

Beyond Neurocentrism: Toward an Embodied, Predictive and Integrative Framework for Consciousness

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Abstract: The prevailing neurological orthodoxy equates the mind with neuronal activation. While empirically grounded, this reductionist paradigm fails to account for subjective experience, altered states of consciousness, and the profound influence of the body on cognition. This opinion challenges the neurocentric assumption and proposes a radical redefinition: The mind is an emergent, dynamic, predictive, and nonlinear process arising from the continuous integration of all intentional (cognitive) and non-intentional (affective, homeostatic, and interoceptive) psychological processes occurring throughout the living body, constantly reconciling internal bodily needs with external environmental demands. Drawing on predictive processing theory, embodied cognition, complex systems dynamics, and recent work on interoception and homeostatic feelings, it is argued that consciousness is not a binary neural switch but a nonlinear spectrum of bodily-cognitive integration. This framework offers novel implications for psychiatry, medicine, artificial intelligence, and clinical diagnostics.

Keywords: Consciousness, Neurocentrism, Embodied Cognition, Predictive Processing, Interoception, Integration, Nonlinearity.

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I. INTRODUCTION

The dominant narrative in modern cognitive science is seductive in its simplicity: neural activation gives rise to the mind. Neural activation refers to the brain's mechanism of relaying information through electrical impulses and chemical neurotransmitters, which enable communication across synapses. This dynamic process sustains every aspect of brain function, ranging from the coordination of motor activities to the execution of advanced cognitive tasks such as problem-solving, memory retrieval, and judgment. This statement, while empirically grounded, commits a classic category error. It confuses the necessary conditions for consciousness with the sufficient explanation of it.

The neurological perspective fails on two critical fronts. First is what philosophers call the Hard Problem of Consciousness. Neuroscience can tell us which neural pathways become active when we experience pain or perceive the color green. But it cannot explain why those particular patterns of activity produce a subjective, first-person experience. It cannot tell us why they actually feel like something from within [1]. This explanatory gap has led some to propose that consciousness may emerge not from neural activity alone, but from the vibrational dynamics of biomolecules within the cellular environment. According to

this view, molecular oscillations carry informational signatures that are encoded and processed by neural networks, potentially providing the missing link between objective neural events and subjective sensory qualities [2,3]. Second, there is the Embodiment Gap. The brain does not function in isolation. Rather, it is embedded within a living, breathing body, awash in hormones and signaling molecules. It constantly receives internal sensory signals from the heart, lungs, and digestive system, while also taking in information from the external environment. Any theoretical model of the mind that overlooks these bodily inputs is inherently incomplete [4,5]. As Damasio and Damasio have argued, homeostatic feelings are the natural grounding of consciousness. These feelings range from hunger and thirst to the subtle sensations of cardiac function. They inform the mind that there is a process of life going on within that same organism [6]. To understand the mind, it is necessary to look not at the neurons in isolation, but between the psychological processes they instantiate across the entire living body.

II. A NEW ONTOLOGY: THE FIVE PILLARS

To move beyond the neurocentric perspective, it is necessary to abandon the idea that the mind is a 'thing' located in the head and embrace it as a process spanning the entire organism. This opinion proposes a definition built upon five

inseparable pillars: *"The mind is an emergent, dynamic, predictive, and nonlinear process arising from the continuous integration of all intentional (cognitive) and non-intentional (affective, homeostatic, and interoceptive) psychological processes occurring throughout the living body, constantly reconciling internal bodily needs with external environmental demands."* This definition comprises five inseparable pillars.

➤ *First, the Mind is Emergent and Dynamic*

The mind is not a substance confined within the skull. It is more like a flame or a whirlpool, a phenomenon that demands a continuous supply of energy and ongoing interaction to sustain itself. It must regulate the body's internal organs and exchange information with the surrounding environment. Much of this processing happens beneath conscious awareness. Our subconscious mind continuously processes information from both the outer world and the inner bodily milieu, often without our knowing. This fact highlights the permeable and reciprocal boundary between the mind and its broader internal and external environments. As enactive approaches contend, the mind is a distributed system that extends across the body, brain, and environment. Internal neural processes are indeed important, yet they are not inherently more significant than external bodily and material [5,7].

➤ *Second, the Mind is Predictive*

The mind is not a passive receiver of the world; it is an active anticipator. Drawing on the Free Energy Principle [8] and predictive processing frameworks [9], the mind continuously generates expectations about incoming sensory signals and internal bodily states, then tests these predictions against actual experience, adjusting its internal models accordingly. A recent and thought-provoking perspective in neuroscience suggests that human emotions may be interpreted through the lens of thermodynamics and information theory. Scientists are developing models in which emotions are analogous to fluctuations in a system's energy state, governed by principles of free energy and entropy. While it is too early to claim that emotions are literally products of energy, this research proposes that emotional states such as arousal and valence can be mathematically linked to the brain's internal processes of prediction and uncertainty reduction. However, this remains a theoretical framework, and current research acknowledges that a causal link between energy and specific emotions has not yet been established [10]. This predictive process is not confined to the brain. It draws upon a continuous stream of information circulating within the body, including hormonal signals, immune molecules, and the unique vibrational signatures of biomolecules and cells, alongside sensory input from the external environment. The immune, endocrine, and autonomic systems each contribute distinct informational signals that refine the brain's internal predictions. These signals are integrated through oscillatory wave patterns and resonant information transfer, allowing the organism to synchronize its internal states with external demands. At the same time, interoceptive signals arising from the heart, lungs, and gut carry evolutionary priority, as their accurate prediction is essential for survival and allostatic regulation.

Anxiety, for instance, is not merely a feeling; it is the brain's prediction of a bodily threat before it occurs, preparing the body for danger in advance of the actual event [5,11-13]. The predictive mind, therefore, is not a disembodied computer; it is a deeply embodied, multiscale system that integrates molecular, cellular, organ-level, and environmental information into a coherent anticipatory model of reality.

➤ *Third, the Mind Relies on Continuous Integration*

The degree of consciousness is directly proportional to the degree of integration between its parts. High integration yields waking lucidity. Low integration yields dreamless sleep. Fragmented or decoupled integration yields anesthesia or psychosis. The Domain Loop Model proposes that consciousness emerges through three hierarchically organized domains: interoceptive (whole-body homeostatic computation), exteroceptive (environmental information), and narrator (integration that constitutes conscious experience) [14-16]. However, the model does not fully specify how these three domains are integrated. To better understand this integration, it is rational to propose that all three domains communicate through two complementary mechanisms: signaling pathways, which carry biochemical messages across the body and brain, and oscillatory wave patterns, which synchronize neural activity across distributed networks. Oscillatory synchronization is now recognized as one of the key mechanisms for integrating information across brain regions [11,17]. At the same time, signaling pathways provide the physiological substrate through which bodily states influence neural dynamics. These pathways range from immune molecules to neurotransmitters. Together, these mechanisms may constitute the integrative language through which interoceptive, exteroceptive, and narrator domains converge into unified conscious experience.

➤ *Fourth, the Mind Operates on Two Psychological Engines: Intentional and Non-Intentional*

- Intentional processes (from the philosophical term *intentionality*, meaning "aboutness") encompass cognition: thoughts, memories, language, beliefs, and deliberate planning. They constitute the mind's narrative voice.
- Non-intentional processes encompass the background hum of existence: interoception (the sense of the internal body), homeostasis (temperature, pH, blood sugar), circadian rhythms, and affective tone (baseline mood and arousal).

Recent work on embodied predictive processing identifies three ways the body actively contributes to minimizing prediction error. First, the body regulates cognitive activity, ensuring that cognition and action remain tightly coupled. Second, the body carries part of the cognitive load, offloading some processing from the brain. Third, the body constrains the information available to the agent, shaping what can be perceived and acted upon [4,18-20]. Yet these three roles only hint at a deeper truth. To minimize prediction error, the organism listens to signals from every biomolecule, every cell, and every organ. Each one speaks with its own unique vibrational signature and oscillatory

pattern. The immune system, the endocrine system, and the autonomic nervous system all join this continuous, multiscale conversation. Each contributes its own informational signature to refine the brain's internal model. Neither engine works alone. The mind emerges precisely where they meet.

➤ *Fifth, and Crucially, the Mind is Nonlinear*

In complex dynamical systems, the relationship between cause and effect is not proportional. A small input can produce a massive output; a large input can produce no effect at all [21-22,5]. The mind exhibits this nonlinear character in several observable ways:

- **Phase transitions:** The shift from wakefulness to sleep, from consciousness to anesthesia, or from depression to remission are not gradual, proportional changes. They are *critical transitions*—abrupt, qualitative shifts in the state of the system. A small change in neurotransmitter concentration or metabolic load can tip the entire mind into a fundamentally different regime [8,23].
- **Hysteresis and history-dependence:** The mind's current state depends not only on present inputs but on its past trajectory. A person who has experienced trauma will respond to a minor bodily sensation with a disproportionate fear response. The system carries memory, and its sensitivity to inputs is shaped by its nonlinear history [21].
- **Self-organization and criticality:** The healthy mind operates at the edge of chaos, a state where information processing is optimized. In this state, neuronal activity follows a pattern known as power-law distribution. This means that most events are small, but occasional large events occur [24]. This critical balance allows the mind to remain maximally responsive to stimuli while avoiding instability. When this balance is disrupted, consciousness becomes impaired. Disruption can take two forms. Excessive synchronization, as seen in epilepsy, tips the system toward rigid order. Excessive desynchronization, as seen in coma, tips it toward chaotic disorder. Both states disrupt the delicate balance required for conscious experience.
- **Non-proportionality of body-mind interaction:** A small change in heart rate variability or a brief bout of deep breathing can dramatically alter mood and cognition. Conversely, a massive flood of sensory input can be completely ignored by a focused mind. The mapping from bodily state to conscious experience is not one-to-one; it is mediated by nonlinear predictive dynamics [25,26].

By incorporating nonlinearity, the definition acknowledges that the mind is not a machine that processes inputs and produces outputs in a predictable, proportional manner. It is a living, self-organizing, metastable system that can be tipped, transformed, and sometimes even healed through small, targeted interventions [22,27].

III. THE STRESS TEST: ALTERED STATES OF CONSCIOUSNESS

The ultimate test of any definition of mind lies in its ability to explain altered states. The neurological view struggles here. It forces a binary choice. Either the neurons are firing, which means the person is conscious, or they are not, which means the person is unconscious. The present definition offers a far more elegant and graduated alternative, which we call the *Spectrum of Integration*. However, this spectrum is not a linear continuum. It is a nonlinear landscape of possible states, separated by thresholds or bifurcations. A small decrease in neural connectivity can produce a sudden collapse into unconsciousness (anesthesia), while a small increase in interoceptive awareness can produce a sudden expansion into psychedelic or meditative states. The transitions between these states are not gradual; they are *phase transitions*—a hallmark of nonlinear complex systems [22,23]. Consider dreamless deep sleep, also known as NREM Stage 3. Intentional cognitive processes vanish entirely. There are no thoughts, no narratives, no self-awareness. However, non-intentional processes continue without interruption. The brainstem regulates breathing. The glymphatic system clears metabolic waste. Circadian rhythms maintain the body's core temperature. Under this definition, the mind does not simply turn off. Instead, it collapses into a minimal biological core, a contentless and primitive state of pure existence. This explains why, upon waking, we feel the continuity of time even without memories of dreams. Now consider general anesthesia. Drugs like propofol do not simply slow down the mind. They pharmacologically sever the physical infrastructure required for thalamocortical integration. Non-intentional processes like heartbeat, respiration, and blood pressure persist, but they are fundamentally decoupled from the higher cortex. In this state, the higher-order self, the narrative "I" that tells our story, disappears entirely. What remains is a primitive, unconscious life-regulatory process that keeps the body alive. The mind, in any meaningful experiential sense, ceases to exist, even though the body continues to function. This distinction aligns with the view of Damasio and Damasio [6], who argue that consciousness depends on three processes: first, the continuous generation of interoceptive feelings (the sense of the body's internal state); second, the production of images from the organism's sensory perspective; and third, the combination of feeling and perspective into a unified subjective experience. Under anesthesia, the first persists while the latter two are disrupted. Consciousness, therefore, is not a light switch. It is a nonlinear dimmer, controlled by the quality and stability of integration between cognition and the living body.

IV. IMPLICATIONS FOR SCIENCE AND SOCIETY

If this new definition is adopted, its implications ripple outward across multiple disciplines.

➤ For Psychiatry:

Depression, anxiety, and chronic stress are no longer viewed as mere "chemical imbalances" or isolated "cognitive distortions." They are understood as *disorders of integration*—breakdowns in the predictive dialogue between bodily (non-intentional) fatigue and cognitive (intentional) self-appraisal. The Domain Loop Model suggests that "interoceptive signals carry evolutionary priority due to the existential consequences of homeostatic failure," creating "vulnerabilities" that can manifest as chronic anxiety [28]. Effective therapy must therefore address both the homeostatic state of the body (sleep, nutrition, vagal tone) and the narrative content of the mind. The two are inextricably linked.

➤ For Medicine and Holistic Healthcare:

Beyond psychiatry, this definition provides a unified theoretical foundation for holistic and integrative medicine. By recognizing that the mind emerges from the continuous integration of cognitive and bodily-homeostatic processes, it validates the clinical intuition that physical health and mental health are inseparable. Chronic pain, for instance, is not merely a peripheral nociceptive signal but a disorder of predictive integration, where the brain's expectations about bodily states become pathologically rigid [29]. In the same way, conditions like irritable bowel syndrome, fibromyalgia, and chronic fatigue can be seen as disruptions in the ongoing conversation between bodily signals and conscious interpretation [30]. Crucially, the recognition of nonlinearity transforms therapeutic expectations. A linear model expects that a proportional dose of a drug or therapy produces a proportional change in symptoms. A nonlinear model sees things differently. It recognizes that a system may hold steady against change until a critical point is crossed. Then, quite suddenly, it can reorganize itself. This explains why some patients experience sudden breakthroughs in therapy after months of little progress. It also explains why tiny doses of psychedelics can sometimes produce deep and lasting change [23]. This insight also supports the clinical value of interventions that might seem small, like improving sleep, adjusting diet, or practicing breathing exercises. Under the right conditions, these small changes can push a nonlinear system across a critical threshold toward better health [8]. This framework encourages therapeutic approaches that address both the body and the mind. The body can be supported through nutrition, sleep, vagal nerve stimulation, and physical activity. The mind can be supported through cognitive-behavioral therapy, mindfulness, and psychoeducation. By doing so, it provides a scientifically sound basis for multimodal, patient-centered care, bridging the gap between the biomedical model and the biopsychosocial approach [31-32,5].

➤ For Artificial Intelligence:

This definition draws a stark, non-negotiable boundary between biological minds and synthetic machines. No matter how sophisticated a Large Language Model becomes, it possesses *zero non-intentional psychological processes*. It has no interoception, no hunger, no circadian rhythm, and no autonomic nervous system. Moreover, it lacks the nonlinear, self-organizing, critical dynamics that characterize biological consciousness. It can simulate intentionality with remarkable fluency, but it can never genuinely possess a mind, because it lacks the living, physiological substrate and the nonlinear complexity required for genuine experience [26].

➤ For End-of-Life Care:

By defining the mind as a nonlinear spectrum of bodily-psychological integration, it becomes possible to move beyond the crude binary of "conscious" versus "vegetative." In cases of coma or severe brain injury, the question ceases to be, "Is there a person in there?" and becomes, "To what degree are their intentional and non-intentional processes still integrated, and can that integration be therapeutically restored? Previous research has shown that vagus nerve stimulation (VNS) facilitates the restoration of consciousness in rats experiencing coma, supporting the view that neuromodulation can promote recovery of consciousness through enhanced functional connectivity across consciousness-related networks [33]. At the same time, advances in neuroimaging have demonstrated that nonlinear EEG parameters such as Approximate Entropy (ApEn), Lempel–Ziv Complexity (LZC), and Correlation Dimension (D2) can distinguish between minimally conscious states and vegetative states, offering promising biomarkers for clinical assessment and intervention [34]. Furthermore, emerging evidence shows that biomolecule misfolding, such as the aggregation of amyloid proteins, generates unique vibrational signatures that can disrupt normal oscillatory dynamics at the molecular level. Scientists can now detect these structural changes using advanced techniques like infrared and Raman spectroscopy, which capture the characteristic spectral patterns of misfolded proteins. These abnormal wave patterns can spread through neural networks and potentially interfere with the brain's ability to integrate internal bodily signals, external sensory input, and self-narrative. Research has demonstrated that amyloid- β peptides can desynchronize neuronal firing and degrade gamma oscillations in the hippocampus, the brain region essential for memory and conscious processing. This disruption contributes to altered conscious states and cognitive decline. By bringing together clinical neuromodulation, molecular vibrational dynamics, and nonlinear EEG biomarkers, this integrated approach provides both greater diagnostic precision and deeper ethical respect for patients and their families [35].

V. CONCLUSION: THE LIVING SYMPHONY

The brain is the orchestra and conductor; the body is the concert hall. But neither is the sole musician. The heart has its rhythm, the lungs their tide, the gut its own quiet intelligence. Each organ plays its part, each with its own tempo, its own voice. Health is their harmony; disorder, their dissonance. Intentional processes are the melody; non-intentional processes are the resonance and acoustics that give the melody weight and depth. And nonlinearity is the improvisation—the unexpected modulations, the sudden crescendos and silences that make the music alive rather than mechanical. The mind, then, is not a single score performed by one instrument. It is the living symphony of the whole body, conducted by the brain, but composed by life itself [3,11-12].

The definition proposed here does not deny the brain's centrality. It insists that the brain does not work alone. The mind is the living dialogue between the body's internal needs and the world's external demands, continuous, predictive, dynamic, and profoundly nonlinear. It waxes and wanes with sleep, shatters under anesthesia, dissolves at death, and can be transformed by the smallest of interventions. As embodied, embedded predictive processing accounts suggest, the predictive mind is also a deeply embodied mind, and a complete picture of human intelligence requires us to explore the many ways that a predictive brain is embodied in a living body and embedded in the social-cultural world in which it was born and lives. To study the mind is to study life itself, in all its complexity, unpredictability, and emergent beauty. This framework carries implications that extend across clinical practice, biomedical science, artificial intelligence, and beyond. Disorders of consciousness and selfhood may be reconsidered not merely as localized neural dysfunctions but as disruptions of embodied predictive engagement with the world, pointing toward interventions that address the broader person-environment system. Health itself may be reframed as the adaptive maintenance of predictive regulation across biological, psychological, and social domains, supporting more integrative models of care. For artificial intelligence, the challenge is substantial: if intelligence is genuinely embodied, situated, and relational, then the development of truly intelligent systems may require moving beyond disembodied computation toward architectures embedded in rich, dynamic environments. More broadly, this framework calls for sustained dialogue between neuroscience, philosophy, and the human sciences, one that does justice to the lived and relational character of mind. The path forward is not to confine consciousness to the brain alone, but to understand it as an emergent property of a body-brain-world continuum, ever predicting, ever adapting, ever becoming.

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