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Human consciousness versus the scientific method

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ABSTRACT

This study explores how science has approached the complex phenomenon of human consciousness, emphasizing the challenges of addressing subjectivity through objective and replicable methodologies. A bibliometric analysis was conducted using the Scopus database, identifying 1,143 documents between 1990 and 2024. The results show a steady increase in publications, particularly since 2018, confirming the consolidation of an interdisciplinary field where medicine, neuroscience, psychology, philosophy, and social sciences converge. The data reveal the predominance of biomedical sciences, complemented by humanities and social approaches that highlight ethical and philosophical debates. Methodological strategies include psychophysics, behavioral designs, neuroimaging, clinical case studies, theoretical models such as Global Workspace Theory and Integrated Information Theory, as well as phenomenological and neuroethical perspectives. Artificial Intelligence (AI) was also examined in this context: while AI offers powerful tools for data analysis and hypothesis testing, there is no empirical evidence that it possesses consciousness in the strict sense, underscoring the need to differentiate between cognitive functionality and phenomenological experience. Epistemologically, the study engages with Thomas Nagel's critique of neo-Darwinian materialism, arguing for the need to expand the scientific framework beyond reductionism to account for rationality, subjectivity, and teleological dimensions of reality. The findings confirm that although science has made significant progress in mapping the correlates of consciousness, a comprehensive explanatory theory remains elusive. Future research should integrate interdisciplinary methodologies and broaden epistemological paradigms to better understand consciousness as a fundamental aspect of existence.

Keywords: Neo-Darwinian materialism; Reductive physicalism; Emergentism; Naturalistic teleology; Neuroethics; Neural correlates of consciousness

Introduction

The scientific method is a systematic process used by researchers to acquire reliable, verifiable, and objective knowledge about natural and social phenomena. Its purpose is to reduce the influence of opinions or beliefs and base conclusions on observable and reproducible evidence (Jennings & Eichinger, 1999). This method is developed in several interrelated stages:

- Observation: Identify a fact or problem that generates curiosity.
- Problem statement and hypothesis formulation: Propose a tentative explanation or answer based on prior knowledge.
- Experimentation: Design controlled tests to evaluate the hypothesis.
- Analysis of results: Interpret the data obtained and compare them with the hypothesis.
- Conclusion: Accept, reject, or modify the hypothesis based on the evidence.
- Communication and replication: Share results so that other scientists can verify them.

For example, a researcher observes that certain plants grow faster under a certain light. He formulates the hypothesis: "Blue light accelerates plant growth compared to red light." To test this, he grows groups of plants under identical conditions, varying only the color of the light. After measuring the average height, he concludes whether the hypothesis is correct. This procedure allows for advances in knowledge based on verifiable facts, not assumptions (Bhattacharya, 2013).

Human consciousness is the human capacity to perceive oneself and the environment, integrating thoughts, emotions, sensations, and experiences into a subjective experience. It involves not only being awake and attentive, but also recognizing one's own existence, reflecting on it, and making intentional decisions. Consciousness allows us to distinguish between the internal and the external, giving meaning to reality and enabling self-criticism, memory, and future planning. It is a complex phenomenon, studied by philosophy, psychology, and neuroscience, yet without a single definitive definition (Paul, Sher, Tamietto, Winkielman, & Mendl, 2020).

Science has become an extraordinary tool for understanding the world around us. It has allowed us to decipher the laws of nature, understand the origin of the universe, manipulate matter and energy, and even prolong life. However, when it comes to explaining consciousness, a clear limit appears. Consciousness, understood as the subjective experience of being, feeling, and perceiving, is not so easily captured by traditional scientific methods. We can study the brain with MRIs, electrical recordings, and computational models, but the intimate experience of what it means to be conscious still eludes any material explanation. The difficulty lies in the fact that science, by definition, works with the objective, the measurable, and the reproducible. And consciousness belongs to the realm of the subjective, the non-transferable, and the unique. Therefore, every time we try to reduce consciousness to mere neuronal processes, we encounter an explanatory void: we can describe which areas of the brain are activated when we feel pain, but that tells us nothing

about how that pain is experienced from within (Ellis, 2013).

Some scientists argue that consciousness is simply an illusion generated by brain activity. According to this view, it does not exist independently, but is the emergent result of neuronal complexity. But this explanation does not resolve the underlying problem: even if we can demonstrate which circuits are activated, it still remains unclear why subjective experience arises from that activity. Other approaches attempt to compare consciousness to computational processes, as if the brain were a biological computer. However, computer programs process information without experiencing anything, and that difference is crucial. We can create increasingly sophisticated artificial intelligences (AIs) capable of recognizing patterns, solving problems, and simulating human conversations, but we have no evidence that an experiencing subject exists behind these calculations. Consciousness, unlike artificial intelligence (AI), is marked by the quality of what is experienced: the color red we see, the taste of coffee we enjoy, the nostalgia of a memory, or the anguish of a loss. These qualitative aspects, called qualia, are impossible to translate into mathematical formulas or algorithms (Hershock, 2025).

In this context, the objective of this scientific contribution is to show the ways in which science has addressed the investigation of human consciousness. The results of this scientific contribution address four specific areas: i) The bibliometric study of research focused on the ways in which the scientific method has investigated human consciousness; ii) Ways in which the scientific method has investigated human consciousness; and iii) Artificial intelligence, in the context of human consciousness versus the scientific method.

Materials and Methods

The Scopus database was used for this research. This academic research directory is one of the world's leading bibliographic and abstract databases, managed by Elsevier. It contains more than 90 million records, including scientific articles, conference papers, books, and patents, covering all areas of knowledge. Its strength lies in offering multidisciplinary coverage and tools for analyzing scientific production, such as citation metrics, h-index, impact indicators, and collaboration networks. Scopus is widely used in research, teaching, and academic management, allowing for the evaluation of trends, comparison of results, and strengthening of literature reviews. It is a key reference for researchers and universities worldwide.

Using the phrase (science AND of AND human AND consciousness) in the title, abstract, and keywords as a search criterion, 1,143 documents were found in the Scopus database, including research articles, review articles, conference papers, books, and book chapters. These types of documents represent more than 95% of the information detected. The information detected is contained between the years 1990 and 2024. This broad timeline was considered in order to obtain a bibliometric analysis that would demonstrate the evolution of this research topic in the international scientific community. The epistemological conception of this research arises from Thomas Nagel's work "Mind and Cosmos," which questions the sufficiency of the neo-Darwinian materialist paradigm to explain consciousness. Nagel argues that, although evolutionary materialism explains biological adaptation, it fails to address subjectivity, rationality, and objective values. He points out that conscious experience cannot be reduced to neurobiological processes and that the reliability of reason transcends adaptive interest. Furthermore, he proposes reintroducing teleology, not in a theistic sense, but as the internal directionality of the cosmos toward life and mind. Among the objections to reductionist alternatives, he criticizes reductive physicalism, emergentism, and strict evolutionary explanations. His thesis implies that science must broaden its scope to include dimensions currently marginalized. Although controversial, the book opens an essential debate about the limits of the scientific method and the place of consciousness in nature.

Using the computational tool VOSviewer, text mining was performed on the indexed keywords of the 1,143 documents detected. VOSviewer is a software specialized in the construction and visualization of bibliometric maps. Developed by Nees Jan van Eck and Ludo Waltman at Leiden University, it allows the analysis of large scientific databases (such as Scopus or Web of Science) to identify relationships between authors, journals, institutions, keywords, or research topics. Its strength lies in representing networks of co-citation, co-occurrence, and scientific collaboration through interactive and easy-to-interpret graphic maps. The program uses multidimensional clustering and scaling algorithms to show the structure of a research field, detect academic communities, and emergent trends. Therefore, VOSviewer has become a fundamental tool in bibliometric, scientometric, and scientific analysis studies. Finally, the bibliographic management for this research was carried out with EndNote. This is a bibliographic management software widely used in academic research. It allows you to organize, store, and format bibliographic references from various sources, such as scientific databases, online catalogs, or personal files. It facilitates the creation of digital libraries where you can classify articles, books, chapters, or documents, incorporating notes and tags for quick access. Its main advantage is its integration with word processors such as Microsoft Word, which automates the insertion of citations and the generation of bibliographies in multiple styles (APA, MLA, Vancouver, Chicago, among others). In addition, EndNote offers online collaboration features, cloud synchronization, and compatibility with database managers, making it an essential tool for researchers, teachers, and students.

Results

This section of the document develops three areas of results: a bibliometric analysis of research focused on the ways in which the scientific method has investigated human consciousness; ways in which the scientific method has investigated human consciousness; and, finally, artificial intelligence, in the context of human consciousness versus the scientific method.

Bibliometric analysis of research focused on the ways in which the scientific method has investigated human consciousness.

Figure 1 shows a trajectory of sustained growth in scientific production indexed in Scopus between 1990 and 2025, albeit with clearly differentiated phases. The first stage (1990–1999) reflects incipient development, with limited production and minor variations. Beginning in 2000, a phase of accelerated expansion began, reaching a peak in 2002, marking the initial consolidation of the field. Between 2004 and 2017, cyclical fluctuations were observed, with significant declines suggesting moments of adjustment or thematic reorientation. However, starting in 2018, a period of clear expansion emerged, highlighting a continuous rise after 2021, culminating in 2025 with more than 360 documents. This trend confirms not only the maturity of the field, but also its growing relevance and diversification on the international scientific agenda.

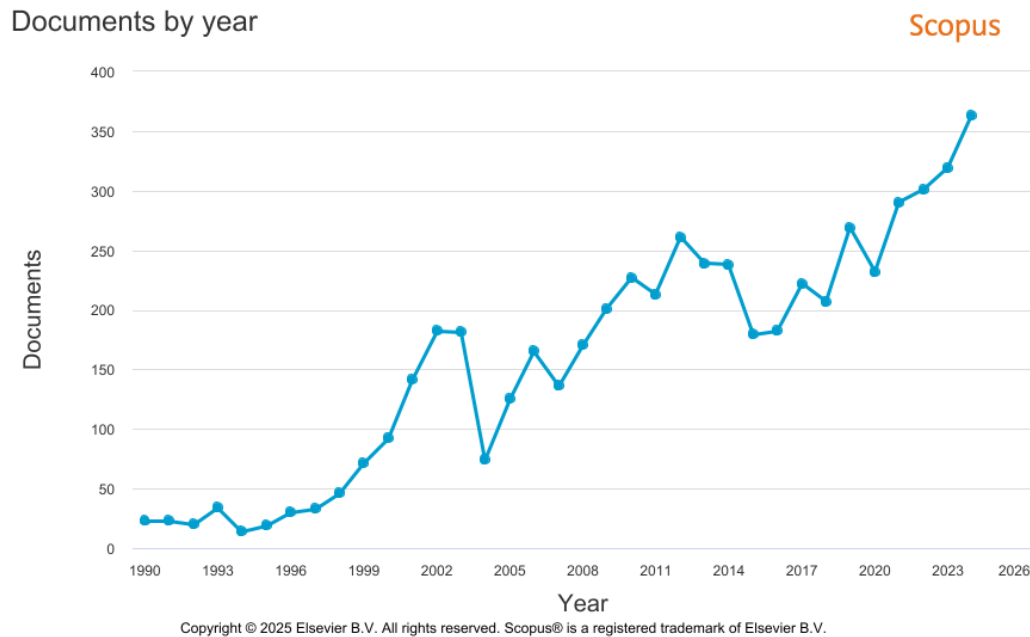


Figure 1. Evolution of scientific productivity, by year.

Figure 2 reveals an uneven distribution of scientific output indexed in Scopus by subject area, with Medicine clearly leading the way (20.2%), doubling the contribution of fields such as Neuroscience (11.3%) and Psychology (11.6%). In second place are the Arts and Humanities (15.8%) and Social Sciences (12.2%), highlighting the importance of humanistic approaches in dialogue with empirical sciences. Emerging areas such as Biochemistry and Computer Science (4.6% each) provide technical foundations for interdisciplinary research, while Engineering, Nursing, and Agriculture maintain marginal shares (2–2.4%). The "Other" category (13%) reflects the growing thematic diversification. Overall, the distribution suggests a scenario where biomedical and humanistic sciences are consolidated as dominant poles, but articulated within an interdisciplinary framework that broadens the scope of scientific knowledge.

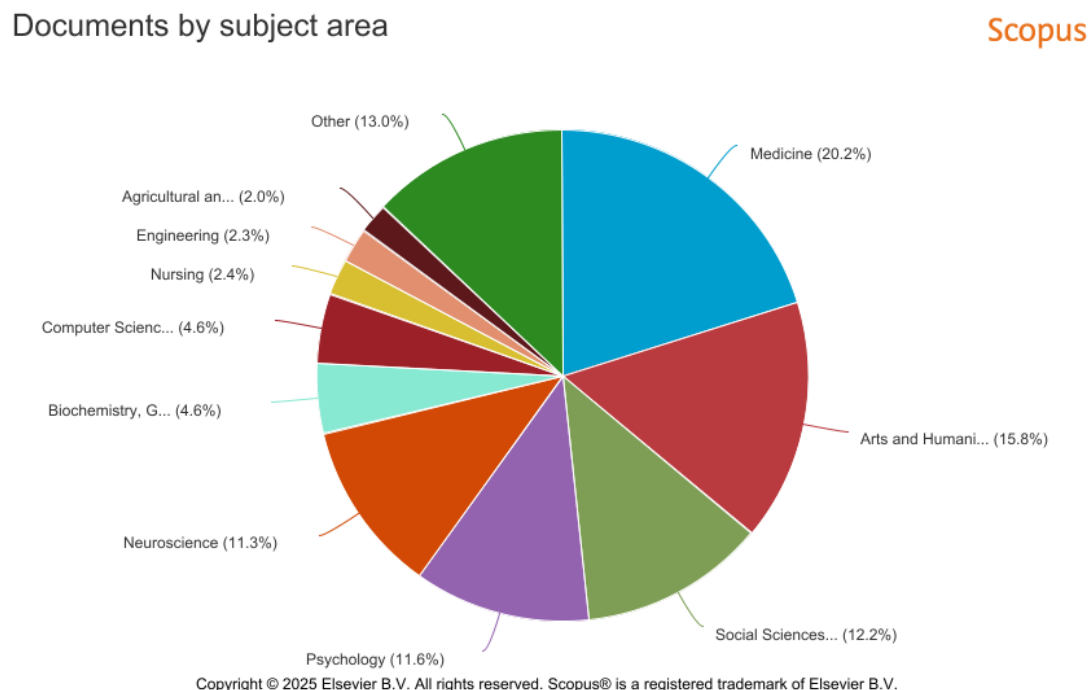


Figure 2. Percentage of documents detected, by subject area.

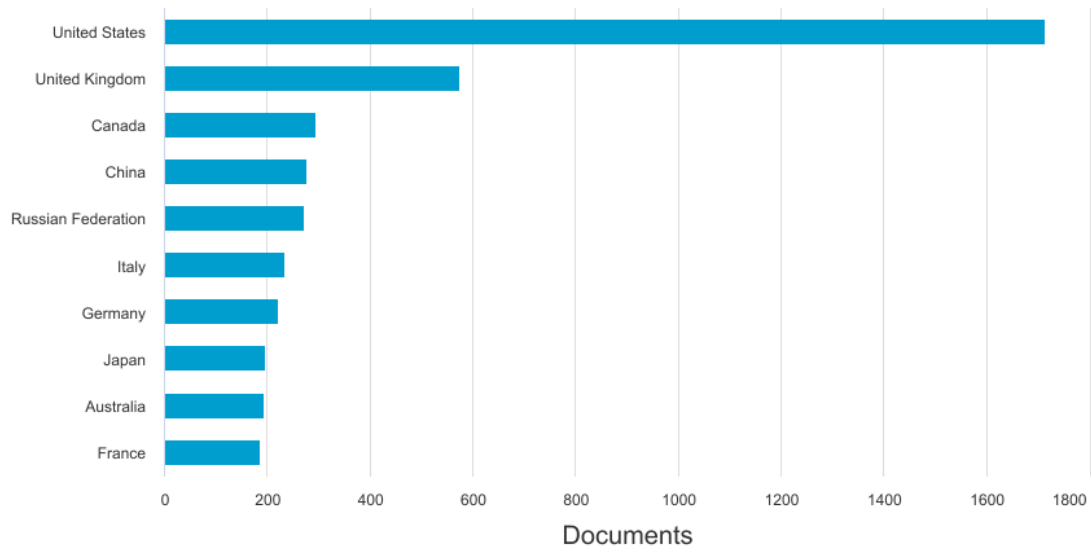
To generate Graph 3, the search criteria indicated in the Materials and Methods section were used, with the only difference being that the time period considered ranges from 1962 to 2024. The aforementioned graph demonstrates a marked asymmetry in the scientific production indexed in Scopus based on country of origin. The United States stands as the undisputed leader, with more than 1,700 documents, a figure that triples the contribution of the United Kingdom, second in the ranking with around 600. Canada, China, and the Russian Federation are at an intermediate level, with volumes close to 300 documents, reflecting their growing role in global research. Finally, European countries such as Italy, Germany, and France, along with Japan and

Australia, exhibit a more balanced production, albeit on a smaller scale. This distribution not only confirms Anglo-Saxon leadership in knowledge generation, but also suggests scenarios of dependence and the need for international collaboration to balance scientific visibility and strengthen transnational research networks.

Documents by country or territory

Compare the document counts for up to 15 countries/territories.

Scopus



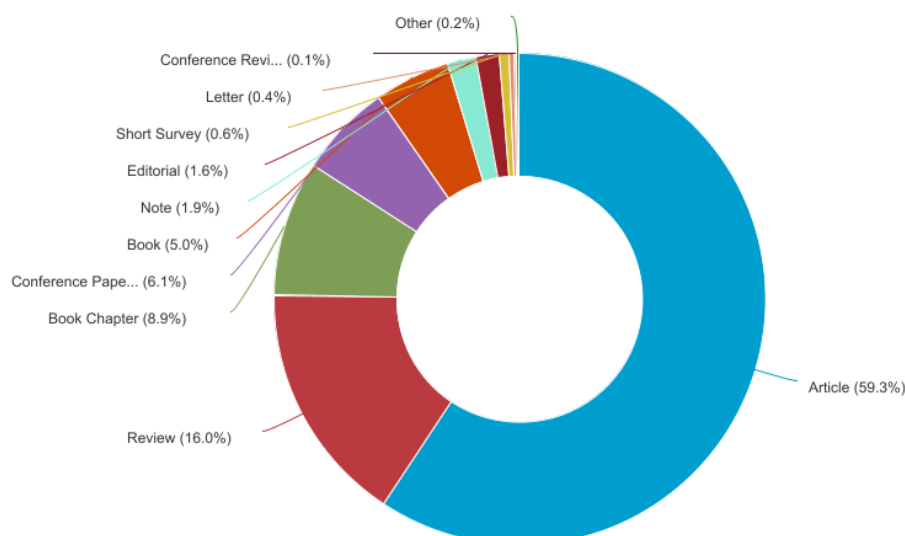
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Figure 3. Number of scientific contributions detected by country.

Figure 4 shows that scientific articles constitute the core of academic production in Scopus (59.3%), establishing themselves as the dominant medium for the validation and dissemination of empirical findings. In contrast, reviews (16%) carry significant weight, as they serve the purpose of integrating and critically synthesizing accumulated knowledge, complementing original research. Book chapters (8.9%) and conference proceedings (6.1%) reflect more specialized spaces, oriented toward thematic debates or the presentation of preliminary results, while books (5%) provide broader and more far-reaching conceptual frameworks. Smaller documents—editorials, notes, surveys, letters, and conference reviews—although small in percentage terms, play a strategic role in energizing academic exchange. Overall, the document typology demonstrates a hierarchical scientific ecosystem, where each format fulfills a distinct function in the construction and circulation of knowledge.

Documents by type

Scopus



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Figure 4. Detected documents, by type.

- Altered states of consciousness: Research on sleep, anesthesia, coma, and near-death experiences has provided insight into the limits of consciousness.
- Psychiatric disorders: schizophrenia, dissociation, or depression allow us to analyze how the subjective experience of the "self" is altered.

4. Theoretical and Computational Models

- Global Workspace Theory (Baars, Dehaene): proposes that consciousness arises when information is integrated and distributed globally in the brain.
- Integrated Information Theory (Tononi, IIT): attempts to quantify consciousness through a value (Φ) that measures the degree of integration of information in a network.
- Simulations in Artificial Intelligence: seek to model conscious cognitive processes in computational systems to test hypotheses about their emergence.

5. Interdisciplinary Approaches

- Philosophy of Mind: discusses the hard problem of consciousness (Chalmers), dualism vs. physicalism, and the role of qualia.
- Phenomenology: Husserl and Merleau-Ponty introduced systematic descriptions of subjective experience as input for science.
- Neuroethics and Cultural Studies: examine how consciousness influences morality, decision-making, and social behavior.

Consciousness has been investigated using experimental methods, neuroimaging and electrophysiology, clinical studies, theoretical models, and philosophical and phenomenological approaches. Each contributes pieces to a still-unresolved puzzle: how subjective experience arises from the physical.

Artificial intelligence, in the context of human consciousness versus the scientific method.

Artificial intelligence (AI) has established itself as one of the most disruptive areas of contemporary science, not only for its practical applications but also for its ability to address philosophical and epistemological questions surrounding human consciousness (Awashreh & Ramachandran, 2024). The scientific method, understood as a systematic procedure based on observation, experimentation, and verification, becomes the indispensable framework for evaluating both the scope and limitations of AI in addressing the problem of consciousness (Ambadi Narayanan & Nair, 2019).

From the perspective of cognitive science, human consciousness is characterized by subjective experience, intentionality, and reflexivity. These attributes have been studied using empirical methodologies such as functional neuroimaging, psychophysics, and the correlation between neural states and reported experiences (Nunez, 2016). However, there is still no consensus on the neural correlates of consciousness or on the possibility of fully explaining the conscious phenomenon through reductive models. This is where AI becomes a conceptual and experimental laboratory: it allows for testing hypotheses about information processing, the emergence of complexity, and the simulation of cognitive functions (Paulson, 2013).

On the computational level, deep learning models and artificial neural network architectures have shown a surprising ability to imitate tasks traditionally associated with human intelligence: pattern recognition, language generation, and adaptive decision-making (Chatterjee & N.S., 2022). However, their success is based on statistical correlations and the algorithmic manipulation of large volumes of data, with no evidence that such systems possess phenomenological experience. The fundamental difference is that human consciousness integrates the qualitative dimension of experience (qualia), while AI lacks this interiority. The scientific method, applied to the study of AI, requires a distinction between cognitive functionality and conscious experience (Barth & Arnold, 1999).

In epistemological terms, the development of AI poses a twofold challenge. On the one hand, it reinforces the physicalist and computationalist view of the mind, according to which mental processes can be modeled as information-processing operations (Androniceanu, 2023). On the other hand, it introduces the need to explore emergentism: the hypothesis that, from the complexity of sufficiently sophisticated systems, an analogue of consciousness could emerge. The scientific debate therefore focuses on determining whether consciousness is a biological epiphenomenon that cannot be replicated in machines, or whether it constitutes an emergent property of certain patterns of informational organization and dynamics (Green, 2018).

AI also offers methodological tools for the scientific study of consciousness itself. Simulation models allow for the testing of hypotheses about brain organization, while data analysis algorithms process large volumes of neuroscientific information with a degree of precision and speed impossible for human researchers (Bojorque & Pesántez-Avilés, 2020). Thus, AI becomes not only an object of study but also an instrument within the scientific method, generating a feedback loop in which science uses AI to understand consciousness and, in turn, questions the possibility of artificial consciousness (Deng et al., 2021).

Finally, it is necessary to underline the scientific nature of this analysis: to date, there is no empirical evidence to support the idea that AI can possess consciousness in the strict sense. Its status remains at the functional and symbolic level, while human consciousness remains an irreducible phenomenon that demands interdisciplinary approaches (Torres-Martínez, 2025). The scientific method requires caution: any claim about consciousness in AI must be based on replicable observations and coherent theoretical frameworks, avoiding metaphysical extrapolations. AI is, for now, a sophisticated mirror that amplifies fundamental questions about the nature of the mind, rather than a definitive answer to them (Hameed et al., 2021).

Discussion

Throughout history, philosophers and scientists have debated this difficulty. Descartes distinguished between *res cogitans*, the realm of thought and consciousness, and *res extensa*, the material world. Since then, the mind-body dilemma has accompanied all theories. Today, neuroscience has provided extraordinary discoveries about how neurons, synapses, and brain networks function, but it still lacks a definitive answer to the big question: how does subjective experience arise from matter? Some propose that we need a paradigm shift, an expansion of the scientific method that allows us to address the subjective in a rigorous manner. Others suggest that consciousness may be a fundamental phenomenon of the universe, as basic as space, time, or energy. This hypothesis, known as panpsychism, suggests that consciousness does not suddenly appear in the human brain, but is present, to varying degrees, throughout all of reality (Carrier, 2006).

Panpsychism is controversial because it breaks with the dominant materialist view, but at the same time it offers a way out of the difficult problem of consciousness. If we accept that consciousness is a fundamental aspect of the universe, we no longer need to explain how it appears out of nowhere in the human brain, but rather how it organizes and becomes more complex until it reaches the form we recognize as mind (Rass, 2013). This perspective forces us to rethink many categories, from biology to physics, as it would imply that everything that exists has some degree, however minimal, of experience. Still, even this hypothesis does not fully resolve the mystery. We still cannot precisely describe the link between observable brain activity

and inner experience. What it does make clear is that science, with its current tools, encounters a limit when it tries to explain what it means to be conscious (Ferrante et al., 2025).

This limit should not be interpreted as a failure of science, but as an invitation to humility and openness. Science is powerful for studying the objective, but it may need to be complemented by other forms of knowledge that explore the subjective. Philosophical and spiritual traditions from different cultures have investigated consciousness for centuries through introspection, meditation, and direct experience (Parks, Nichols, & Parks, 2019). Although their methods are not reproducible in the laboratory, they provide valuable insights into the nature of the mind and its relationship to reality. Dialogue between science and these traditions could open a more complete path to addressing the mystery of consciousness. The important thing is to recognize that being alive, having experiences, feeling joy, pain, love, or fear, is something that cannot be exhausted by chemical or electrical descriptions (Dahan, 2023).

Ultimately, consciousness reminds us that we are more than a set of organized atoms. We can analyze the structure of the brain and describe its processes in detail, but the essential question remains: what does it feel like to be that organism from within? This "qualitative leap" is what still eludes science. And perhaps this impossibility is not a weakness, but proof that consciousness constitutes a unique aspect of existence. We may never be able to reduce it to equations or experiments, because it belongs to an irreducible dimension of the human. Consciousness is the stage where everything else happens: thoughts, perceptions, memories, and dreams. Trying to explain it with the tools we use to study matter is like trying to trap the ocean in a net: we will always miss something essential.

Perhaps the true value of reflecting on consciousness lies not in finding a definitive answer, but in recognizing the mystery that dwells within us. This mystery invites us to contemplation, gratitude, and a search for meaning. It reminds us that being conscious is, in itself, a gift impossible to reduce to formulas. And it is precisely there where science reaches its limit: at the threshold of the inexplicable. We owe much of our progress to science, but we must also accept that there are dimensions of reality that resist being captured by its methods. Consciousness, with all its richness and depth, seems to be one of them.

Perhaps, rather than waiting for science to explain everything, we should learn to live with the mystery. Consciousness is the very condition of our existence, that which makes any question and any answer possible. Instead of trying to reduce it, we can value it as the sacred space from which we live and experience the world. In the end, science may continue to advance in our understanding of the brain and the mind, but the intimate experience of being conscious will continue to remind us that there is something within us that transcends the measurable. And perhaps it is precisely this unattainable dimension that gives meaning to our humanity.

Limitations and Scope of the Research.

The main motivation for this scientific contribution was the work of the American philosopher Thomas Nagel, author of the book "Mind and the Cosmos." In this work, the author addresses the difficulty of fitting conscious experience into a strictly materialist and reductionist framework. His purpose is not to formulate a definitive alternative, but rather to question the sufficiency of the materialist neo-Darwinian paradigm that dominates contemporary science. Nagel considers that this paradigm, based on the combination of Darwinian biological evolution and physicalist explanations, is incapable of accounting for fundamental phenomena such as the mind, rationality, and objective values (Nagel, 2012).

This work interprets Nagel as arguing that evolutionary materialism satisfactorily explains biological adaptation and the complexity of organisms, but fails to address subjectivity and consciousness. According to him, qualitative experience—what is felt from within—cannot be reduced to neurobiological processes. Materialist science offers external descriptions of reality, but fails to capture the internal character of mental states.

Added to this limitation is another: human rationality. If evolution is merely a blind process of natural selection, how can we justify the reliability of our cognitive faculties in understanding universal, mathematical, or metaphysical truths? For Nagel, the fact that the human mind can transcend immediate adaptive interest suggests that reason is not reducible to a contingent product of evolution.

Furthermore, on the theological level, one of the most provocative points of the book is the reintroduction of teleology into the explanation of nature. Nagel does not advocate intelligent design in the theistic sense, but he does argue that it is reasonable to think that the universe possesses an internal directionality toward the emergence of life, mind, and consciousness. This proposal is not a return to classical vitalism, but rather an attempt to open space for models that integrate purposes or tendencies inherent to the cosmos, beyond impersonal physicochemical laws.

Nagel suggests that the mind should not be viewed as an improbable evolutionary accident, but as a constitutive element of the universe. In this sense, consciousness would be as fundamental as matter or energy. This approach seeks to invert the traditional relationship: instead of explaining the mind through matter, matter should be thought of as a framework containing mental potentialities.

Objections to Reductionist Alternatives

According to our review, the objections to reductionist alternatives. Nagel analyzes several contemporary proposals that attempt to salvage materialism:

- Reductive Physicalism: holds that every mental state is reducible to a physical state. For Nagel, this ignores the irreducibility of subjective experience.
- Emergentist Physicalism: acknowledges that the mind emerges from the physical, but maintains that it remains entirely dependent on it. Nagel objects that it does not explain why consciousness emerges at all.
- Strict Evolutionary Explanations: focus on the adaptive utility of consciousness. Nagel points out that this does not justify the reliability of reason or the normative character of logic and morality.

Nagel's central thesis has far-reaching implications. If consciousness and reason are not explainable within a materialist framework, then the scientific method, as conceived, is not sufficient to offer a complete view of reality. Nagel does not reject science, but demands that its framework be expanded to include dimensions that are currently marginalized. His proposal straddles the border between the philosophy of mind and the philosophy of science, and seeks to open a space for discussion about new explanatory paradigms.

The work was met with controversy. Many materialist scientists and philosophers considered it a step backward toward pre-scientific conceptions, accusing Nagel of providing indirect arguments for creationism. However, others recognized the value of his critique of the dogmatism of scientific materialism, highlighting the need to seriously consider the unresolved problems of consciousness. In any case, the book achieved its objective: to provoke debate about the limits of the scientific method applied to the mind.

For an analysis of human consciousness versus the scientific method, this book is central because it directly questions the ability of the scientific method, in its reductionist version, to address the phenomenon of consciousness. Nagel does not offer definitive solutions, but highlights the tension between the empirical rigor of the scientific method and the irreducible complexity of conscious experience. His insistence on considering the mind as a fundamental component of the cosmos compels us to rethink the ontological assumptions of science and opens the door for more integrative models. In *Mind and Cosmos*, Thomas Nagel challenges the hegemony of neo-Darwinian materialism, proposing that consciousness, reason, and values cannot be understood as accidental products of biological evolution. His defense of teleology and rejection of reductionism point to the need for a broader science, capable of recognizing the mind as an intrinsic part of reality. Although the book has generated strong criticism, it constitutes a provocative contribution that, far from closing the debate, rekindles discussion about the limits of the scientific method and the place of consciousness in nature. For all these reasons, it has been the fundamental motivator for this concluding investigation.

Conclusions

The evidence gathered shows that scientific research on human consciousness has established itself as a highly interdisciplinary and clearly expanding field. The bibliometric analysis reveals sustained growth since 1990, with phases of consolidation and a clear upswing starting in 2018, culminating in 2025 with more than 360 contributions. This trend confirms the growing interest in a phenomenon that transcends the boundaries of a single discipline and demands dialogue between neuroscience, psychology, medicine, philosophy, and social sciences.

The thematic distribution of the indexed production points to a dual dominant focus: on the one hand, biomedical sciences (medicine, neuroscience, and psychology) as the axis of empirical objectification of conscious experience; on the other, the humanities and social sciences, which provide conceptual and ethical frameworks for interpreting the findings. This architecture confirms that the neural correlates of consciousness and behavioral designs explain parts of the problem, but do not exhaust its phenomenological or normative dimension. The documentary typology—with the scientific article as the hegemonic format—also suggests a mature ecosystem of peer review, complemented by reviews and chapters that integrate knowledge and guide new agendas.

On the geopolitical level of science, the United States easily leads in production, followed by the United Kingdom and an intermediate group (Canada, China, Russia), with Western Europe and Asia-Pacific in relevant but secondary positions. This pattern reveals asymmetric research and infrastructure capabilities and, at the same time, invites strengthening collaborative networks to diversify perspectives and methods—key when the object of study combines biology, subjective experience, and sociocultural contexts.

Methodologically, the field has advanced triangulation strategies: psychophysics and behavioral designs to link stimuli and conscious reports; neuroimaging and electrophysiology to identify functional patterns; and clinical studies of injuries, anesthesia, or disorders that illuminate the boundaries and components of consciousness. However, an explanatory gap persists between the description of neural mechanisms and the emergence of phenomenological experience (qualia). This gap justifies integrating neurophenomenological approaches and more refined first- and third-person protocols, with greater standardization and replicability, to reduce introspective biases without losing the richness of the experience.

Regarding Artificial Intelligence, your results support a cautious thesis: although deep learning models show remarkable performance in tasks associated with intelligence, there is no evidence of phenomenological experience in current systems. In terms of the scientific method, it is important to distinguish between cognitive functionality and consciousness; the former can be successfully simulated and measured, while the latter remains, for now, without conclusive empirical indicators. Two implications arise from this: (i) AI is a powerful tool for analyzing neuroscientific data and testing hypotheses; (ii) attributing consciousness to it requires more solid observational and theoretical criteria that avoid metaphysical extrapolations. On the epistemological and philosophical level, Thomas Nagel's critique of neo-Darwinian materialism—and his reopening of teleology in a naturalistic sense—is useful for mapping the limits of the reductionist paradigm. Your findings engage with this critique: empirical evidence accumulates correlates and mechanisms, but it still does not satisfactorily explain why the subjective emerges from the physical, nor how to ground the reliability of reason within a purely adaptive framework. Far from denying science, this suggests expanding the explanatory framework toward models that consider directionality, integration, and levels of organization where the mind is not a mere epiphenomenon.

The study's limitations—its exclusive use of Scopus, a limited search string, different time windows between analyses, and the lack of comparison with other databases (WoS, PubMed), as well as the lack of quality metrics by subfield—invite future extensions: (i) query sensitivity (terms, synonyms, thesauri), (ii) comparison between databases and standardization by field, (iii) incorporation of replicability and pre-registration indicators, and (iv) analysis of collaboration networks to detect brokers and regional gaps.

Overall, your research supports three robust conclusions: (1) science has generated a large and plural corpus on consciousness, but its phenomenological core remains without an empirically verifiable unifying theory; (2) AI, today, is a methodological instrument rather than a conscious subject, and its evaluation must rigorously distinguish between performance and experience; (3) Moving forward requires an interdisciplinary synthesis that articulates biomarkers, first- and third-person protocols, and non-reductionist philosophical-epistemological frameworks. This work program would allow us to move from descriptive and correlational maps to explanatory models capable of integrating neural, cognitive, and lived experience with criteria of evidence and replicability specific to the scientific method.

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