

ORIGINAL ARTICLE

Biological Basis of the Concept of *Chitta-Vrittis* in Yoga: A Thematic Investigation

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ABSTRACT

This research examines the biological underpinnings of *Chitta-Vrittis* – mental modifications as articulated in Patanjali's Yoga Sutras by synthesising Yogic psychology with modern neuroscience. Traditionally, *Chitta* denotes the mental realm comprising cognition, emotion, and volition, whereas *Vrittis* represent its fluctuating changes. Patanjali delineates five fundamental categories: *Pramana* (valid cognition), *Viparyaya* (false cognition), *Vikalpa* (imagination), *Nidra* (sleep), and *Smriti* (memory). This restricted typology fails to encompass the complete spectrum of cognitive processes recognised in contemporary psychological and neurological studies.

To bridge this gap, this work introduces an enhanced theme taxonomy of fifty *vrittis*, which is classified into epistemic, emotional, conative, pathological, and spiritual dimensions. This encompasses both constructive states, such as *Shraddha* (faith) and *Viveka* (discernment), and negative states, including *Raga* (attachment), *Krodha* (rage), and *Moha* (delusion). Each *vritti* is further analysed through neurobiological frameworks, emphasising their correlation with particular brain regions, including the limbic system, prefrontal cortex, hippocampus, and default mode network.

The research highlights the dual capacity of *Chitta-Vrittis* to either obscure or illuminate consciousness and illustrates how Yogic techniques designed to regulate these *vrittis* correspond with neuro-plastic alterations. Integrating ancient Yogic

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principles with contemporary biological models offers a comprehensive framework for comprehending mental health, indicating practical uses in psychotherapy, education, and contemplative neuroscience. This integrative approach reinforces Yoga as a spiritual discipline and a scientifically validated emotional and cognitive management method.

KEYWORDS

• *Chitta-Vrittis* • Yoga Sutras • Mental Alterations • Neuroscience
 • *Patanjali* • Neuroplasticity • *Vritti* Regulation • Cognitive-Emotional States • Integrated Psychology • Yogic Neuroscience

INTRODUCTION

Investigating human consciousness (*Chitta*) has been an enduring endeavour in Eastern and Western cultures. Modern neuroscience endeavours to delineate brain activity and elucidate behaviour through biological mechanisms, whereas Yogic philosophy, particularly as expressed in the *Patanjali Yoga Sutras*, presents a profoundly introspective framework of the mind grounded in the dynamics of *Chitta* (consciousness) and its modifications, termed *Vrittis*. The fundamental maxim of Yogic psychology, "*Yogah Chitta-vritti-nirodhah*" [PYS: 1.2], is sometimes rendered as "Yoga is the cessation of the fluctuations of the mind" [Satchidananda, 2012]¹. This succinct yet significant remark embodies the primary objective of Yoga: to tranquillise the erratic mental fluctuations (*Chitta-vrittis*) that result in pain and spiritual ignorance.

The term "biology" originates from the Greek terms 'bios,' signifying life, and 'logos,' denoting study. Biology is the scientific examination of life and living systems, including their structure, function, growth, origin, evolution, and relationships [McEwen, 174].² Contemporary biology encompasses subdisciplines such as molecular biology, neurology, endocrinology, and genetics, essential for comprehending the physiological foundations of mental and behavioural functioning.

Chitta derives from the Sanskrit word "*chit*," signifying consciousness or awareness, whereas *vritti* originates from "*vrt*," meaning to turn, roll, or vary. Thus, *Chitta-vritti* denotes the alterations or variations of consciousness [Desikachar, 18].³ In this context, *Chitta* denotes the nuanced, cognitive, and dynamic facet of the mind/consciousness that records

experiences and perceptions. It serves as both the observer and the processor of cognitive material. *Vrittis* are the dynamic patterns or fluctuations that emerge in the realm of *Chitta* (consciousness) due to internal and external stimuli. These cognitive processes affect perception, memory, and emotion, motivation, reasoning, problem-solving, and decision-making. The five principal *vrittis* delineated in *Patanjali Yoga Sutra* 1.5–1.11 *Pramana* (valid cognition), *Viparyaya* (false cognition), *Vikalpa* (imagination), *Nidra* (sleep), and *Smriti* (memory) constitute the fundamental categories for comprehending the essence of mental processes in Yoga [Satchidananda, 2012].⁴

The restricted categorisation into five mental modifications (*vrittis*) fails to capture the intricacy of mental events observed in modern psychological and neurobiological research. The extensive categories outlined in the *Patanjali Yoga Sutras* allow for thematic expansion. Elaborating on these five into more detailed subtypes such as anger, desire, attachment, insight, faith, and volition not only better corresponds with real-life experiences but also facilitates the association of these Yogic constructs with particular cognitive, affective, and neurobiological mechanisms [Davidson & Begley, 2012].⁵

What is the rationale for physiologically examining *Chitta-vrittis*? The solution resides in the increasing demand for integrative models that connect the subjective experiences of Yoga with the empirical constructs of neuroscience. Cognitive science, neurobiology, and psychology have commenced elucidating attention networks, memory circuits, and emotional regulation systems; however, they frequently lack the philosophical profundity and introspective methodologies

Yoga provides. In contrast, Yogic literature frequently lacks physiological specificity, constraining its practical use. A biological interpretation of vrittis provides a synthesis an integrative framework honouring the Yogic perspective and imparts empirical clarity and therapeutic significance [Holzel *et al.*, 2011]⁶ & [McEwen, 1998].⁷

This article suggests a thematic elaboration of *Chitta-vrittis* into 50 designated mental changes, derived from textual, philosophical, and contemplative sources. These are subsequently analysed through the perspective of contemporary neuroscience, encompassing domains such as affective neurobiology, memory research, and neuroimaging studies. This article demonstrates how ancient insights into consciousness can enhance modern comprehension of mental processes, positioning Yoga as a spiritual journey and a scientifically validated cognitive and emotional self-regulation technique.

PHILOSOPHICAL BACKGROUND

The basis of *Chitta-vrittis*, as articulated in *Patanjali's Yoga Sutras*, is encapsulated in the concise yet profoundly perceptive passages from *Sutra* 1.5 to 1.11. These *sutras* delineate the typology of mental changes, classifying all mental activity into five primary categories, which can result in either bondage or release based on their quality and impact. *Vyasa's Bhashya* (commentary) on these *sutras*, a very authoritative interpretation, elucidates that vrittis resemble waves in the lake of *Chitta*. The lake's agitation by these waves distorts the authentic reflection of Purusha (pure consciousness).

Patanjali asserts in *Sutra* 1.5: "*Vrittayah panchatayaha klishhta aklishhta*" (The mental modifications are fivefold and can be either painful [*klishhta*] or non-painful [*aklishhta*]). This implies that mental activities (*Chitta-vrittis*) are not intrinsically negative or positive; their character is contingent upon the extent of egoism, attachment, and ignorance. The subsequent *sutras*, 1.6 to 1.11, delineate each *vritti*.

- 1. Pramana:** Knowledge obtained by direct observation, logical deduction, and authoritative texts.
- 2. Viparyaya:** Erroneous perception or inaccurate understanding.

- 3. Vikalpa:** Conceptual knowledge derived from linguistic constructs lacking tangible essence.

- 4. Nidra:** Sleep is characterised by the absence of content, yet nonetheless is a *vritti*.

- 5. Smriti:** The recollection of past events and experiences.

The classification originates from *Samkhya philosophy*, which forms the foundation of much Yogic thought. In *Samkhya*, *Chitta*, referred to as *Mahat*, comprises *buddhi* (intellect), *ahamkara* (ego), and *manas* (mind), which together perceive, interpret, and respond to the environment. The *Samkhya* model elucidates the genesis of vrittis due to the interaction between the *gunas* (*Satva*, *Rajas*, and *Tamas*) and inputs from both the exterior and internal environments.

Notwithstanding the sophistication of this concept, the *Patanjali Yoga Sutras* do not provide a comprehensive inventory of mental oscillations. Commentators including *Vyasa*, *Vijnanabhikshu*, *Bhoja Raja*, and other Yogic thinkers reference subtle *vrittis* such as doubt, pride, delusion, joy, sadness, desire, fear, and detachment. These are not independent of the five categories but may be considered subgroups or expressions.

The necessity for thematic granularity is evident in light of this philosophical context. The conventional five-fold classification can be elaborated into more precise categories based on experiential, emotional, cognitive, and behavioural differences. This theme categorisation honours the essence of the original writings while augmenting its relevance to modern psychological science. This theme analysis enables researchers, clinicians, and practitioners to correlate these mental alterations with established psychological categories, including anxiety, cognitive biases, memory traces, and emotional valence.

Thematic Elaboration of Chitta-Vrittis

The conventional categorisation of five mental modifications (*Chitta-vrittis*) in the *Patanjali Yoga Sutras* provides a succinct and fundamental framework for comprehending the functions of the mind/consciousness. This framework allows for significant elaboration, particularly about the variety of emotional, cognitive, and volitional states encountered by

humans in typical and exceptional situations. Enhancing the fivefold classification into a more sophisticated and functional taxonomy facilitates a deeper introspective comprehension and a practical correlation with cognitive neuroscience and psychology.

Thematic expansion entails categorising Chitta-vrittis according to their primary psychological function. For example, certain

vrittis are associated with perception and knowledge (epistemic), others with emotions (affective), others with volition (conative), and others with clinical problems, memory retention, or ethical attributes. Yogic comments, traditional Indian psychology, and comparative frameworks in contemplative neuroscience guide this expansion. Presented herein is a classification of 50 vrittis, organised thematically into 10 overarching domains:

Thematic Clusters	Sanskrit Name	English Equivalent
A. Epistemic Vrittis (Pramana based Vrittis or Valid knowledge through five categories)		
1	<i>Pratyaksha</i>	Direct sensory perception.
2	<i>Anumana</i>	Inference or Knowledge through reasoning.
3	<i>Agama</i>	Authentic and original scriptures.
4	<i>Buddhi-Nishchay</i>	Thinking: Intelligence and Creativity
5	<i>Viveka</i>	Discernment or Ability to distinguish truth.
B. Cognitive Errors Vrittis (Viparyaya based Vrittis or Cognitive errors through five categories)		
6	<i>Mithyajnana</i>	Illusion or Misapprehension of objects.
7	<i>Bhrama</i>	Delusion or Confused thinking, belief and value.
8	<i>Pratibimba</i>	Hallucination or False sensory perception.
9	<i>Adhyasa</i>	Superimposition or Attributing qualities falsely.
10	<i>Aropa</i>	Projection or Imposing imagined attributes.
C. Imaginative Vrittis (Vikalpa based Vrittis or Conceptual Fabrication or Perception due to word related knowledge of something without substantial truth)		
11	<i>Kalpana</i>	Imagination or creative thought without object.
12	<i>Sankalpa</i>	Resolution or intentional mental formation.
12	<i>Bhawana</i>	Visualization or mental creation of experiences.
14	<i>Nama-rupa</i>	Concept formation or naming and shaping reality.
15	<i>Vakya-vikalpa</i>	Verbal constructs or illusory meaning through language.
D. Unconscious Vrittis (Nidra based Vrittis or physical inertial with mental activities)		
16	<i>Sushupti</i>	Dreamless Sleep (N-REM/ Non-Rapid Eye Movement)
17	<i>Stayana</i>	Languor or want to do activity but don't do.
18	<i>Alasya</i>	Laziness or avoidance of activity.
19	<i>Vishada</i>	Despair/depression or emotional fatigue or apathy
20	<i>Avarna</i>	Mental veiling or obscuration of awareness.
E. Memory Vrittis (Smriti based Vrittis or mental modification based on memory)		

Thematic Clusters	Sanskrit Name	English Equivalent
21	<i>Anubhava</i>	Experiential memory or retention of past events.
22	<i>Sukha</i>	Pleasure Memory or memory based on joy and happiness.
23	<i>Dukkha</i>	Pain memory or memory based on sufferings.
24	<i>Bhaya</i>	Fear memory or memory of threats/danger.
25	<i>Nama</i>	Name memory or retention of names and identities.
F. Derived Driven Vrittis (Ichha or Desired driven Vrittis)		
26	<i>Raga</i>	Attachment or attraction towards pleasant things.
27	<i>Dwesa</i>	Aversion or rejection of unpleasant things.
28	<i>Kama</i>	Kama or longing for desire, need and purpose fulfillment.
29	<i>Lobha</i>	Greed or longing for seeking more than needs.
30	<i>Moha</i>	Delusion or loss of right judgment due unipolar thinking pattern.
G. Ego Driven Vrittis (Sense of 'I' ness based Vrittis)		
31	<i>Asmita</i>	Sense of 'I' ness due to lack of discernment.
32	<i>Ahamkara</i>	Ego or sense of doer of things/ activities
33	<i>Mamakara</i>	Mine-ness or feeling of mine or possessiveness.
34	<i>Abhimana</i>	Pride or aggressive self-perception.
35	<i>Garva</i>	Arrogance or prideful self-concept
H. Emotion Vrittis (Emotion or Bhava based Vrittis or mental modifications based on emotions)		
36	<i>Bhaya</i>	Fear or psycho-physiological response to perceived existential threat.
37	<i>Krodha</i>	Anger or Hostile response to obstruction or frustration.
38	<i>Shoka</i>	Grief or sorrow arising from loss of attachments.
39	<i>Hasa</i>	Laughter or experience of joy, mirth or light hearted amusement.
40	<i>Ashcharya</i>	Wonder or astonishment evoked by unexpected or extraordinary or surprising phenomena.
I. Spiritual or Subtle Vrittis or (Vrittis based on philosophical thought which brings clarity and self-awareness)		
41	<i>Bhakti</i>	Devotion or Surrendering to the God.

Thematic Clusters	Sanskrit Name	English Equivalent
42	<i>Shraddha</i>	Faith or
43	<i>Manana</i>	Reflection or actively memorizing and thinking upon with logical systems.
44	<i>Daya</i>	Kindness towards to those who are suffering
45	<i>Kshama</i>	Forgiveness or letting go of resentment or hurt easily.
J Pathological Vrittis (Distracted Vrittis)		
46	<i>Vikshepa</i>	Distracted or Scattering of mind/ attention/ mental state.
47	<i>Udvega</i>	Anxiety or imagined fear leading physiological changes
48	<i>Asamadhi</i>	Restlessness or disturbed/unsettled consciousness/mind.
49	<i>Vipralabdha</i>	Cognitive loss or Cognition clouded by illusion.
50	<i>Sammoha</i>	Mental for or deluded/ confused state of mind.

This comprehensive list encapsulates the intricacies of inner world experiences (*Chitta-vrittis*) and is applicable in contemplative practices, psychotherapy investigations, and neuroscientific modelling. Each *vritti*, although classified here for analytical reasons, is interdependent with others. Fear (*Bhaya*) may emerge as a misperception (*Viparyaya*), driven by recollection (*Smriti*), and perpetuated by fantasy (*Vikalpa*). The interrelation of *vrittis* reflects the cohesive structure of neuronal networks within the brain.

This list highlights the dual potential of *vrittis* each can either conceal or disclose the essence of the self, contingent upon its management. *Shraddha* (faith) fosters advancement when properly nurtured, but *Moha* (illusion) results in spiritual ignorance. The subsequent section analyses the correlation between these *vrittis* and the biological processes and structures within the brain.

Mapping Five Fundamental Types of *Chitta-Vrittis* to Biological Correlates

The fundamental basis of *Chitta-vrittis* resides in the brain's complex neuronal circuits that govern cognition, emotion, perception, and memory. From the perspective of contemporary neuroscience, each *vritti* despite its origins in ancient Yogic psychology can be linked to specific bodily systems. This section correlates several core *vrittis* from the traditional enumeration and the thematic expansion with their neurological equivalents, synthesising insights from emotional

neuroscience, neurocognitive research, and contemplative science.

1. Pramana (Valid Cognition) and Sensory-Cognitive Pathways: Pramana, or valid cognition, encompasses precise perception, inference, or literary understanding. This pertains to optimum sensory processing and integration among brain regions, including the primary sensory cortices (visual, auditory, somatosensory), the thalamus, and the prefrontal cortex [Davidson & Begley, 2012, p. 114].⁸ The occipital and temporal cortices support Pratyaksha (direct perception), whereas Anumana (inference) involves working memory and executive functions associated with the dorsolateral prefrontal cortex. During linguistic interpretation, the Agama (authoritative testimony) activates language processing regions, including Broca's and Wernicke's areas. Practical cognition necessitates the synthesis of bottom-up sensory inputs and top-down attentional regulation, facilitated by the salience network and the dorsal attention network [Tang *et al.*, 2015].⁹ Neuroplasticity, particularly through brain-derived neurotrophic factor (BDNF), maintains perceptual clarity and decision-making accuracy [Praag *et al.*, 2006].¹⁰

2. Viparyaya (False Cognition) and Perceptual Error: *Viparyaya* refers to cognition that fails to align with the thing's true nature. This has significant neuropsychological ramifications in scenarios such as illusions, hallucinations, and cognitive distortions. The erroneous identification of a rope as a snake may stem from impaired visual processing in the brain, coupled with a hyperactive amygdala eliciting a panic reaction [LeDoux, 1996, p. 145].¹¹ The interaction among the thalamus (sensory relay), amygdala (emotional significance), and hippocampus (memory) underpins many manifestations of erroneous cognition. The misinterpretation of stimuli can be intensified by increased stress reactivity, as noted in [Sapolsky 2004],¹² and by compromised regulation from the medial prefrontal cortex [McEwen, 1998].¹³

3. Vikalpa (Imaginary Cognition): *Vikalpa* pertains to cognition that relies solely

on language or conceptual frameworks, devoid of any basis in experience, and is associated with the Default Mode Network (DMN). It is intricately linked to self-generated tales, reverie, and reflective thought. This corresponds with the default mode network (DMN) function, comprising the medial prefrontal cortex, posterior cingulate cortex, and angular gyrus [Vago & Zeidan, 2016].¹⁴ The DMN activates during rest and mind-wandering, playing a role in internal simulations, planning, and hallucinations. *Vikalpa* activates linguistic regions in the brain, including the left inferior frontal gyrus (Broca's area) and the superior temporal gyrus (Wernicke's area), rendering it a powerful catalyst for unrestrained mental growth [Cryan, J. F. and Dinan, T. G., 2012].¹⁵

4. Nidra (Sleep as a Vritti) and Sleep Architecture:

Nidra is a cognitive alteration characterised by a state of absence or unconsciousness. Contemporary sleep research delineates two primary states REM and non-REM sleep essential for psychological well-being. *Nidra* neurobiologically correlates with variations in cortical arousal and neurotransmitter activity across sleep stages [Born et al., 2011].¹⁶ Non-REM sleep is linked to memory consolidation and cellular repair, supported by slow-wave oscillations in the neocortex and thalamus. REM sleep, characterised by rapid eye movements and vivid dreams, is associated with emotional regulation and is controlled by pontine and limbic circuits. The glymphatic system, responsible for eliminating metabolic waste during sleep, also enhances cognitive clarity [Iliff et al., 2013].¹⁷

5. Smriti (Memory) and Hippocampal Encoding:

Smriti, or memory, refers to the retention and retrieval of previous impressions. It is based on the role of the hippocampus, which encodes new experiences, and the neocortex, which retains long-term memories [Thompson, 1990].¹⁸ Memory retrieval engages the prefrontal cortex and is modulated by emotional significance from the amygdala [Nestler et al., 2016].¹⁹ Chronic stress hinders memory development by

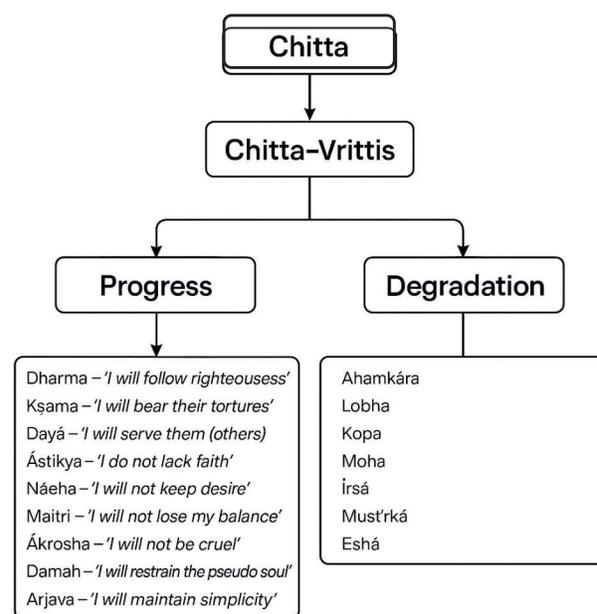
increasing cortisol levels, which harm hippocampus neurones [McEwen, 1998].²⁰ In contrast, techniques such as mindfulness and meditation have been demonstrated to enhance grey matter density in memory-associated areas [Holzel et al., 2011],²¹ illustrating the malleability of *Smriti* within yogic disciplines.

Expansion Vrittis and Neural Models:

Some of additional *vrittis* from the thematic expansion have also been biologically correlated as follow, not entire list of 50 *Chitta-Vrittis*.

Raga (Attachment) and *Dwesha* (Aversion) engage reward circuitry (ventral striatum) and avoidance mechanisms (insula, periaqueductal grey). *Krodha* (Anger): Associated with dysregulation of the orbitofrontal cortex and increased activity in the amygdala. *Shraddha* (Faith): Correlates with activation in the medial prefrontal cortex and anterior cingulate, areas linked to trust and belief. *Viveka* (Discernment): Activates the lateral prefrontal cortex and insular circuits associated with metacognition and self-awareness. *Samskara* (Latent Impressions): Comparable to implicit memory and neural patterns retained in the basal ganglia and cortical microcircuits.

This neurobiological mapping validates Yogic principles within contemporary research and offers instruments for therapeutic regulation via neurofeedback, behavioural intervention, and contemplative practices.



DISCUSSION

The biological mapping of *Chitta-vrittis* provides significant insights into consciousness at the convergence of Yogic psychology and neuroscience. It enables us to articulate conventional philosophical concepts with observable physiological functioning. The comprehensive list of 50 *vrittis* offers a detailed comprehension of mental changes encompassing emotional, cognitive, and behavioural phenomena.

This mapping promotes a more rigorous discourse between Eastern contemplative traditions and Western science. Yogic writings underscore the significance of mental alterations in influencing pain and/or stress (*dukkha*) and ultimate freedom (*kaivalya*). Neuroscience offers comprehensive insights into how patterns of cerebral activity facilitate or obstruct emotional regulation and cognitive clarity. By associating *vrittis* such as *Raga*, *Krodha*, and *Dwesha* with neural structures including the amygdala, striatum, and prefrontal cortex, researchers and practitioners acquire a practical comprehension of how specific mental inclinations result in neurophysiological imbalance and psychological distress [Davidson & Begley, 2012].²²

Furthermore, the interaction between *vrittis* and neuroplasticity underscores the adaptability of the human brain. Yogic practices seek to diminish *vrittis* through meditation, ethical living, and the disciplined interplay of practice and detachment (*Abhyasa and Vairagya*). Contemporary research indicates that these practices can enhance grey matter density and functional connectivity in brain regions linked to attention, empathy, and emotional regulation [Holzel *et al.*, 2011].²³ For example, the diminishment of *Viparyaya* and *Vikalpa* by mindfulness practices has been associated with reduced activity in the default mode network, a brain system linked to rumination and internal narrative [Vago & Zeidan, 2016].²⁴

Significantly, *Chitta-vrittis* function as indicators of mental well-being. Mental disorders such as anxiety, depression, PTSD, and substance addiction may be viewed as dominance or dysregulation of specific *vrittis*. For instance, persistent *Smriti* (intrusive memory) in PTSD and *Viparyaya* in delusional disorders exhibit significant neurological

connections. Identifying them can enhance treatment interventions integrating Yogic techniques with cognitive-behavioural and neurofeedback methodologies.

The notion of *Samskara* latent impressions also provides significant clinical insights. It strongly corresponds with the neurobiological comprehension of implicit memory, habitual patterns, and conditioned reactions encoded within the basal ganglia and cortical-subcortical circuits [Thompson, 1990].²⁵ The behavioural transformation in Yoga corresponds to the reconfiguration of entrenched brain processes.

In integrative psychology, these linkages provide a holistic psycho-neuro-spiritual paradigm. They allow therapists, educators, and contemplative scientists to perceive mental states not just as fleeting feelings but as functionally significant patterns that can be reconfigured. Yoga-based therapy, when customised to target particular mental states and inner experiences (*vrittis*), may effectively complement traditional psychotherapies [Streeter *et al.*, 2012].²⁶

The thematic extension and neurological foundation of *Chitta-vrittis* substantiate the scientific legitimacy of Yogic insights and offer a framework for their practical use in psychological recovery, education, and spiritual development. This discourse connects the ancient with the contemporary, the internal with the external, providing a cohesive framework for comprehending human awareness.

CONCLUSION

This essay offers a novel endeavour to integrate the traditional Yogic concept of *Chitta-Vrittis* within a thorough neurological framework. The study substantiates a cohesive model of consciousness by thematically expanding and biologically mapping 50 *vrittis*. These integrative approaches enhance Yogic psychology and contemporary neuroscience, facilitating multidisciplinary avenues for mental health treatment, education, and personal development.

This study has conducted a comprehensive investigation into the molecular underpinnings of *Chitta-vrittis*, merging traditional Yogic insights with contemporary neuroscience. The article commenced with the fundamental definitions of *Chitta* and *Vrittis* in the

Yoga Sutras, then expanding beyond the conventional five-fold classification to a more extensive taxonomy of fifty *vrittis*, organised into 10 thematic areas. These expansions are not random; they represent specific cognitive, affective, and volitional processes identified in current psychological and neurobiological research.

The philosophical insights derived from *Patanjali*, *Vyasa's Bhashya*, and *Samkhya* philosophy establish the ontological foundation for comprehending the nature of mental alterations (*Chitta-vrittis*). With its comprehensive list of *vrittis*, this framework facilitates a nuanced comprehension of the human psyche and its internal variations. When correlated with brain processes, these *vrittis* demonstrate associations with central cognitive systems, including the default mode network, limbic structures, and prefrontal executive regions, substantiating the Yogic assertion that mental activity is impactful and malleable.

Neuroscientific research confirms that techniques for *vritti* regulation such as mindfulness, breath control, and ethical adherence can profoundly modify brain structure and function. The ramifications are significant: cognitive lucidity, emotional equilibrium, and spiritual enlightenment are achievable results that align with quantifiable neurobiological changes. The paradigm additionally accommodates the application of Yogic frameworks in clinical psychology, especially for diseases such as anxiety, PTSD, mood disorders, and addiction, where *vritti* dysregulation is frequently apparent.

Future studies should continue to amalgamate qualitative and quantitative methodologies to investigate the manifestation of specific *vrittis* in cerebral activity and behaviour. Advancing diagnostic instruments and tailored interventions grounded in *vritti* profiles may signify a transformative trajectory in mental health care. Educational systems and contemplative neuroscience may also benefit from embracing this integrated perspective to cultivate inner stability and cognitive superiority.

In conclusion, the biological underpinnings of *Chitta-vrittis* offer a coherent, evidence-based framework that facilitates a productive conversation between the ancient discipline of Yoga and contemporary scientific inquiry. This

synthesis does not diminish the metaphysical nature of Yoga but rather amplifies its applicability and significance in a world pursuing integrative, holistic paradigms of mental and spiritual well-being.

Limitation

1. There can possibly be more than 50 *Chitta-vrittis*, which are not studied here.
2. The 50 *Chitta-vrittis* are not categorised into painful [*Klishta*] and [*Aklishta*].

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