**Consciousness from a Neuroscientific Perspective:
Is Consciousness Merely a Product of Neural Activity? Is There a Reality Beyond Neuroscience?**

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Abstract

This article explores human consciousness within the framework of neuroscience, questioning whether consciousness is merely a product of neuronal activity or whether it reflects a deeper underlying reality beyond such activity. It analyzes two leading theories that attempt to explain how interactions between neurons generate conscious experience—Global Neuronal Workspace Theory (Dehaene & Changeux, 2011) and Integrated Information Theory (Tononi, 2004)—and critically evaluates the extent to which these theories can fully account for consciousness through neural correlates alone. Grounded in David Chalmers' (1995) notion of the "hard problem," the article examines the limitations of current explanations regarding the nature of subjective experience. These limitations, it is argued, may challenge the objectivity of scientific inquiry in this domain. In addition, speculative yet compelling approaches such as panpsychism (Goff, 2017) and quantum consciousness theories (Hameroff & Penrose, 2014), which suggest that consciousness may point to a reality beyond neurons, are discussed. Drawing on empirical findings from neuroscience, the article emphasizes the need to consider consciousness not only through biological mechanisms but also within psychological and sociological frameworks. In doing so, it proposes a multidisciplinary foundation for consciousness research that integrates diverse perspectives to foster a more comprehensive understanding of the phenomenon.

Keywords: Consciousness, Neuroscience, Hard Problem, Neuropsychology, Neural Activity, Neurophilosophy, Panpsychism

INTRODUCTION
Consciousness and Neuroscience: Theories, Neuroimaging, and the Nature of Conscious Experience

Biological approaches generally consider consciousness to be a product of the brain's complex neural activities, suggesting that such processes can explain conscious experience. However, there remains significant uncertainty as to whether subjective phenomena—such as *qualia*, awareness, the sense of self, and intentionality—can be fully accounted for by neural mechanisms alone (Chalmers, 1995).

Recent advancements in neuroimaging technologies have provided valuable insights into the neural correlates of conscious awareness. In this context, two prominent theories have emerged: the **Global Neuronal Workspace Theory (GNWT)** (Dehaene & Changeux, 2011) and the **Integrated Information Theory (IIT)** (Tononi, 2004). Research using neuroimaging techniques such as **electroencephalography (EEG)** and **functional magnetic resonance imaging (fMRI)** has revealed distinct patterns of brain activity associated with conscious states, particularly in the brain's frontal areas- most notably the **prefrontal cortex** and **parietal lobes**. However, more recent studies have suggested that this relationship is far more complex.

Emerging evidence indicates that the **posterior regions** of the brain also play a crucial role in conscious experience.

These findings continue to offer new perspectives on the study of consciousness. Among contemporary theoretical models, **IIT** and **GNWT** remain central to the ongoing scientific discourse. IIT posits that conscious experience arises when a system—such as the brain—exhibits a high degree of both informational complexity and integration. According to this theory, consciousness emerges as a unified entity when information within a system is richly interconnected (Tononi, 2004). GNWT, on the other hand, proposes that consciousness results from a network of brain regions that collectively select and broadcast significant information across the cortex, allowing certain content to enter our conscious awareness. This theory emphasizes the role of widespread information sharing in shaping conscious experience (Baars, 2005).

Neuroscience, while offering biological explanations for how consciousness is organized in the brain, also opens the door to deeper philosophical inquiries into the nature of consciousness itself. For instance: *Is consciousness merely the outcome of complex information processing in the brain? Or does it point to a more fundamental layer of reality?* These are questions that remain unresolved for many philosophers and scientists alike. David Chalmers famously referred to this issue as **"the hard problem of consciousness"**, highlighting the challenge of explaining why and how physical processes in the brain give rise to subjective experience (Chalmers, 1995).

Some researchers have also explored more speculative theories, such as **panpsychism** (Goff, 2017) and **quantum consciousness** (Hameroff & Penrose, 2014), which question whether consciousness can be fully explained within the limits of neural structures. Within this broader framework, consciousness is increasingly viewed not just as a biological phenomenon, but also as a subject with **ontological** and **epistemological** dimensions. These alternative perspectives are valuable in that they encourage deeper inquiry and may help expand the boundaries of current scientific paradigms.

The Neurobiological Foundations of Consciousness

Efforts to uncover the biological foundations of consciousness aim to identify which brain regions and functions are directly associated with conscious experience. One key concept in this pursuit is that of **Neural Correlates of Consciousness (NCC)**, which refers to the minimal neural mechanisms necessary to produce specific conscious states (Koch, Massimini, Boly & Tononi, 2016).

Neural correlates seek to identify the tangible traces of subjective experience in the brain, and neuroimaging technologies have become vital tools in these investigations. Studies using **fMRI**, **EEG**, and **transcranial magnetic stimulation (TMS)** have pointed to strong connections between consciousness and activity in regions such as the **prefrontal cortex**, **posterior parietal cortex**, and the **thalamus**.

In one large-scale study conducted across 12 laboratories in the United States, Europe, and China, brain activity was recorded from 256 participants while they were shown various visual stimuli. Researchers measured electrical and magnetic activity, as well as blood flow, to identify which brain regions became activated. Findings indicated that consciousness may not

reside solely in the brain's frontal regions; instead, it might originate in the **posterior areas** involved in sensory processing, such as vision and hearing. Interestingly, these results did not fully align with the predictions of either IIT or GNWT.

Neuroscientist **Christof Koch**, one of the study's lead authors from the **Allen Institute in Seattle**, summarized this contradiction as follows:

"In studies of conscious experience, signals associated with consciousness are either completely absent or very weak in the brain's frontal regions. In contrast, much stronger and more distinct signals have been observed in the brain's posterior regions. While the frontal lobes are clearly crucial for cognitive tasks such as reasoning, intelligence, and social behavior, they appear to be less directly involved in generating conscious visual perception. However, the failure to observe continuous, stable connections in these posterior regions throughout the duration of conscious states also suggests that Integrated Information Theory (IIT) cannot be fully confirmed either"(Seth et al., 2006; Tononi, 2004).

The Boundaries of Consciousness: Approaches Beyond Neurons

Although we have gained detailed insights into how neural circuits operate, the question of why and how these mechanisms give rise to conscious experience remains unanswered.

David Chalmers (1995) famously distinguished between two types of problems regarding consciousness: the "Easy problems" those related to attention, memory, and perception, which are believed to have neural underpinnings—and the "Hard problem", which concerns the subjective nature of experience. According to Chalmers, while the biological foundations of neural activity may be understood, current scientific frameworks fall short in explaining why neural activity produces the feeling of redness or the sensation of pain. This limittion has led some researchers to approach consciousness not merely as a biological phenomenon, but as a more fundamental and holistic reality. One alternative framework that has gained attention in this context is panpsychism. According to panpsychism, consciousness is a basic feature of matter, and everything in the universe may possess some form of conscious experience (Goff, 2017). This view argues that consciousness is not solely the product of complex organisms, but rather one of the fundamental building blocks of nature. It offers a metaphysical alternative to classical physicalism.

Another notable approach is the quantum consciousness theory, particularly the Orchestrated Objective Reduction (Orch OR) model proposed by Stuart Hameroff and Roger Penrose. This theory suggests that consciousness arises from quantum processes occurring in the brain's microtubules—structures that cannot be fully explained by classical physics due to their complexity and coherence (Hameroff & Penrose, 2014). Although controversial, quantum consciousness offers a radically different perspective, challenging the idea that consciousness can be entirely accounted for by neural networks.

These alternative approaches argue that a comprehensive understanding of consciousness must go beyond biological explanations and consider ontological, metaphysical, and epistemological dimensions. While these theories differ significantly in terms of empirical support, they share a common view: current scientific paradigms may be insufficient to fully

explain consciousness. Shifting from a strictly neural model to a more universal or structural understanding opens the door to interdisciplinary questions and insights.

Consciousness and Its Neuroscientific Foundations: Philosophical and Ethical Reflections

A central question in consciousness research remains: Is the brain the true origin of conscious experience and subjective awareness?

While neuroscientific theories have provided critical insights into the neurological foundations of consciousness, deeper ontological and philosophical implications must also be explored. It is essential to distinguish between objective phenomena and subjective experiences, and to acknowledge the limitations of purely biological frameworks.

Theoretical Approaches to Consciousness: GNWT and IIT

In this context, leading theories such as Integrated Information Theory (IIT) and Global Neuronal Workspace Theory (GNWT) offer valuable frameworks. According to IIT, the foundation of consciousness lies in a system's ability to hold deep and integrated information about its internal organization (Tononi, 2004). Notably, IIT does not restrict consciousness to the human brain—it extends the possibility of conscious experience to artificial intelligence and other complex systems. GNWT, by contrast, suggests that consciousness arises when a specific network of brain regions selects and broadcasts significant information across the cortex, thereby bringing it into awareness. Both theories have been influential in shaping neuroscientific discourse. However, they continue to face criticism for their inability to fully capture the qualitative nature of subjective experience (Chalmers, 1996; Seth & Bayne, 2022; Koch et al., 2016).

Neuroethics and the Ethical Implications of Consciousness Research

Another critical dimension of neuroscience is the ethical debate it provokes. The idea of manipulating brain regions to influence consciousness raises profound concerns about free will, personal autonomy, and moral responsibility. Technologies such as neurostimulation, brain implants, and neurological treatments have generated new ethical dilemmas regarding the potential manipulation of consciousness. For example, intervening in a person's decision-making processes may infringe upon their freedom and generate ethically questionable scenarios. Furthermore, the combination of artificial intelligence and neuromodulation may eventually lead to the emergence of machine-like conscious entities, raising questions about their rights and our ethical obligations toward them.

Consciousness research also has significant societal and individual implications. Its ethical dimensions intersect with critical issues such as human rights, neuroethics, and the responsibilities we have toward potentially conscious beings. Discussions about free will, conscious experience, and ethical accountability represent some of the most pressing moral challenges of modern society.

Conclusion

A crucial question remains: Can we even define consciousness in a universally accepted way? Countless studies and theories can be proposed, but without a common standard of measurement, the ambiguity surrounding consciousness may persist. Clearly, there is a collective expectation for a definitive explanation of consciousness that accounts for the biopsychosocial nature of human beings. Whether future neuroscience will construct this understanding based on empirical data or on conceptual expectations is an important question.

This journey likely requires the collaboration of both science and philosophy. Should these disciplines work together, or should they remain distinct? Consciousness continues to be one of the deepest and most fundamental questions in our quest to understand human nature and the universe.

To navigate this journey effectively, an evidence-based, scientific approach—one that attempts to understand the brain through its own mechanisms—may offer a more grounded path than relying on subjective interpretations alone. Ultimately, as beings who seek to understand ourselves through the very organ we are trying to study, it becomes evident that we may need a higher-level paradigm.

Discussions about artificial intelligence and consciousness raise further questions about the rights and responsibilities related to non-human conscious entities. Meanwhile, applications such as brain manipulation and neuromodulation continue to spark ethical concerns about individual freedom and personal rights.

In this broader framework, the philosophical dimensions of consciousness research are not just of scientific interest—they also carry profound ethical and societal implications. While future research may deepen our understanding of consciousness, such progress will undoubtedly require an interdisciplinary effort that bridges science, philosophy, and ethics in a long and evolving journey.

Recommendations

Fostering collaboration between disciplines such as neuroscience, linguistics, anthropology, sociology, philosophy, ontology, psychology, and artificial intelligence will contribute to a more holistic understanding of consciousness. In particular, the integration of neuroscientific data with philosophical inquiry can provide a deeper and more comprehensive perspective on the nature of conscious experience.

Given the current limitations in consciousness research, it is crucial to develop new experimental methodologies. In addition to advanced neuroimaging techniques, the use of artificial intelligence and machine learning may allow for a more detailed analysis of brain functions and conscious states. Furthermore, exploring novel neuromodulation techniques that can influence conscious experiences could help clarify how consciousness is linked to neural structures. The question of whether artificial intelligence can evolve into conscious entities remains one of the most profound inquiries into the nature of consciousness. This issue requires deeper philosophical and neuroscientific investigation. Understanding whether AI can possess conscious experience could be a pivotal step in uncovering the nature of human consciousness and may raise fundamental questions about the possibility of consciousness in non-biological systems.

It is also important to remember that consciousness research is not only a scientific endeavor, but an ethical one. In the field of neuroethics, further research should be conducted on the rights, free will, and moral responsibilities of conscious beings. Topics such as neurological interventions and the creation of consciousness through AI raise ethically complex issues. In this context, a global dialogue on the ethical status and rights of conscious entities should be initiated.

Consciousness research can have significant implications not only in scientific and philosophical domains but also within social and cultural contexts. For example, neuroscientific studies may have broader applications in areas such as mental health, consciousness disorders, and the effects of psychoactive substances. Developing public health policies related to consciousness could enhance societal awareness and foster better understanding of consciousness-related conditions.

REFERENCES

Libet, B. (1983). Time of conscious intention to act in relation to onset of cerebral activity (readiness-potential). Brain, 106(3), 623-642. https://doi.org/10.1093/brain/106.3.623

Koch, C., & Tononi, G. (2016). Consciousness: Synapses, circuits, and the flow of information. Neuron, 88(1), 43-58. https://doi.org/10.1016/j.neuron.2015.09.039

Hameroff, S., & Penrose, R. (2014). Consciousness in the universe: A review of the 'Orch OR' theory. Physics of Life Reviews, 11(1), 39-78. https://doi.org/10.1016/j.plrev.2013.08.002
Tononi, G. (2004). An information integration theory of consciousness. BMC Neuroscience, 5(1), 42. https://doi.org/10.1186/1471-2202-5-42

Chalmers, D. J. (1995). Facing up to the problem of consciousness. Journal of Consciousness Studies, 2(3), 200-219. Retrieved from https://www.imprint.co.uk/jcs

Dehaene, S., Changeux, J. P., Naccache, L., Sackur, J., & Sergent, C. (2006). Conscious, preconscious, and subliminal processing: A testable taxonomy. Trends in Cognitive Sciences, 10(5), 204-211. https://doi.org/10.1016/j.tics.2006.03.001

Baars, B. J. (2005). Global workspace theory of consciousness: Toward a cognitive neuroscience of human experience. Progress in Brain Research, 150, 45-53. https://doi.org/10.1016/S0079-6123(05)50006-1

Edelman, G. M., & Tononi, G. (2000). A universe of consciousness: How matter becomes imagination. Basic Books.

Seth, A. K. (2014). Theories and measures of consciousness. Progress in Brain Research, 211, 1-14. https://doi.org/10.1016/B978-0-444-63216-5.00001-1

Van Gulick, R. (2004). Consciousness and self-consciousness. Cambridge Handbook of Consciousness, 221-245. https://doi.org/10.1017/CBO9780511816788.013