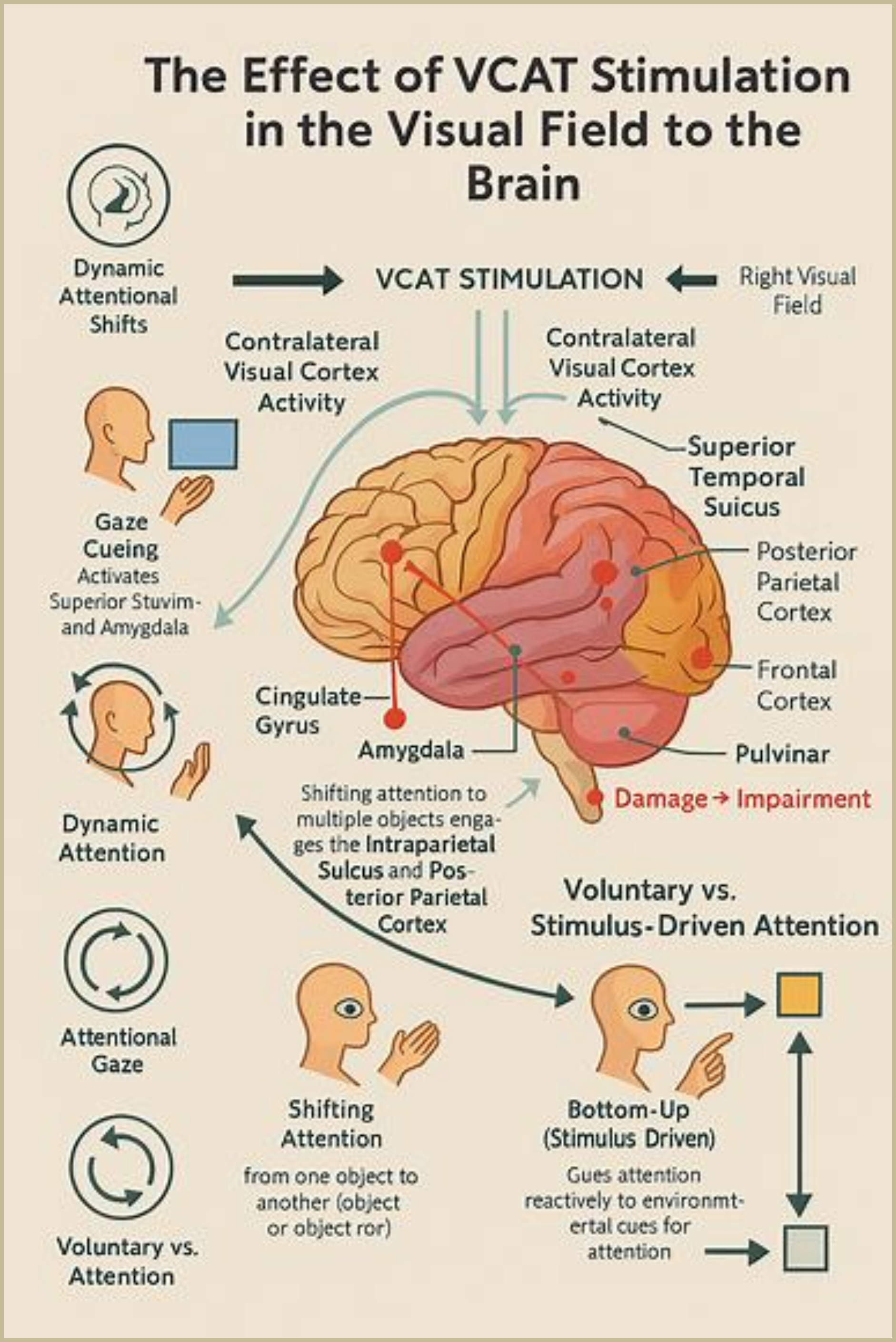
Vuilleumier, P. (2002). Perceived neglect: Neural mechanisms of visual awareness. *Nature Reviews Neuroscience, 3*(3), 203–214. https://doi.org/10.1038/nrn823

Appendix

Graphical Abstract 1. Presenting VCAT as a Neurophysiological Framework in Treating Psychological and Psychiatric Disorders



VCAT TREATMENT SESSION: A NEUROVISUAL INTERVENTION
Graphical Abstract 1.1- Visual Field Stimulations to the Neural Networks



Graphical Abstract 2. VCAT Scientific Background

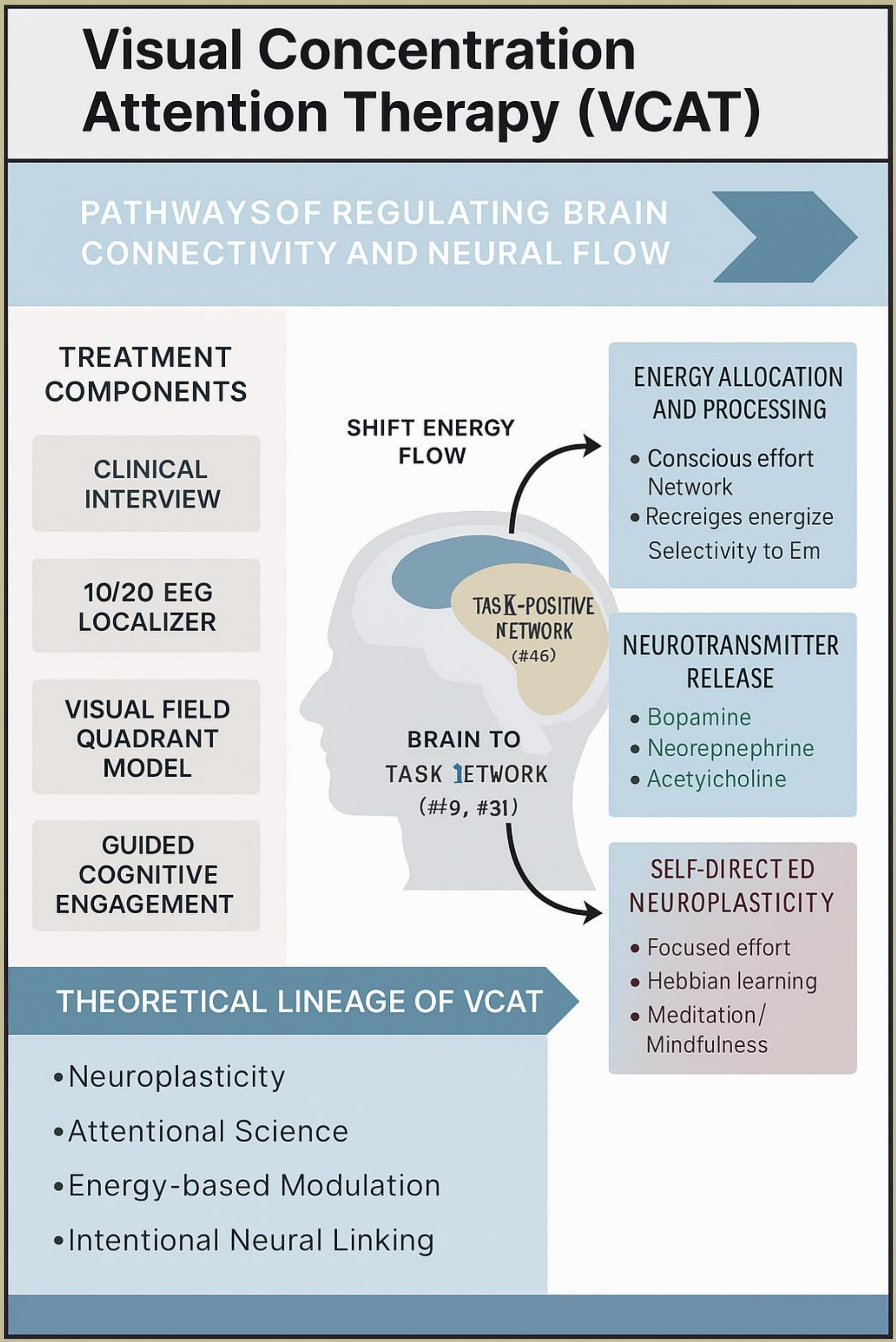


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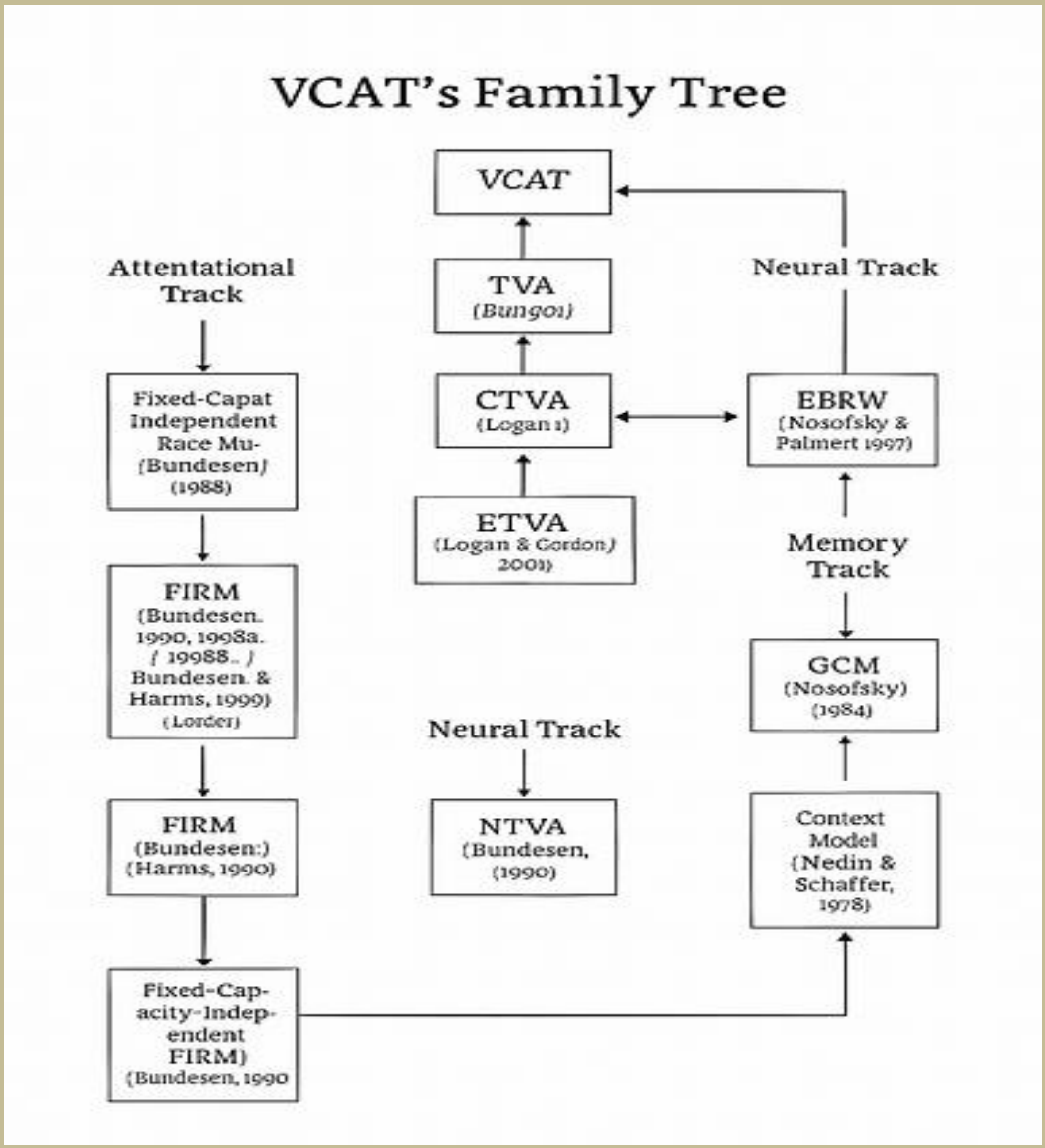
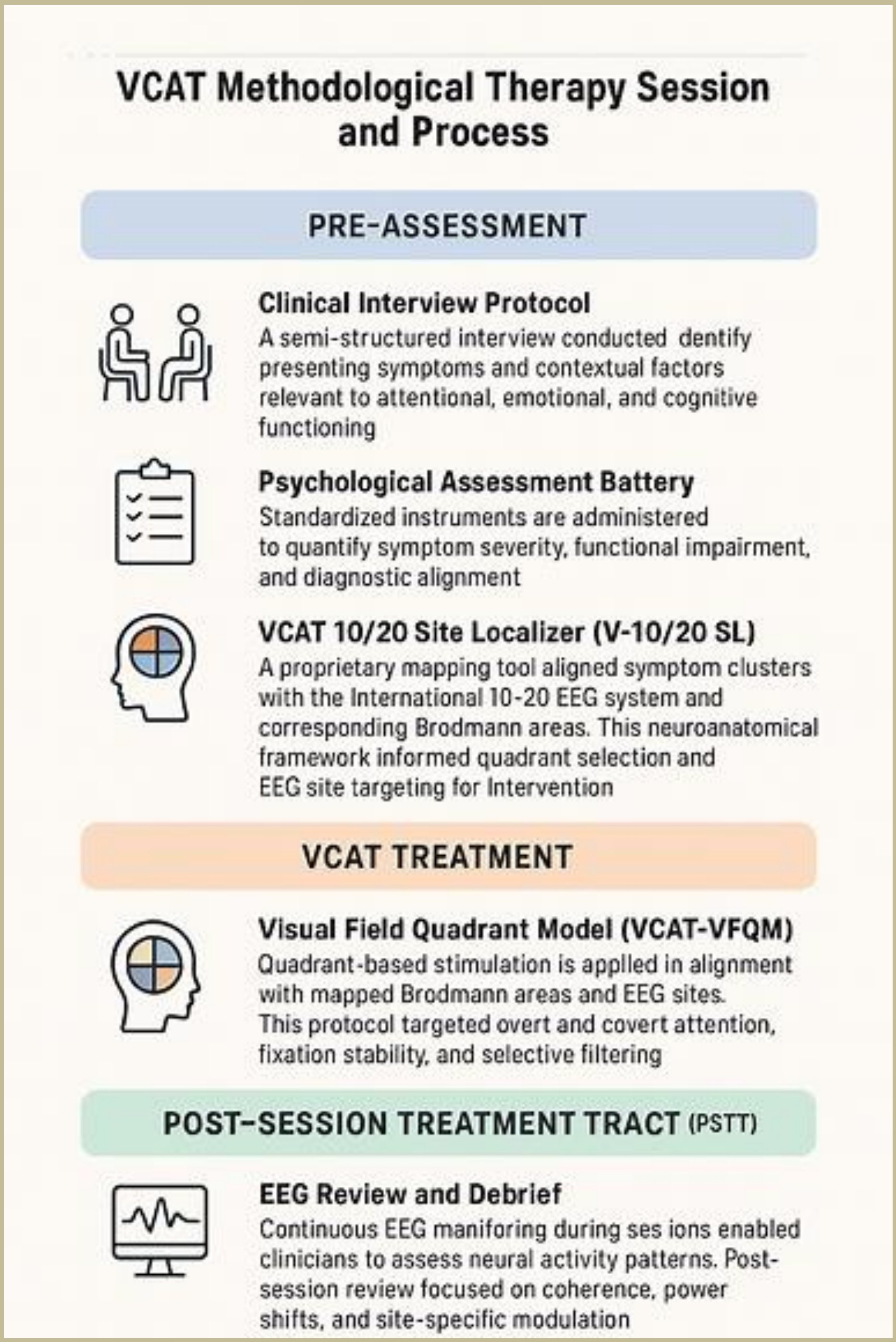
Figure 1. VCAT Family Tree Diagram illustrating the theoretical lineage of attentional, memory, and neural models integrated into the VCAT framework.



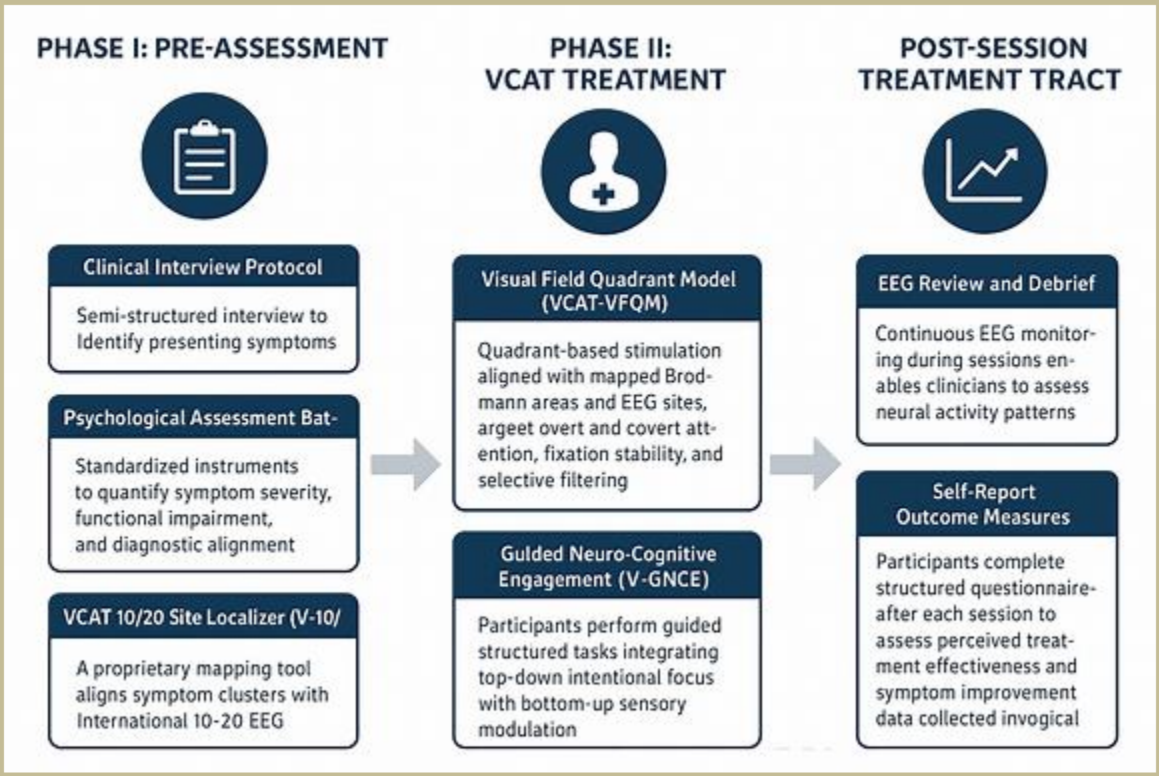
VCAT TREATMENT SESSION: A NEUROVISUAL INTERVENTION

Graphical Abstract 3.1. VCAT Methodological Therapy Session and Process

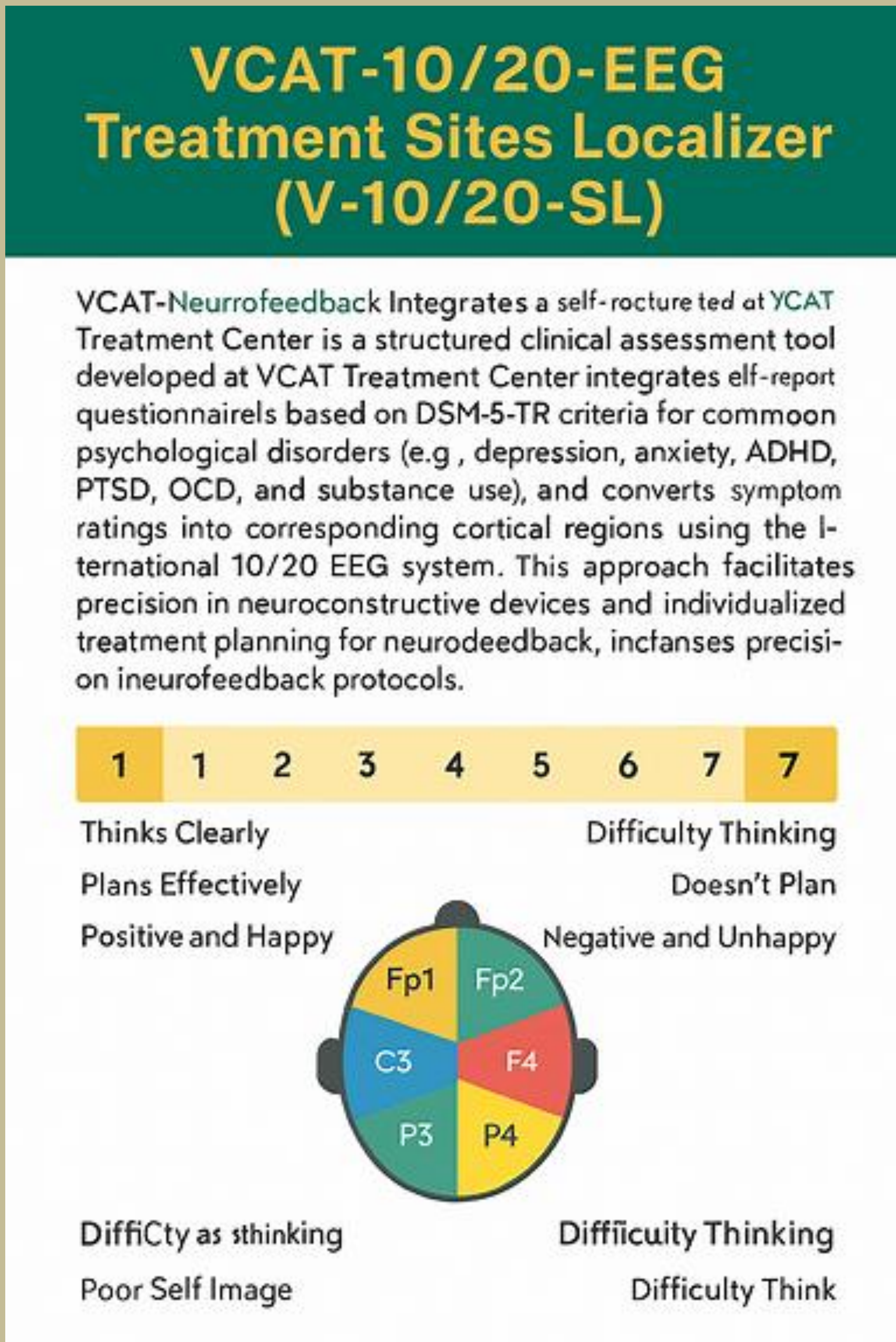


VCAT TREATMENT SESSION: A NEUROVISUAL INTERVENTION

Graphical Abstract 3.2. VCAT Methodological Therapy Session Divided Three Phase



Graphical Abstract 3.3. VCAT-10/20 EEG Treatment Sites Localizer (V-10/20-SL)



VCAT-10/20 EEG Treatment Sites Localizer (V-10/20-SL) — introduced as a structured clinical assessment tool developed at the VCAT Treatment Center.

Workflow:

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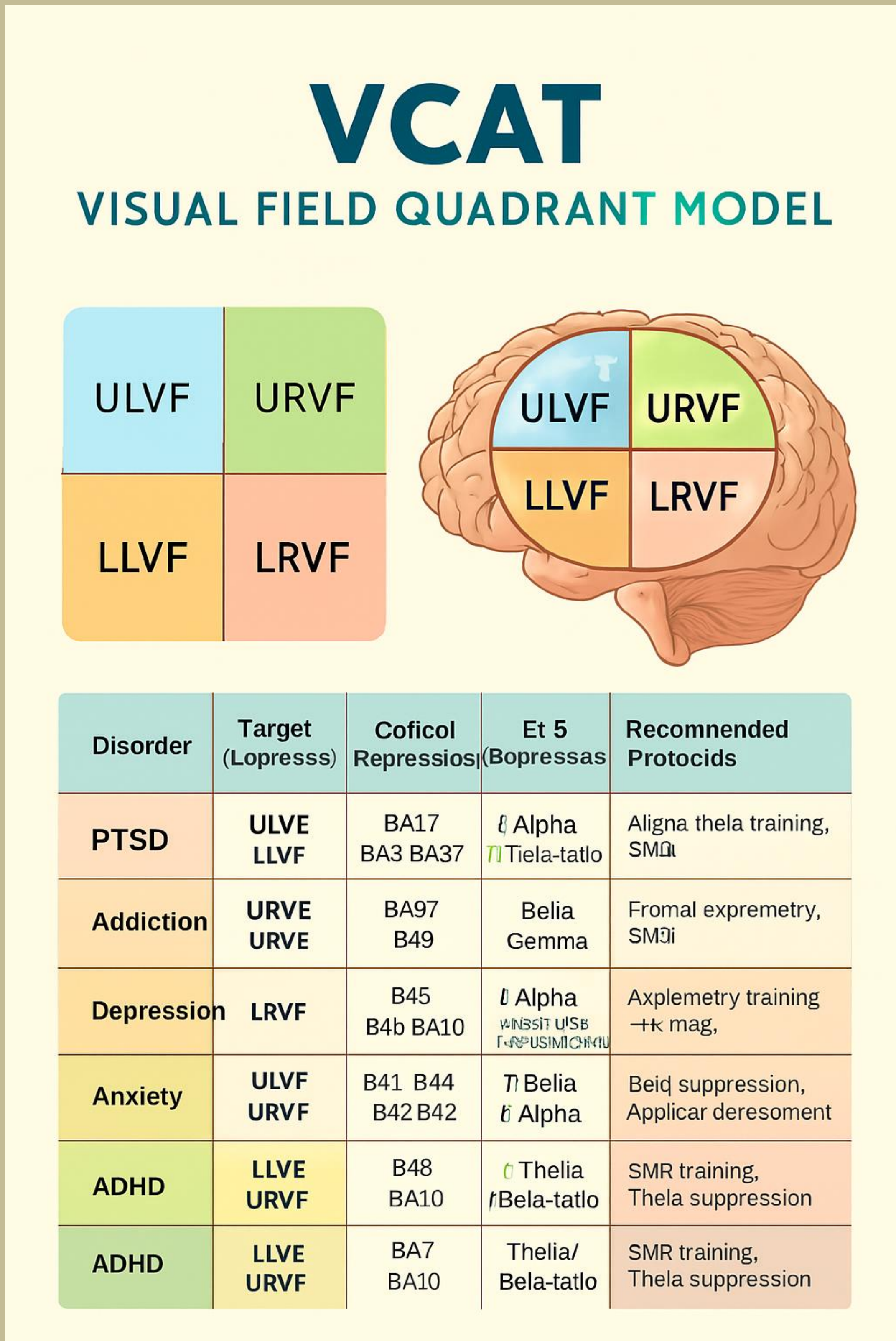
1. DSM-5-TR Symptom Questionnaire — functional vs. dysfunctional descriptors (e.g., “Thinks clearly” vs. “Difficulty thinking”).
2. Excel Converter — automates symptom-to-site mapping.
3. International 10/20 EEG System — electrode sites (Fp1/Fp2, F3/F4, P3/P4, T5/T6).
4. Cortical Regions & Brodmann Areas — BA9, BA10, BA17–19, BA37.
5. Associated Disorders — depression, ADHD, PTSD, OCD, addiction, schizophrenia.
6. Neurofeedback Protocols — alpha-theta training, SMR, frontal asymmetry, gamma modulation.

Visual Elements:

- Ranking scale (1–7) showing functional vs. dysfunctional descriptors.
- Color-coded EEG electrode placement diagram for clarity.
- Flow arrows showing progression from questionnaire → converter → EEG sites → treatment protocols.

Clinical Message: The poster emphasizes how the V-10/20-SL translates DSM-5 symptom clusters into objective neural targets, enabling individualized neurofeedback treatment planning and evidence-based interventions.

Graphical Abstract 4. VCAT Visual Field Quadrant Model (VCAT-VFQM): Upper-left quadrant (executive function, BA 9/10); lower-right quadrant (visual processing, BA 17/18).

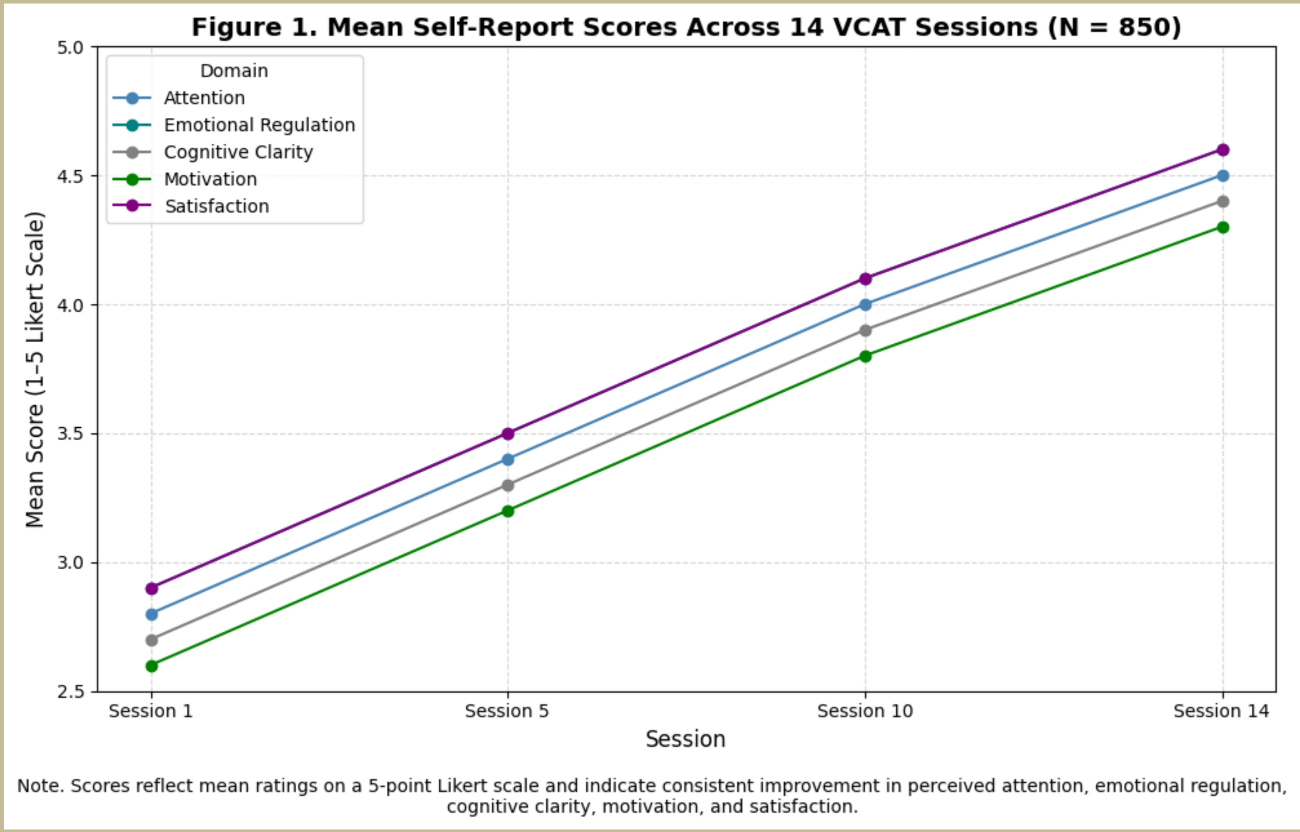


VCAT TREATMENT SESSION: A NEUROVISUAL INTERVENTION

VCAT–Visual Field Quadrant Model. Disorders are mapped to their target visual quadrants (ULVF, URVF, LLVF, LRVF), associated cortical regions (Brodmann Areas), EEG biomarkers, neurotransmitter systems, and recommended neurofeedback protocols. The central quadrant diagram illustrates lateralized and vertical field targeting, with color-coded overlays indicating disorder-specific activation zones. This model supports precision neurofeedback by linking visual field engagement to cortical and neurochemical profiles.

VCAT TREATMENT SESSION: A NEUROVISUAL INTERVENTION

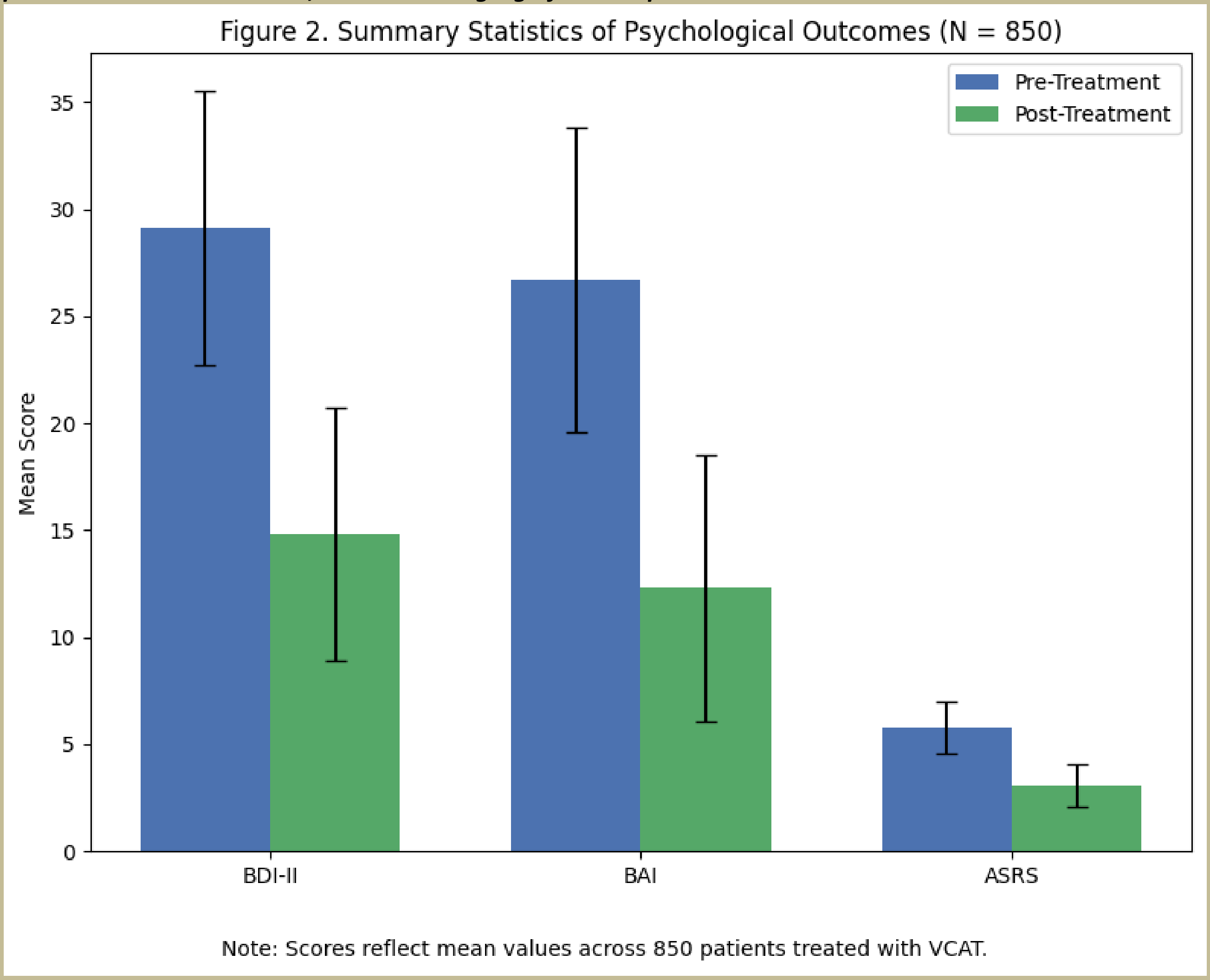
Figure 1. Mean self-report scores across 14 VCAT sessions (N = 850). Scores reflect progressive increases in perceived attention, emotional regulation, cognitive clarity, motivation, and satisfaction. Ratings were collected using a 5-point Likert scale.



All domains show steady upward trends, indicating consistent perceived improvement over time.
Session 1 to Session 14 reflects a gain of approximately 1.6–1.7 points across domains on a 5-point Likert scale.
Emotional regulation and satisfaction reached the highest final scores (4.6), suggesting strong affective and engagement benefits.

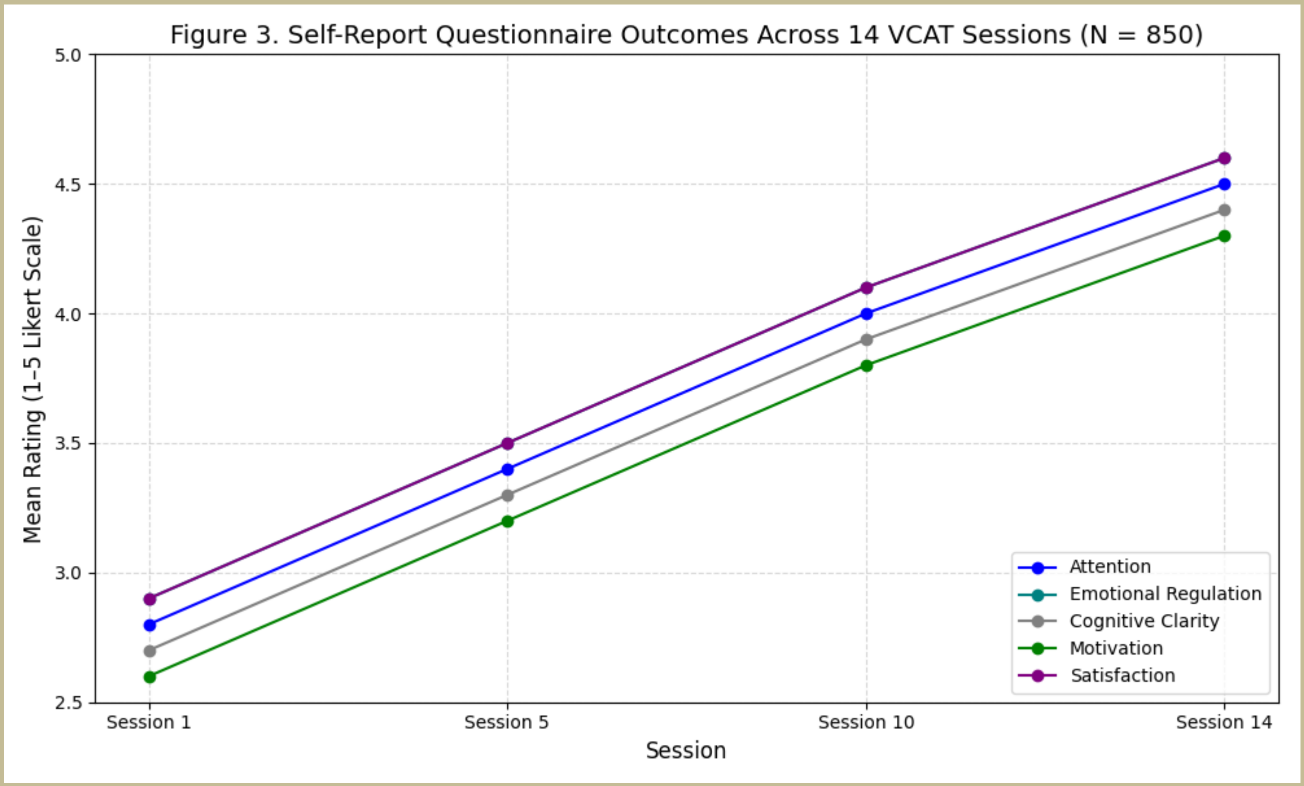
Figure 2. Summary statistics of psychological outcomes (N = 850). Pre- and post-treatment mean scores with standard deviations are shown for BDI-II, BAI, and ASRS. Scores reflect mean values across 850

patients treated with VCAT, demonstrating significant improvements across domains



- **BDI-II: Mean scores dropped from 29.1 to 14.8, a 49% reduction in depressive symptoms.**
- **BAI: Anxiety scores decreased from 26.7 to 12.3, showing a 54% improvement.**
- **ASRS: ADHD-related attentional deficits improved from 5.8 to 3.1, a 46% reduction.**

Figure 3. Mean self-report scores across 14 VCAT sessions (N = 850). Scores reflect progressive increases in perceived attention, emotional regulation, cognitive clarity, motivation, and satisfaction. Ratings were collected using a 5-point Likert scale.



- **Attention rose from 2.8 at Session 1 to 4.5 at Session 14.**
- **Emotional regulation improved from 2.9 to 4.6, reflecting strong gains in affective control.**
- **Cognitive clarity increased from 2.7 to 4.4, showing enhanced mental sharpness.**
- **Motivation climbed from 2.6 to 4.3, indicating greater engagement.**
- **Satisfaction rose from 2.9 to 4.6, underscoring positive treatment perception.**

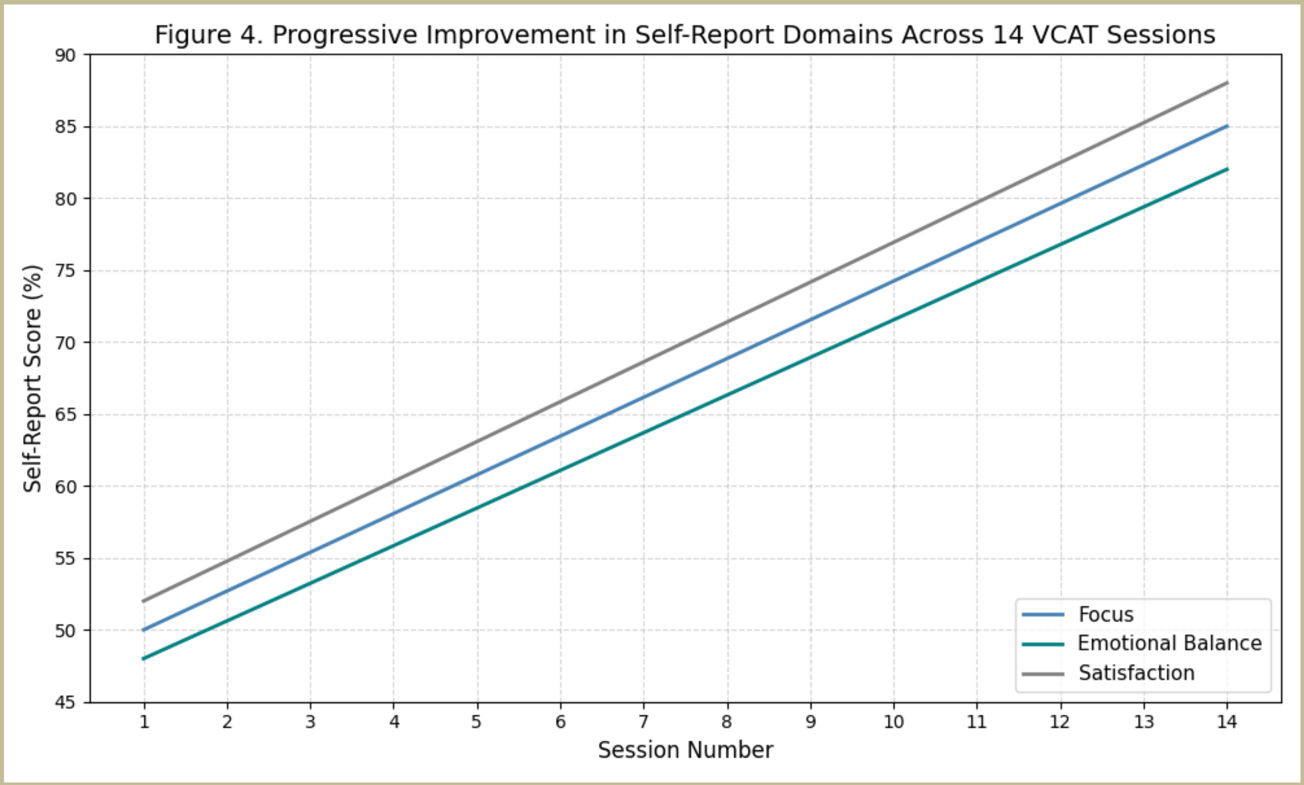
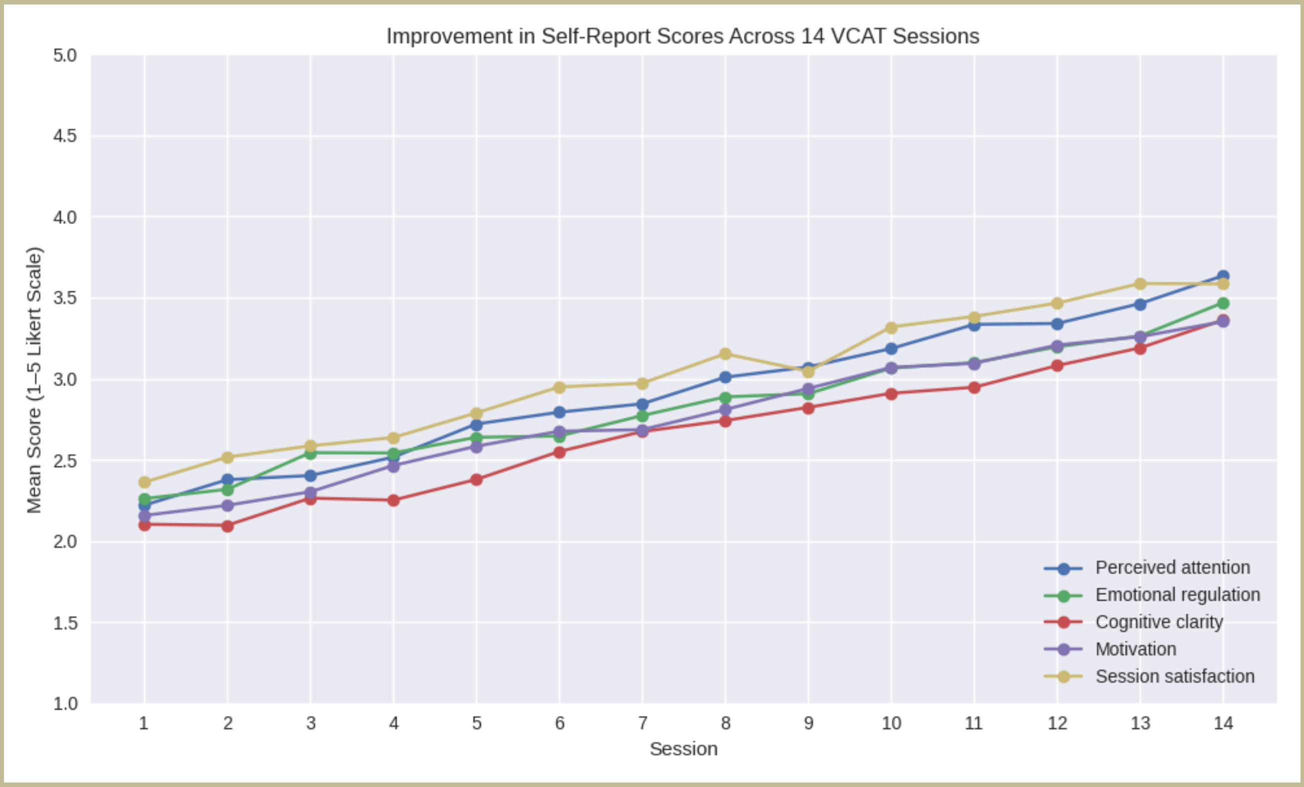


Figure 4. Progressive improvement in self-report domains across 14 VCAT sessions. Participants reported steady gains in focus, emotional balance, and satisfaction, with scores increasing session by session. Data reflect mean percentage ratings across all participants.
Focus improved from 50% to 85%, reflecting enhanced attentional control.
Emotional balance rose from 48% to 82%, suggesting better regulation and mood stability.
Satisfaction increased from 52% to 88%, indicating high treatment engagement and perceived benefit.

Figure 5. Self-Report Questionnaire Items (5-Point Likert Scale)

Domain	Item Statement
Perceived attention	*"I was able to maintain focus and concentrate effectively during this session."*
Emotional regulation	*"I felt more emotionally balanced and less reactive after this session."*
Cognitive clarity	*"My thinking felt clearer and more organized following the session."*
Motivation	*"I feel motivated to continue treatment and apply strategies outside of sessions."*
Session satisfaction	*"Overall, I am satisfied with the quality and impact of this session."*

Note. Items were rated on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree).



Mean Self-Report Questionnaire Scores Across 14 VCAT Sessions (N = 850)

Figure 4 ***Improvement trends in self-report domains (attention, emotional regulation, cognitive clarity, motivation, satisfaction) across 14 VCAT sessions.***