



## The Mind and the Brain: Will We Ever Decipher Consciousness?

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### Commentary

A dichotomy of high-level model and biological basis of the mind constitutes this paper. As Descartes said, I think, therefore I am, representing a philosophical argument of the existence of humans as characterized by the ability to think. More important to consciousness is metacognition, the process to reason about one's thoughts. The former is formation of consciousness, and the latter is cognitive real-estate using which I write this paper. Building on the prerequisite of cognition and metacognition, in this essay, I attempt to analyze attributes of consciousness and how it is non-unique to humans on many levels; I will wrap up arguing that although consciousness could be characterized into attributes, it is not reducible to their sum, due to evidence connecting the aforementioned dichotomy of consciousness.

Awareness is parsed into five segments, presented in hierarchical order from most seen in the animal kingdom to being unique to certain groups:

#### 1. Agential self-awareness

This is an understanding of the ability to act upon the world which impacts the environment. In the human brain, more complex functions are anterior, and those shared by most living beings are located in the posterior lobes. This creates a consensus upon which I build my argument that the brain is hierarchical. Agential self-awareness, being different from the reflexive response from stimulating the motor homunculus, is the transmission of signal from the motor cortex to the frontal lobe. This is a consciousness shared by all animals having a physical body capable of movements.

#### 2. Biographical awareness of identity

Evidence from human memory study points to a complementary learning system, where the hippocampus first constructs a rapid representation of conjunctive memories; the cortex later encodes this information into permanent, simplified representation based on which a personal identity is established. This is the biological basis of identity, which emerges based on the being's ability to form memories. It is shared by most mammals.

#### 3. Social self-awareness

In the natural world, collaboration within the same species, capable of reproduction with the individual or transmitting the similar gene down the same lineage, is crucial to survival. Therefore, social intelligence has evolved in many species, ranging from bees, where a societal structure dictates hierarchy to individual animals, accompanied by strict societal responsibility. Humans manifest this awareness through various concepts in social psychology, such as adhering to social norms, being subject to polarization with social media, etc.

#### 4. Introspective awareness

Whereas thinking belongs to the realm of cognition, consciousness is an area above cognition - it requires metacognition, the awareness of one's own thoughts and feelings. Most animals have physical agency, self-awareness, social intelligence, but few have shown evidence of introspection beyond several primates.

#### 5. Spiritual awareness or awe

Understanding of or connection with another being higher than one's physical existence, including the notion of immortality beyond physical decay, and characterization of God based on one's identity. Research on the religious brain points to evidence of correlation between cortical thickness and the degree to which one identifies with religion, and BOLD signal in certain brain

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areas predicting fundamentalism. Some people identify with a religious group, while others connect with certain ideological beliefs beyond their individual existence.

On the other hand, the joke has been made that if you provide dogs with food and shelter and affection, they will think you are god; whereas replicating the actions to a cat make them think that they are gods. Thinking beyond the humor, it is a fact that religion has not been found in animals in current literature.

Based on these characters, I draw a hierarchical triangle of consciousness. On most levels, a human equivalence animal exists, yet the number of species that possess the consciousness decrease as we go up the hierarchy. It is possible that we've not reached the end of the hierarchy, and humans are not the most conscious species – another unknown species, or perhaps – to my religious readers – deity, a sixth level of temporal or causal context in the world should be added. They might be aware of the past and future of events relative to present, and understand their agency within the cosmos. Efforts have been made to connect various aspects of consciousness to biology. The central dogma of neuroscience states that all of our mental states are inextricably linked to the brain, making it natural to find neurological basis of certain attributes in the brain. Although I endorse the approach to parse consciousness when discussing it in a philosophical context, I reject the approach taken by Gestalt psychology where consciousness is the addition of all its attributes. Given the presence of 86 billion neurons in the 3-pound human brain, every increase in 0.03 pound of brain mass corresponds to increase in 1 billion neurons. In other words, emergent properties of growing larger brains are central to consciousness.

In neuroscience research, no single neuron is responsible for one function only, and are often involved in many pathways. In fact, 80% of the human brain is activated during any given moment; functions emerge under the co-activation of thousands of neurons – no single neuron could undertake the entire function, nor would removal of one neuron impact the functionality. On a systems neuroscience level, significant overlaps between networks in neuroimaging study point to the conclusion that there isn't a clear-defined boundary between brain networks. I call this the conceptual dilemma of neuroscience – although we could study the functions or malfunctions of certain networks, it is impossible to reduce the functionality of a brain to the summation of its parts.

If we take the conceptual dilemma to the study of consciousness, we find that research often emphasizes the link between certain brain area activation and the presence of functions. However, has it ever been studied that, if we preserve the area only and remove all others, would the functionality still stand? The study of consciousness using neuroimaging takes the fundamental approach of subtracting the activation of task-based fMRI to resting state fMRI to reduce the degree of complexity involved, yet has it ever been considered that these ever-present, non-attended neurons could be the pillars of brain functions? The potential flaws in the methodology undertaken are questionable and insufficient to address a topic as nuanced as consciousness.