Consciousness in the Brain: An Integrative Review of Contemporary Theories

Abstract

Understanding consciousness has been a longstanding challenge at the intersection of neuroscience, philosophy, and cognitive science. Despite tremendous advances in neuroimaging and electrophysiological methods, a unifying theory explaining the neural basis of consciousness remains elusive. This review synthesizes major contemporary theories of consciousness, including the Global Neuronal Workspace Theory (GNWT), Integrated Information Theory (IIT), Recurrent Processing Theory (RPT), Dendritic Integration Theory (DIT), Predictive Processing (PP), and the Memory Theory of Consciousness (MToC). We explore their philosophical underpinnings, empirical support, and the extent to which they explain both phenomenal consciousness (the subjective experience) and access consciousness (the functional availability of information for report and behavior). Drawing from a wide range of clinical, theoretical, and computational literature, this review proposes a multiscale framework to reconcile seemingly divergent theories by focusing on their complementary mechanisms. We argue that a pluralistic and integrative approach that includes temporal, structural, and functional dimensions of brain activity may offer the most promising path forward in consciousness research.

1. Introduction

Consciousness—the subjective awareness of internal and external stimuli—remains one of the most complex and elusive phenomena in neuroscience and philosophy. At its essence, consciousness can be divided into two domains: *phenomenal consciousness*, which involves the first-person experiential aspect of what it feels like to see a color, hear music, or experience pain; and *access consciousness*, which pertains to the availability of information for reasoning, decision-making, behavior, and verbal report [1]. The enduring "hard problem" of consciousness, famously articulated by philosopher David Chalmers, concerns how physical processes in the brain give rise to these subjective experiences [2]. By contrast, the so-called "easy problems" focus on uncovering the neural mechanisms underlying cognition and perception—complex challenges in their own right [3].

Despite decades of research and numerous theories, consciousness remains poorly understood. Theoretical approaches vary widely—some emphasize the brain's structural organization, others its dynamic activity, the integration of information, or recurrent neural processing. This diversity has resulted in a fragmented landscape of ideas [4]. However, recent integrative reviews and collaborative efforts suggest that these different theories might not be mutually exclusive, but instead represent complementary levels of description or distinct facets of conscious experience.

Beyond neuroscience, broader perspectives on consciousness's origin and nature in the universe can be categorized into three main views:

(A) The dominant scientific materialist perspective holds that consciousness is not an independent entity but an emergent property arising from complex biological computations within brains and nervous systems through evolution [5,6,7]. Opinions vary regarding when consciousness first appeared—whether exclusively in humans or earlier in simpler organisms. Often seen as epiphenomenal (a secondary byproduct without causal power) or even illusory (constructing rather than directly perceiving reality), consciousness is nevertheless considered evolutionarily advantageous. In this view, consciousness is not intrinsic to the universe itself [7,8,9].

(B) In contrast, dualistic and spiritual viewpoints regard consciousness as a distinct, non-physical quality that has always existed in the universe. Philosophical dualism, religious doctrines, and spiritual traditions conceive consciousness as fundamental—sometimes as the "ground of being," a creator, or an omnipresent divine presence. Here, consciousness may influence physical matter and behavior but lies outside the domain of scientific explanation. Related ideas include panpsychism, which attributes a form of consciousness to all matter without clear scientific basis, and idealism, which asserts that consciousness is the only true reality, with the material world being illusory [10,11,12]. Under this viewpoint, we also propose Arachchige's Consciousness Interface Model (A-CIM), a framework positing that consciousness is an entity capable of interfacing with the central nervous system .

(C) A third perspective proposes that consciousness emerges from discrete physical events inherent to the universe's fabric—proto-conscious moments governed by physical laws not yet fully understood. Biological evolution developed mechanisms to orchestrate and couple these events to neuronal activity, producing meaningful conscious experiences capable of influencing behavior. This view is exemplified by the Penrose–Hameroff "orchestrated objective reduction" (Orch OR) theory, which identifies conscious moments with quantum state reductions occurring in brain microtubules. Such quantum events are proposed to have experiential qualities, making consciousness an intrinsic feature of the universe's operation [13-21].

In summary, contemporary discourse on consciousness spans from materialist science, which treats consciousness as a byproduct of brain activity, to spiritual and dualistic traditions that place consciousness beyond scientific inquiry, to emerging scientific frameworks that view consciousness as a fundamental component of physical reality . This paper seeks to critically evaluate and synthesize these diverse perspectives, exploring their areas of convergence and divergence, and considering pathways for their potential integration.

2. Theoretical Frameworks of Consciousness

2.1. Science/Materialism: Consciousness as Having No Distinctive Role

One of the most influential models of consciousness is the Global Neuronal Workspace Theory (GNWT), developed primarily by Stanislas Dehaene and colleagues [22]. This theory postulates that conscious access occurs when information is broadcast to a global workspace composed of long-range connections linking the prefrontal, parietal, and cingulate cortices. According to GNWT, various specialized processors operate unconsciously in parallel. When a piece of information becomes the focus of attention and is amplified sufficiently, it enters the global workspace, becoming available for verbal report, decision-making, and intentional action [22]. This "ignition" process is thought to be marked by late, sustained neural activity, particularly in the P3b component observed in event-related potentials. Empirical support for GNWT comes from studies using masked priming, binocular rivalry, and attentional blink paradigms [23,24,25]. Neuroimaging studies show that conscious perception is consistently associated with widespread frontoparietal activation, while unconscious processing remains confined to local sensory areas [26,27]. The theory emphasizes access consciousness, arguing that phenomenal consciousness may not exist independently of reportable content [22].

The Higher Order Theory (HO**T)** suggests that consciousness arises from meta-representations—representations of other mental representations—occurring at higher levels of processing. For instance, a visual scene such as a painting may first be represented in the visual cortex simply as patterns of color, like red and green areas. It becomes a conscious experience only when this lower-level information is transmitted to higher brain regions, particularly the prefrontal cortex, enabling self-reflective awareness, such as the thought, *"I am seeing a painting"* [28].

The Local Recurrency Theory (LRT) takes a different view, proposing that conscious experience can emerge from recurrent processing within sensory cortices alone. In this model, parietal and frontal brain regions are involved not in generating consciousness itself, but rather in enabling verbal reports and judgments about the stimulus [29,30].

The Memory Theory of Consciousness (MToC) argues that phenomenal consciousness evolved as part of episodic and other explicit memory systems, including sensory, working, and semantic memory [31,32]. This framework accounts for phenomena such as postdictive effects, where the conscious perception of a stimulus can be influenced by events occurring after the stimulus is presented. According to MToC, the cerebral cortex and hippocampus work together to sequentially integrate and time-stamp parallel unconscious processes, producing a coherent, linear flow of conscious experience. In this view, consciousness is essentially a form of memory, preceded by unconscious stages of perception, decision-making, or action [31,32]. Furthermore, it holds that different cortical regions generate distinct aspects of consciousness, each with its own specific neural correlates. This perspective is especially relevant for understanding conditions like delirium and amnesia, where the integrity of memory systems is compromised [31,32,33].

In contrast, the Integrated Information Theory (IIT), pioneered by Giulio Tononi, begins with phenomenology [34]. It asserts that consciousness corresponds to the capacity of a system to integrate information [35]. This capacity is quantified by a value called Phi (Φ), which represents the degree to which the whole system's information exceeds the sum of its parts [36]. IIT posits that high Φ systems are both highly differentiated and highly integrated, leading to a rich repertoire of possible states [37]. According to IIT, the physical substrate of consciousness resides in the "posterior hot zone" of the cortex, including the temporo-parietal-occipital junction, which shows high integration and complexity [38].

If theories such as HOT, GWT, IIT, or LRT were correct in proposing a cortical "hot zone" for consciousness, we would expect to see a specific type of cortical stroke that severely disrupts consciousness—yet no such lesion has been reported. In contrast, the MToC framework predicts that cortical strokes would impair certain qualities of phenomenal consciousness while leaving the overall level of consciousness intact [34-38].

The theory has inspired a range of empirical studies attempting to measure Φ through techniques such as the Perturbational Complexity Index (PCI), which involves stimulating the cortex with transcranial magnetic stimulation (TMS) and recording the complexity of the EEG response. IIT has been influential in discussions about disorders of consciousness, such as vegetative and minimally conscious states, where PCI can serve as a biomarker [34-38].

The Recurrent Processing Theory (RPT), introduced by Victor Lamme, takes a different route [39]. It argues that recurrent (feedback) interactions within sensory cortices are sufficient for consciousness, even in the absence of prefrontal involvement [40]. According to RPT, early feedforward sweeps through the sensory hierarchy are not conscious per se. Consciousness arises when there is sustained, recurrent processing between higher and lower areas, allowing for contextual modulation and perceptual binding [41]. This theory is supported by visual masking experiments and single-cell recordings in primates showing that recurrent activity correlates more strongly with perceptual awareness than feedforward responses. Unlike GNWT, RPT emphasizes phenomenal consciousness and downplays the role of report and higher cognitive functions [39-41].

The Dendritic Integration Theory (DIT), more recently proposed by Matthew Larkum and others, addresses consciousness at the cellular level. It focuses on the role of layer 5 pyramidal neurons, which possess dendrites that receive inputs from both lower and higher cortical areas [42]. According to DIT, these neurons act as coincidence detectors, integrating inputs from the apical and basal dendrites to produce bursts of activity that may underpin conscious experience. The theory suggests that conscious perception depends on the simultaneous activation of cortico-cortical and thalamo-cortical loops, with dendritic processing playing a central role. DIT represents a promising attempt to link cellular mechanisms to conscious phenomena, though it remains largely theoretical and in need of empirical validation [43].

Predictive Processing (PP) and Neurorepresentationalism (NREP) offer yet another lens. These theories conceptualize the brain as a hierarchical prediction machine that continuously generates and updates models of the world [44,45,46]. Consciousness, in this framework, may emerge from the precision-weighting of prediction errors and the updating of generative models. PP accounts for a wide array of phenomena, including illusions, hallucinations, and the effects of attention [46]. While not originally intended as a theory of consciousness per se, it has been extended to explain both the contents and levels of consciousness by linking them to model complexity and error minimization [47]. Some proponents argue that phenomenal consciousness corresponds to the content of high-level predictions, while access consciousness relates to the modulation of lower-level sensory prediction errors [44-48].

Category theory offers a formal insight called the Yoneda Lemma, an alternative, relational approach which formalizes entities in terms of their relationships to all others within a given domain [49]. According to the Yoneda Lemma, an object is fully determined by the pattern of relations it holds with every other object in its category. Applied to consciousness, this suggests that a given conscious state can be completely characterized by the lawful transitions into and out of it from all other possible states, rather than by its internal constitution alone. By defining categories of consciousness—whether in terms of levels or contents—we can exhaustively describe consciousness through its relational structure. This framework offers a potential gold standard for formalizing empirical research, such as mapping the structure of color qualia at the fovea and periphery, and for rigorously testing competing theories of consciousness by comparing their predicted relational patterns against observed data [49].

2.2. Dualism/Spirituality: Consciousness Existing Outside the Scientific Framework

Under this category, one of the most important theories is Eccles's dualist interactionism, a theory in the philosophy of mind that posits the existence of two distinct substances—the mental (mind or soul) and the physical (body/brain)—which interact causally [50,51]. Developed by neurophysiologist Sir John Eccles to account for consciousness and free will, the model proposes that mental events can influence physical processes and vice versa. Eccles introduced the concepts of *psychons*—units of conscious experience—and *dendrons*—neural assemblies in the cortex with which psychons interact. He suggested that psychons could modulate the probability of neuronal firing via quantum effects at synapses, providing a potential mechanism for mind–brain interaction without overtly violating physical laws [52]. This framework supports a libertarian view of free will, where the mind can exert top-down control over voluntary actions. Eccles argued that dualist interactionism offers a more complete causal explanation of mental phenomena than monistic materialism, which he saw as struggling to bridge the explanatory gap. However, the theory has been criticized for its speculative nature, the vague definition of key constructs, difficulties in empirical testing, and potential conflicts with conservation laws. Despite these challenges, it remains a landmark example of interactionist dualism in the modern philosophy of mind [52].

2.3. Science with Incomplete Laws: Consciousness as an Essential but Not Yet Fully Understood Component of Physical Reality

The Orch-OR theory proposes that consciousness arises from quantum processes within microtubules—tiny cylindrical structures inside neurons. These microtubules are thought to sustain quantum superpositions involving the states of tubulin proteins, representing multiple potential informational arrangements simultaneously [53,54]. Conscious moments occur when these quantum superpositions undergo Objective Reduction (OR), a physical collapse caused by an instability in spacetime geometry related to gravity, as proposed by Penrose [55]. Each such collapse corresponds to a discrete event of awareness, and the continuous flow of consciousness is seen as a sequence of these collapses, much like frames in a film. The brain "orchestrates" these quantum states by synaptic inputs and memory patterns, biasing the possible outcomes so that the collapse produces meaningful and experience-based results rather than random noise. The outcome of the collapse influences whether the neuron fires, effectively embedding the quantum event into classical neural processing, which links subjective awareness with physical brain activity. This theory contrasts with classical neuroscience, which views consciousness as emerging purely from complex neural computations. Instead, Orch-OR argues that consciousness fundamentally depends on a non-computable physical process rooted in quantum gravity and spacetime structure [56,57]. The theory also explains the timing of conscious moments, suggesting they occur roughly every 25–100 milliseconds, matching observed brain wave rhythms, such as gamma synchrony. Although the warm, wet brain was traditionally thought too noisy for quantum coherence, biological evidence from processes like photosynthesis and bird navigation shows that quantum coherence can exist at body temperature. Microtubules may provide a shielded environment supporting this coherence, and experiments have observed resonant vibrations and high-frequency oscillations in microtubules that could facilitate quantum processing in the brain [58,59].

3. Empirical and Clinical Correlates

Across these theoretical frameworks, a recurring theme is the identification of neural correlates of consciousness (NCCs). These are the minimal neural mechanisms sufficient to support a specific conscious experience. EEG and ERP components like the P300, visual awareness negativity (VAN), and the Pe component have been studied extensively [60,61,62]. The VAN, for example, is an early marker occurring around 200 ms post-stimulus and is thought to index perceptual awareness [63]. The P300, on the other hand, is associated with post-perceptual processes such as working memory updating and decision-making. These components have been used to distinguish between conscious and unconscious states in both healthy individuals and patients with disorders of consciousness [64]. Functional MRI studies have shown that conscious perception involves not just sensory cortices but also widespread activation in the frontoparietal network, supporting the GNWT framework. At the same time, recurrent interactions within visual cortices, emphasized by RPT, have also been validated through intracranial recordings [65].

Clinical applications of consciousness theories are most apparent in the assessment and management of patients with brain injuries. The Coma Recovery Scale-Revised (CRS-R) and the Glasgow Coma Scale (GCS) are commonly used clinical tools, but they rely heavily on behavioral responses [66]. Advanced techniques such as PCI and resting-state fMRI offer objective, brain-based measures of consciousness. For example, patients in a vegetative state may show covert consciousness through EEG responses to verbal commands, highlighting the dissociation between behavioral unresponsiveness and neural activity [67,68,69]. Such findings underscore the importance of theoretical frameworks that can account for both conscious content and level [67].

4. Toward an Integrative Approach

Despite their differences, contemporary theories of consciousness share several commonalities. Most agree that consciousness involves integration across multiple brain regions and levels of processing. Whether this integration occurs primarily in the posterior cortex, as in IIT, or the prefrontal cortex, as in GNWT, is still debated. Similarly, the role of recurrent processing is emphasized in both RPT and DIT, albeit at different spatial scales. What emerges is the possibility that these theories are not mutually exclusive but address different facets of the same phenomenon. For example, GNWT may explain access consciousness and cognitive control, while IIT and RPT focus on the core experience of awareness. DIT provides a cellular substrate, and PP offers a computational framework (Table 1).

Theory	Primary Focus	Neural Substrate	Consciousness Type	Empirical Markers
GNWT (Global Neuronal Workspace Theory)	Access	Frontoparietal cortex	Access consciousness	P3b, fMRI ignition
IIT (Integrated Information Theory)	Phenomenal	Posterior hot zone	Phenomenal consciousness	PCI, Φ (Phi) estimates
RPT (Recurrent Processing Theory)	Phenomenal	Visual cortex	Phenomenal consciousness	VAN, local recurrence
DIT (Dendritic Integration Theory)	Micro-scale integration	Layer 5 pyramidal neurons	Mixed (phenomenal & access)	Dendritic spikes (theoretical)
PP (Predictive Processing)	Computational modeling	Hierarchical neural networks	Both phenomenal & access	Prediction errors, precision-weighting
HOT (Higher-Order Theories)	Meta-awareness	Prefrontal cortex	Access consciousness	Metacognition, confidence ratings
MToC (Memory Theory of Consciousness)	Reconstructed memory	Hippocampus, related cortex	Phenomenal consciousness	Postdictive effects, amnesia patterns

Table 1. Summary of Contemporary Theories of Consciousness

An integrative approach would involve specifying the conditions under which different mechanisms contribute to consciousness. This may require a multiscale model incorporating cellular, network, and system-level processes. Such a model would acknowledge that consciousness is not a monolithic entity but a dynamic, multifaceted process. Future research should aim at empirically testing the predictions of each theory in overlapping experimental paradigms. Cross-disciplinary collaborations, including philosophy, computational modeling, and clinical neuroscience, will be essential in refining our understanding.

Need for alternative frameworks

The dominant neuroscientific materialist perspective holds that consciousness emerges entirely from complex neuronal activity and information processing within the brain's neural networks. According to this view, advanced computational systems—such as deep learning networks, video cameras, or artificial intelligence—lack consciousness because they do not replicate the full complexity and organization of neuronal substrates. However, this explanation remains incomplete and contested. Critics point out that complex processing alone does not account for the qualitative, subjective aspects of conscious experience, often referred to as the "hard problem" of consciousness [70,71].

Notably, Hameroff and Penrose have emphasized that even unicellular organisms such as *Physarum polycephalum* (slime mold) can navigate mazes and solve problems, while *Paramecium* demonstrates intelligent behaviors including swimming, locating food and mates, learning, memory, and sexual reproduction—all in the absence of synaptic connections or a nervous system [72,73]. These phenomena suggest that intelligent, goal-directed behavior and rudimentary forms of information processing occur outside the conventional neural architecture. Such findings challenge purely neuron-centric models and support the need for alternative frameworks—such as the Arachchige's Consciousness Interface Model—that accommodate consciousness or proto-conscious processes as fundamental and not solely reducible to neural computation.

5. Arachchige's Consciousness Interface Model

In this section, we describe *Arachchige's Consciousness Interface Model* (A-CIM), a novel theoretical framework that conceptualizes consciousness as an independent entity dynamically interfacing with the central nervous system (CNS) to generate awareness and cognition. While interface concepts between consciousness and neural processes have appeared in prior theories, A-CIM distinguishes itself by integrating cultural cosmology, trance phenomenology, and neuroscience to explain mechanisms underlying non-local perception and possession phenomena.

Naming the model after its proposer highlights its originality and specific contributions to the ongoing discourse on consciousness. The A-CIM is intended to complement, not contradict, existing theories such as Eccles' dualist interactionism, Penrose–Hameroff's Orch-OR, offering a perspective rooted in both scientific inquiry and metaphysical insights (Figure 1, Table 2).

Among theories that regard consciousness as more than an emergent property of neural computation, A-CIM posits that subjective awareness arises from the interaction between the CNS and a substrate of consciousness. Within this framework, the CNS functions as a biological interface translating between physical sensory–motor processes and a non-material substrate capable of information processing beyond the spatial and temporal constraints of physical matter. This non-local substrate is not a mystical or theological entity but is conceived as a functional component with properties distinct from known physical forces, potentially existing within a field-like or higher-dimensional domain.

A defining feature of A-CIM is the distinction between integration and disintegration states. In the *integrated state*, the CNS and non-local substrate are fully coupled, producing the typical conscious experience where perception is mediated by the body's sensory organs and voluntary actions are controlled by motor pathways. Here, perceptual limits correspond to the constraints of physical signal transduction (e.g., photons impacting the retina, vibrations stimulating the cochlea). This integrated state is characteristic of normal waking consciousness in typical individuals.

In contrast, the *disintegrated state* occurs when the non-local substrate partially or fully decouples from the CNS, allowing consciousness to operate independently of conventional sensory and motor pathways. In this mode, perception may be direct, unmediated by physical senses, and spatially non-local. Such states are hypothesized to arise under exceptional physiological or pathological conditions—such as near-death experiences, clinical death, deep meditation, trance, or certain culturally specific possession phenomena—rather than in everyday conscious experience. In the disintegrated state, conscious interaction with the physical environment may be limited or absent due to disengagement from motor control.

To provide an example, trance-induction practices such as shamanic drumming, chanting, and repetitive movement are proposed to facilitate transitions from the integrated to the disintegrated state by modulating oscillatory dynamics in the central nervous system. Cross-cultural evidence indicates that rhythmic auditory stimulation is one of the most ancient and universally employed methods for inducing altered states of consciousness, with archaeological indications of its use dating back at least 14,000 years. Neuroscientific studies suggest that exposure to isochronous rhythmic sounds entrains thalamocortical pathways to low-frequency oscillations in the theta (4–7 Hz) and alpha (8–12 Hz) bands—frequencies associated with absorption, altered ime perception, and reduced executive control. This entrainment, also observed in psychedelic and certain psychotic states, may weaken the tight coupling between the CNS and its primary consciousness substrate, enabling partial or complete interface with alternative substrates. In possession or trance mediumship, this decoupling could manifest as "dual-driver" or "driver-swap" control of the CNS, consistent with behavioral observations of automatisms, vivid imagery, and amnesia reported in both anthropological and experimental contexts [74].

The A-CIM model also incorporates a multiplicity principle**,** whereby a single CNS may interface with multiple non-local substrates. This could manifest as alternating or simultaneous control by distinct consciousness entities, potentially accounting for anomalous phenomena where individuals demonstrate disparate skill sets, languages, or behaviors inexplicable by standard neurological or psychological mechanisms. This could potentially explain psychiatric conditions such as Dissociative Identity Disorder (Multiple Personality Disorder).

Though speculative, A-CIM draws analogy from non-local correlations in quantum physics and theoretical models of spacetime topology that permit distant three-dimensional points to be adjacent in higher dimensions. Proposed coupling mechanisms between the substrate and CNS include quantum processes within neuronal microstructures, interactions mediated by endogenous electromagnetic fields, or other yet unidentified forms of energy. Candidate anatomical sites such as the thalamus, claustrum, or pineal gland have been suggested for substrate integration, but empirical support remains preliminary. For example, the pineal gland has long been surrounded by mystical associations—from its identification with the Eye of Horus in ancient Egypt to its portrayal in various religious traditions as the “seat of the soul” or “third eye.” René Descartes (1596-1650), French philosopher, defined the pineal gland (in greek konàrion) the seat of the soul In modern interpretations, it has been suggested that the gland releases N,N-dimethyltryptamine (DMT) at birth, during dreams, and in near-death situations, supposedly triggering out-of-body experiences (OBE). However, scientific findings do not support these claims. In adults, the pineal gland weighs under 0.2 grams and primarily produces about 30 micrograms of melatonin daily—a hormone that regulates circadian rhythms through strong interactions with melatonin receptors. While extremely small amounts of DMT have been detected in the brain, they are far too low to induce psychoactive effects. The pineal gland would need to rapidly produce about 25 mg of DMT to provoke a psychedelic experience. The production of DMT in such large quantities in those claiming OBEs has not yet been experimentally validated [75].

However, others argue that alternative explanations account for how stress and near-death experiences may lead to altered states of consciousness without involving DMT release.

Importantly, the model generates empirically testable hypotheses, including the possibility of veridical perception in conditions of absent CNS sensory input (e.g., under deep anesthesia or cardiac arrest), reproducible neurophysiological correlates marking transitions between integration and disintegration states, and acquisition or expression of knowledge beyond prior learning in rigorously controlled settings. Verification of these predictions would profoundly impact neuroscience, cognitive science, and the philosophy of mind, potentially necessitating a redefinition of the brain–consciousness relationship [76,77].

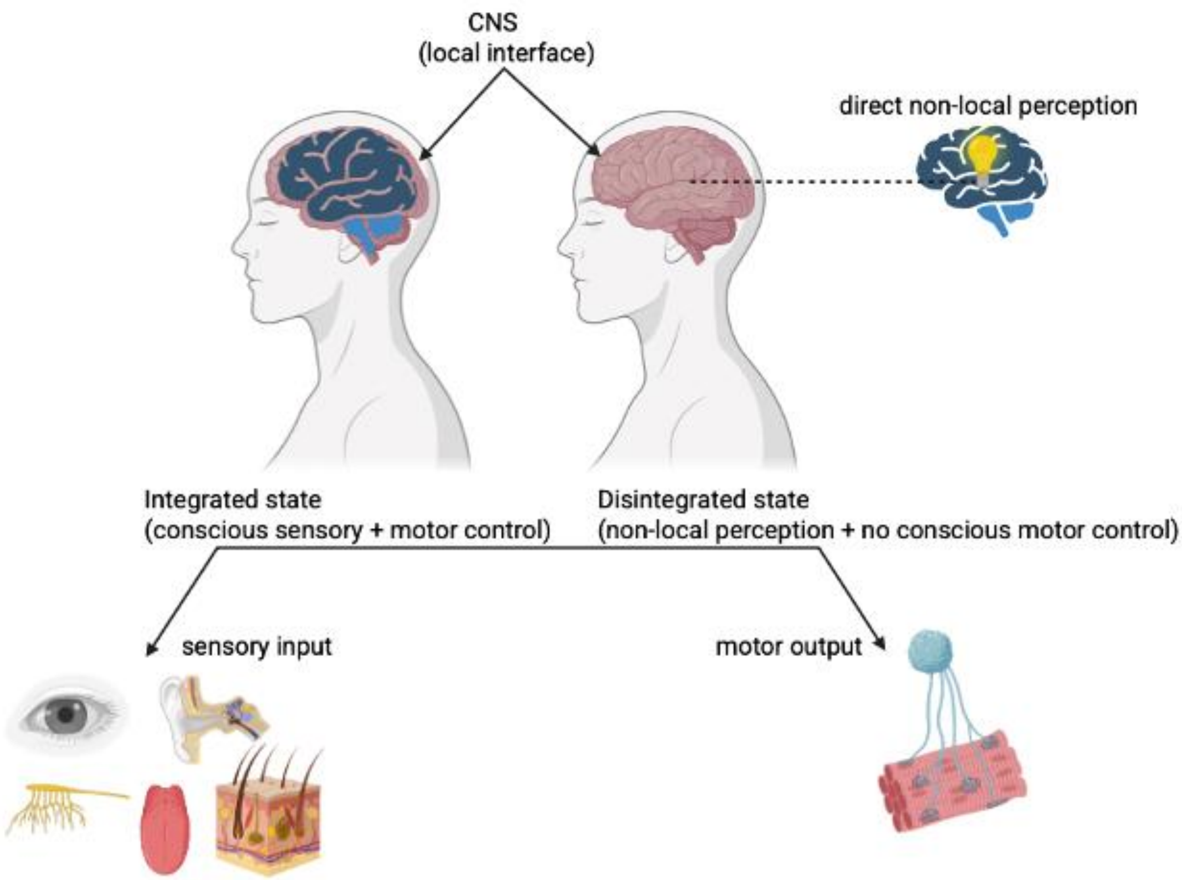

Figure 1. Schematic representation of the CNS acting as a local interface/port for consciousness. The left panel illustrates the normal physiologic integrated state, characterized by conscious sensory processing and motor control, where sensory inputs from the eye, ear, tongue, skin, and nerve signals are integrated within this local interface. This state enables both sensory perception and conscious motor output. The right panel depicts the disintegrated state (hypothesized to be present in certain non-physiological conditions), marked by non-local perception without conscious motor control. Here, direct non-local perception occurs outside the CNS local interface, resulting in a lack of conscious motor output, as shown by the absence of motor control signals to muscles.

Feature	Eccles's Dualist Interactionism	Arachchige's Consciousness Interface Model (A-CIM)
Ontology	Substance dualism: two distinct entities — immaterial mind (*psychons*) and physical brain (*dendrons*).	Consciousness as an independent, **non-local substrate** interfacing dynamically with the CNS.
Core Mechanism	*Psychons* interact with cortical *dendrons*, possibly via quantum modulation of synaptic events.	CNS–consciousness coupling with two modes: **Integrated** (normal sensory-motor mediation) and **Disintegrated** (non-local perception, decoupling from motor control).
Scope	Focuses mainly on voluntary action, free will, and conscious intention within a single mind–brain pairing.	Encompasses altered states (trance, near-death, possession), multiple consciousness entities, and culturally specific phenomena.
States of Consciousness	Primarily describes normal waking states; altered states are not central.	Explicit two-state model: *Integration* vs *Disintegration*, with transitions triggered by rhythmic entrainment, extreme physiology, or pathology.
Non-local Perception	Not a central claim — focuses on mind–brain causation rather than perception beyond the body.	Central claim — disintegration may allow perception unmediated by physical senses and unconstrained by space–time.
Multiplicity Principle	Assumes one-to-one mind–brain pairing.	Allows for one CNS to interface with multiple consciousness substrates, sequentially or simultaneously.
Key Predictions	Quantum synaptic modulation; measurable causal effect of mind on neuronal firing.	Veridical perception without sensory input; reproducible neural markers of integration/disintegration; new skill/knowledge acquisition during decoupled states.
Criticisms	Lack of empirical evidence for *psychons*; speculative quantum	Highly speculative; non-local substrate unverified; risk of unfalsifiability without strict experimental design.

Feature	Eccles's Dualist Interactionism	Arachchige's Consciousness Interface Model (A-CIM)
	mechanism; possible violation of physical laws.	

Table 2. Direct comparison of A-CIM with Eccles's dualist interactionism.

6. Conclusion

The quest to understand consciousness has generated a rich tapestry of theories, each illuminating a different aspect of this complex phenomenon. From global workspaces and information integration to dendritic processing and memory reconstruction, these theories reflect the multidimensional nature of consciousness. Rather than viewing them as competing accounts, a more productive approach may be to explore their complementarities and synthesize their insights. By integrating phenomenological, computational, and neurobiological perspectives, we may inch closer to a unified theory of consciousness. Until then, the study of consciousness will remain a fertile ground for inquiry, bridging the gap between mind and brain.

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