JNphi

New Perspectives on Human Consciousness as the Brain Activation State (BAS)

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Abstract

The exploration of the origin and essence of human consciousness has a long history, and although various disciplines—such as philosophy, medicine, sociology, biology, and psychology—have offered different explanations, none has gained widespread recognition to date. This lack of consensus stems primarily from the complexity of consciousness itself, combined with significant disciplinary differences in perspective, which together prevent researchers from fully, reasonably, and comprehensively grasping its essence. Consequently, consciousness remains an enduringly ambiguous subject, making deeper investigation necessary. Based on a systematic analysis, summarization, and synthesis of knowledge across multiple fields, this paper draws the following conclusions: the origin of consciousness lies in natural materials; its essence is material information; and it possesses the attributes of congenitality, materiality, complexity, systematicity, dynamics, differentiation, subjectivity, and selfhood.

Key Words: Material information, Complexity, Orderliness, Energy, BAS (Brain Activation State), Attributes

DOI: 10.5281/zenodo.20141359

1. Introduction

The concept of consciousness originates from the Latin word *conscientia* (meaning "cognition"), which typically refers to advanced neural activity. Although adopted by multiple disciplines, each discipline has a different interpretation of it, such as in philosophy, biology, medicine, and psychology. The idealist definition, represented by the ancient Greek philosopher Plato, holds that consciousness originates from the soul, including reason, will, and emotions. Consciousness is an attribute of the soul, which he viewed as a primordial entity existing before the forms (or ideas) and capable of governing their movement. He posited that the soul resided in the

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world of ideas before the creation of humans (Plato, 2009). The materialist definition describes consciousness as the reflection of the objective material world by the human brain, and as the sum of mental processes, including feelings and thoughts (Marx & Engels, 2012). Consciousness can also be defined broadly or narrowly in psychology: the broad concept refers to the brain's reflection of the objective world, aligning with the materialist definition, while the narrow concept refers to the degree to which individuals perceive and attend to the external world and themselves (Lin et al., 2023). From a biological perspective, human consciousness arises in the brain, an organ comprising the cerebrum, cerebellum, thalamus, hypothalamus, and basal nuclei. Sensory information (e.g., vision, hearing, touch, smell, taste) is transmitted step-by-step through cerebral neurons as neural signals. These signals are synthesized by the thalamus into a unified perceptual representation, which is then relayed to the brain's association areas. This process generates awareness—what we recognize as human consciousness (Koch, 2004). To interpret consciousness as fully, comprehensively, and rationally as possible, this paper analyzes, summarizes, and generalizes disciplinary knowledge to conclude its origin, essence, and attributes.

2. The Origin of Consciousness

The origin of consciousness traces back to the birth of the universe, which gave rise to stages of inorganic matter, then organic matter, and ultimately living organisms—culminating in the emergence of human consciousness.

2.1 Production of Inorganic Matter

Astrophysical evidence, including hydrogen abundance, cosmic background radiation, and interstellar redshift, indicates that the universe formed ~13.8 billion years ago from a singularity (a point of infinite density) containing immense energy. This energy drove the Big Bang, producing all cosmic components: matter (e.g., elements, compounds), fundamental forces, spacetime, and more. The earliest formed elements were hydrogen and helium; subsequent processes (e.g., nuclear fusion, galactic collisions, neutron star mergers) led to simple inorganic substances, including elements, compounds, and early galaxies (Xiang & Fang, 2024). Around 4.5 billion years ago, the Solar System began to emerge. At this stage, the primary constituents on Earth were inorganic substances such as elements and compounds, all of which possessed certain material information, the information inherent to the existence of matter. Examples include particle distribution, size, ordering, velocity, mass, energy, and electromagnetic fields. This information dictates a substance's distribution, ordering, and inherent properties under energy-driven interactions. In both microscopic and macroscopic systems, material information (e.g., charge, mass, ordering, interaction type) defines a

substance's identity and properties. Crucially, material information is not a physical substance—it does not occupy space or possess mass/energy. Instead, it requires matter as a carrier and energy to be manifested. Thus, energy governs the distribution, ordering, and properties of material information in substances. *It represents the transition from 0 (pure energy) to 1 (inorganic matter).*

2.2 Production of Organic Material

Around 3.8 billion years ago, inorganic matter formed more complex organic compounds (e.g., precursors to nucleotides such as phosphate, ribose, deoxyribose, and nitrogenous bases) on Earth through physicochemical processes driven by environmental factors like sunlight, lightning, water, and atmospheric gases. Subsequently, ribonucleotides and deoxyribonucleotides were synthesized, leading to the evolution of genetic material: DNA and RNA. RNA, an organic molecule capable of limited self-replication, combined with other substances to form increasingly complex structures, ultimately giving rise to single-celled organisms. This transition is considered pivotal for the emergence of life systems (Gesteland et al., 2007). *It represents the transition from 1 (inorganic matter) to 2 (organic matter).*

2.3 Birth of Life

Approximately 3.5 billion years ago, stable cells gradually formed through the assembly of newly produced substances (e.g., proteins, sugars, lipids, phospholipids, enzymes) and pre-existing trace elements (e.g., Na, K) under specific conditions (such as volcanic activity). These cells gave rise to single-celled life forms. While these organisms responded to external stimuli, they lacked consciousness, having only developed basic instincts to adapt to environmental pressures. Later, some jellyfish exhibited peptidergic cells—precursors to neurons—with functions like sensing, transmission, processing, and response. As organisms evolved, nervous systems gradually emerged: originating from primitive cells, they became concentrated in ganglia and bundled into nerve fibers. Over time, anterior ganglia fused to form a "brain" which grew in complexity from early vertebrates to advanced primates. Neurons are the foundation of brain function. Structurally, they comprise cell bodies, dendrites, axons, synapses, and nerve terminals. The information encoded in these components (e.g., protein sequences and ion channel distributions) constitutes material information. Different neuronal connections and interactions generate distinct functional blocks (e.g., visual, memory, computational processing). The integration of these blocks forms an animal's consciousness system (Gesteland et al., 2007). *It represents the transition from 2 (organic matter) to 3 (living organisms).*

2.4 Birth of Humans

Approximately 3 million years ago, primates began leaving primeval forests for plains due to changing geographical conditions. To survive, they engaged in unique social activities—such as hunting, cooperative

labor, communication, and learning—which continuously stimulated and updated material information in the brain. Additionally, the dietary shift from raw omnivores to cooked meat accelerated digestion and nutrient absorption. Under the principle of "natural selection and survival of the fittest" genetic mutations promoted the expansion of basal brain capacity, with brain volume increasing by over 200%. This led to greater complexity in the brain's basic structure. Stimulated by uniquely human social activities, the order of material information in functional brain regions was significantly enhanced, upgrading cognitive abilities, including the emergence of language—and ultimately forming the consciousness system of modern humans (Wu, 2006). The essence of this evolutionary process lies in the increasing complexity and orderliness of material information in the brain.

Laozi (2006) noted, "Nothing (0) generates Being, being generates Tao, Tao generates 1, 1 generates 2, 2 generates 3, 3 generates All things." This process reflects the progressive complexity and orderliness of material information from "0" to "All things" in nature. *It represents the transition from 3 (living organisms) to all things (humans).*

In summary, the evolution of life is a process of continuous increase in the complexity and orderliness of material information.

3. Definition of Consciousness

Based on the preceding discussion and analysis of consciousness evolution, consciousness is an emergent property of material information supported by energy arising from increasing complexity and orderliness. It encompasses the formation of consciousness and the full evolutionary journey from 0 (energy) to all things (humans). From this, we derive the following definition: *Consciousness: The Activation State formed by material information with the support of energy in the Brain.* Abbreviation: *BAS* (Brain Activation State). Operating Principle: It involves inputting internal/external information into BAS for processing (e.g., reception, encoding, storage, computation, extraction, transmission, perception) and output processed information to organs to direct activity with energy.

3.1 Material Information

Material information is the spatiotemporal state of matter. It exists in static or dynamic forms, covering material distribution, quantity, sequence, electromagnetic fields, voltage, electric current, various signals, physical and chemical reactions, and so on. Material information depends on matter but is not matter itself; it requires matter as a carrier. It depends on energy, and it is not energy itself yet requires energy to support it. Essentially, material information is the spatiotemporal state of the combination of matter and energy. According to the philosophical definition of matter, both material information and energy belong to the category of matter. Pythagoras

stated: "All things are numbers." The essence of "numbers" here is material information, which can be understood as "All things are material information." The operational foundation of the BAS lies in the complexity and orderliness of material information. Here, ***"Complexity"*** refers to the number of neurons and the scale of their network structures in BAS. ***"Orderliness"***, which can be interpreted as entropy, refers to the degree of logic, rationality and effectiveness formed by material information in BAS. The higher the degree of order, the lower the entropy; conversely, the lower the degree of order, the higher the entropy. *Consciousness Ability (CA) can be understood as* $\propto$ *Energy (E) × Complexity (C) × Orderliness (O) = E×C×O.* The combination (C×O) can be understood as human intelligence: the higher their levels, the higher the intelligence of BAS.

3.2 Energy

This primarily refers to thermal energy and related forms. The telencephalon of the brain comprises approximately 14 billion cells, weighs about 1400 grams, and features a cerebral cortex with thickness of roughly 2–3 mm. The brain constitutes only about 2% of total body weight, yet its oxygen consumption reaches 25% of the body's total, and blood flow accounts for 15% of cardiac output. Blood glucose serves as the fundamental energy source. During aerobic respiration, ATP is produced. The sodium-potassium pump maintains resting potential, consuming about 50–70% of neuronal energy; action potentials and synaptic transmission demand large amounts of ATP (Hall, 2015). Without energy and oxygen input, BAS loses vitality and enters brain death. Even idle or sleep states require energy to maintain basic vitality.

3.3 Activation State & Input/Output

Activation State: a state of activity arises when energy excites matter, characterized by excitation, activation, and state. BAS processes input information from external, internal, and proprioceptive receptors. Outputs include perceptions (pain, pleasure) and reactions (language, voluntary movement). Functional activation states enable encoding, memory, spatial reasoning, etc.

4. Attributes of Consciousness

Based on the definition and essence of BAS, consciousness has eight attributes: *Congenitality, Materiality, Complexity, Systematicity, Dynamics, Differentiation, Subjectivity, and Selfhood.*

4.1 Congenitality

A gene (or genetic factor) is the complete nucleotide sequence required for RNA (Ribonucleic Acid) synthesis. It sustains the fundamental architecture and functions of living organisms and encodes all essential information of a species—including lineage, blood type,

reproduction, growth, and apoptosis. All life phenomena—from birth, growth, and maturation to decline, disease, aging, and death—are linked to genes, which also serve as intrinsic determinants of health. Consequently, genes exhibit a dual nature: materiality and informativity. The former represents the physical carrier of genetic material, whereas the latter describes its state of existence; together, they constitute the material-informational essence of the gene (Thomas Hunt Morgan, 1926).

In short, human emergence and evolution are information-driven—we exist by virtue of information and thrive through its dynamics.

Therefore, the BAS possesses the attribute of Congenitality.

4.2 Materiality

Material information reflects the ordering, distribution, and combination of substances (electromagnetic fields, ions, molecules, neurons, biochemical reactions) in the BAS. Neurons (supported by glial cells) transmit signals: electrical pulses via action potentials within neurons, and chemical neurotransmitters across synapses. Synaptic transmission alters ion permeability, propagating signals. Since neurons are the BAS's basic units, the BAS is inherently material. Additionally, all matter is composed of various atoms and molecules formed after the Big Bang—such as sodium, hydrogen, carbon, oxygen, and other substances—which have evolved into the BAS over time. Of course, the distribution (including arrangement, combination, etc.) of these substances also possesses materiality. From a philosophical perspective, all matter, information, and energy fall within the category of material existence.

Therefore, the BAS possesses the attribute of Materiality.

4.3 Complexity

The brain is composed of approximately 14 billion cells, weighs about 1400 grams, and has a cerebral cortex thickness of roughly 2–3 millimeters. The entire cerebral cortex forms quadrillions of neural connections. There are over 10 billion neurons, each extending between 1,000 and 10,000 synapses that interconnect with adjacent neurons. These synapses function like circuits, each equipped with a "gate" that either permits or blocks the "flow of electrical signals" gradually forming a powerful network capable of storing massive connections—a capacity comparable to that of 10,000 computers. Furthermore, more than 100,000 chemical reactions occur every second, including physical and biological processes, thereby generating an astronomical volume of information.

To date, no comprehensive, rational, or systematic understanding of its workings has been achieved, making it a millennia-old puzzle that remains unsolved (Lin Chongde et al., 1926).

Therefore, the BAS possesses the attribute of Complexity.

4.4 Systematicity

A system is a whole composed of a set of interrelated and interacting elements. The elements are material information (such as electromagnetic fields, neurons, biochemical reactions, etc.) and energy, and the whole composed of their interconnections and interactions forms the BAS. For example, each neuron has no function or value on its own in the BAS, but together they form various functions, synthesizing a powerful and valuable BAS system. These features exhibit typical systemic markers. In the fields of biology and medicine, there are numerous theories describing the functional blocks and distribution of the brain. Due to the complexity of the BAS, none of these theories has gained complete consensus. However, it is generally accepted that the brain can be divided into seven major networks: the sensorimotor system, visual system, limbic system, central executive network, default mode network, salience network, and dorsal attention network. Regardless of the specific theory, these functional blocks are first formed by the activation of minimal units—neurons. Through multi-dimensional transmission pathways—lateral, longitudinal, transverse, and oblique—electrical signals establish local connections and interactions, leading to the activation of functional blocks. They interact and influence each other, ultimately integrating to form the systemic activation of the brain, known as the BAS. All these characteristics exhibit typical systemic signatures.

Therefore, the BAS possesses the attribute of Systematicity.

4.5 Dynamics

According to the definition of consciousness, it is an active state that primarily manifests through physical and biochemical reactions in the brain, such as continuous electrical signal transmission. For instance, approximately eleven million biochemical reactions occur per second (Zhou, Ling,2020), and these activities determine the activity level of the BAS. Furthermore, given certain input information transmitted through the nervous system and a sustained supply of sufficient energy, the BAS activity immediately becomes more vigorous under such impetus, and physical (e.g., electromagnetic propagation) and chemical reactions in the brain intensify, enhancing processing capacity. Subsequently, through the transmission of the nervous system, the BAS directs the responses and activities of various organs in the body, albeit to varying degrees depending on the specific state. Moreover, the tens of billions of neurons and their intricate organization and connections are not static; they undergo dynamic changes influenced by age and environmental factors. BAS can be classified by age into infant, juvenile, adult, and elderly states; by space into unit, functional, and system activation states; and by daytime state into quiescent, stable, and dynamic states. In short, as long as there is activity, there are dynamics. The greater the activity, the stronger the dynamics.

Therefore, the BAS possesses the attribute of Dynamics.

4.6 Differentiation

The primary function of the BAS is to process incoming information and transmit the output to various organs throughout the body. Generally speaking, it has certain commonalities. Firstly, genetic inheritance ensures a high degree of consistency in the material information carried by genes, which underlies common perceptual experiences—such as vision, smell, hearing, taste, and the sense of distinguishing humans from other species. Secondly, accumulated knowledge, experiences, and lessons derived from millennia of social practice contribute to relatively consistent understandings of certain events and objects. This is reflected in the widespread acceptance of universal values like kindness, sincerity, integrity, freedom, democracy, fairness, and justice. Despite these commonalities, pervasive human contradictions, conflicts, and disputes primarily originate from differences in the BAS. The principal sources of this variability include innate differences, divergent observational perspectives, and temporal factors. In summary, differences across multiple dimensions—including individuality, group affiliation, time, and spatial environment—collectively cause variations in the output after the BAS processes input information. These variations ultimately shape distinct patterns of thinking and behavior, influencing how individuals perceive and react to the same event. All these differences contribute to the formation of each person's unique worldview, philosophy of life, and set of values. They are also fundamental to the emergence of various contradictions among humans. Differentiation in BAS means that the biggest gap between people lies in consciousness, not in other traits.

Therefore, the BAS possesses the attribute of Differentiation.

4.7 Subjectivity

The BAS is the entity that processes internal and external information inputs into the brain. Some input information differs only minimally, making it unlikely for BAS to directly recognize and distinguish them and thereby generate clear perceptions. Thus, processing (such as encoding and amplification) is required to produce distinct perceptions. For instance, the perception of color leads humans to believe the world is objectively colorful, but in reality, color arises when the eye’s sensory cells convert visible light of different frequencies (wavelengths between 380–780 nanometers) into electrical signals, which the BAS compiles, simulates, and amplifies to form distinct color perceptions (similar to computer programs). Therefore, color is a subjective perception generated by the BAS processing the frequency and intensity of visible light, which are objective realities. In other words, human color perception is the result of amplification, compilation, and simulation by the BAS, making it subjective; color can be seen as an illusion, while the frequency and intensity of visible light are real.

Other perceptions, such as taste, smell, and touch, follow the same pattern and will not be elaborated here.

In short, the BAS is a subjective reflection of the objective world, albeit to varying degrees. The BAS represents a continuous cycle of exploration and research into the essence of the objective world.

Therefore, the BAS possesses the attribute of subjectivity.

4.8 Selfhood

In various systems of existence in the universe, a common feature is the presence of a "center" characterized by relatively high mass and energy. For example, an atom exists with the atomic nucleus as its center; the earth exists with its core; the solar system exists with the sun as its center; and the Milky Way exists with a central black hole as its center. All these centers sustain the system by governing the motion of surrounding entities through substantial mass or energy, giving rise to a sense of "I" and "mine" The atomic nucleus would regard the atom as "mine"; the earth would regard the moon as "mine"; the sun would regard the earth as "mine"; and a black hole would regard the Milky Way as "mine" Clearly, the center plays an active, dominant, and essential role, distinctly embodying a sense of self.

In natural and social systems, a similar pattern holds: a powerful center controls the entire system. Cells exist with the nucleus as the center; the human body exists with the brain as the center; the family exists with parents as the center; enterprises exist with leaders as the center; and countries exist with governing authorities as the center. All these centers foster a sense of "mine" as everything within the system operates around them, and the center plays an active, dominant, and vital role. Conversely, the cell membrane would not call the cell "mine"; hands and feet would not claim the body; children would not claim the family; employees would not claim the company; and citizens would not claim the nation. This is because they lack the power to control other entities and play only a passive, subordinate, and secondary role.

Evidently, the "center" can be understood as the core of a system. This core is marked by high energy and significant mass, occupies a dominant position, possesses a strong sense of ownership, and embodies the concept of "mine"—as in "I am the center, the center is me" or "Everything is mine."

Following this logic, the human body system is no exception. The BAS, as the central control region for the body's operations, determines its dominance, giving rise to self-perceptions such as "Everything is mine." "I am right." "I am good." and "I am the only one that matters." thereby fostering self-centeredness. Since every individual naturally views themselves as the "center" from their own perspective, they hold different views on the same matter in social contexts, leading to disagreements and conflicts.

We propose that selfhood may emerge from any high-energy center within a system as a theoretical hypothesis. For researchers interested in this hypothesis, experimental verification is warranted.

Therefore, the BAS possesses the attribute of Selfhood.

5. Comparison of IIT/GWT/HOT/BAS

Current consciousness research is dominated by three major theoretical frameworks: Integrated Information Theory (IIT), proposed by neuroscientist Giulio Tononi in 2004; Global Workspace Theory (GWT), put forward by cognitive scientist Bernard Baars in 1988 and later developed by Stanislas Dehaene into the Global Neuronal Workspace Theory; Higher-Order Thought Theory (HOT), advanced by philosopher David Rosenthal in the 1980s. Their main theoretical foundations are: IIT: Focuses on information integration structure (intrinsic inherent consciousness); GWT: Focuses on global information broadcasting (access functional consciousness); HOT: Focuses on higher-order self-reflection (metacognitive phenomenal awareness).

BAS transcends pure information and cognitive paradigms by introducing energy, material information complexity, and orderliness. It reconciles the informational integration of IIT, the global broadcasting of GWT, and the higher-order representation of HOT, establishing a unified interdisciplinary framework.

6. Conclusion

The essence of BAS is material information. Characteristics include excitation supported by energy, activation as dynamic process, and state in the distribution of material information. Consciousness Ability (CA) ∝ Energy (E) × Complexity (C) × Orderliness (O). Attributes are congenitality, materiality, complexity, systematicity, dynamics, differentiation, subjectivity, and selfhood. The foundation of core human conflicts is subjectivity, selfhood, and differentiation; the greatest human error is the persistent belief that one is always right and good.

7. Discussion

The definition of human consciousness (BAS) can be aligned with that of a biological computer. The basic units of BAS are not limited to binary values; they may also include graded electrical signals (theoretical hypothesis) and chemical signals. Material information supported by energy can be regarded as the foundational operating principle of all things, namely the "Tao" including living organisms, the earth, the solar system, and the universe.

References

Gesteland RF, Cech TR, Atkins JF. *The RNA World*. Science Press; 2007.

Hall JE. *Guyton and Hall Textbook of Medical Physiology*. Peking University Medical Press; 2015.

Koch C. *Consciousness: A Neurobiological Approach*. Roberts and Company Publishers; 2004.

Lao Tzu. *Tao Te Ching*. Harper Perennial Modern Classics; 2006.

Lin C, Yang Z, Huang X. *Dictionary of Psychology*. Shanghai Education Press; 2023.

Marx K, Engels F. *Selected Works of Marx and Engels*. People's Publishing House; 2012.

Morgan TH. *The Theory of the Gene*. Yale University Press; 1926.

Plato. *Phaedo*. Gallop D, trans. Oxford University Press; 2009.

Wu R. *The Birth and Evolution of Humankind*. Tsinghua University Press; 2006.

Xiang S, Fang W. *Introduction to Cosmology*. Science Press; 2024.

Zhou L. *Cognitive Awakening: Unleash the Motivation for Self-Transformation*. Posts & Telecom Press; 2020.