Mind and Cognition: The Long Evolutionary Journey—From Biological Existence to the Threshold of Artificial Intelligence.

How would you define the "mind"? To put it simply, the mind is a functional entity that enables us to receive essential information from the external world through our five senses, store that information in memory, reflect upon it, and proceed to make decisions and translate them into action. It is through these very functions that self-awareness develops within us. Self-awareness entails perceiving one's own existence within the environment and remaining conscious of the boundaries of that existence as well as the relationship between oneself and the outside world.

The neuron, or nerve cell, is the structural and functional unit of the brain. Although nerve cells are in physical contact with one another, communication between them occurs via electrical or chemical means. Chemical communication relies on neurotransmitters such as dopamine and serotonin. The combined electrical and chemical activity within the complex network formed in this way makes the existence of the mind possible.

Cognition represents the functional aspect of the mind. Let us attempt to define the term 'cognition' .Cognition can be described as the collective combination of perception, memory, thinking, and decision-making. Although it captures only a part of the meaning, it can be succinctly termed 'cognitive ability.'

These two concepts of mind and cognition are best understood by comparing them to the structure of a computer. A computer consists, firstly, of a physical structure made of metal or plastic—known as hardware—within which logic is encoded via electromagnetic signals; this logic is referred to as software. The core software is known as the operating system—such as Microsoft Windows or Linux. Beyond that, we require specific applications—like Microsoft Word, LibreOffice, or similar programs—to perform particular tasks. To utilize a computer, both these components must be operational on the hardware. Similarly, the mind functions as an operating system, yet it cannot operate without cognition.

The mind or cognition functions properly only when the brain (its physical substrate) remains intact,and to understand that it is necessary to discuss dementia. Dementia is a state of mental decline characterized by memory loss, an inability to communicate thoughts to others, an impaired capacity for reasoning or decision-making, and a loss of the ability to protect oneself; these issues arise from deficits in one or more of the functional areas discussed below. Dementia can result from structural damage to the brain caused by various factors, such as strokes (multi-infarct dementia), Alzheimer's disease, or the aging process (senile dementia). From this, it can be unequivocally stated that the full functionality of the mind or cognition is impossible without an intact brain.

Breaking cognition down into smaller processes makes its immense significance easier to understand. These processes include:

1/ Sensing: Among the information from the outside world perceived through our five senses, only that which holds personal significance is registered. "Significant" implies information that is either beneficial or harmful to the individual. The mind possesses a mechanism to filter information in this way; otherwise, our brains would be overwhelmed and rendered useless by

the sheer volume of sensory input. Consequently, we do not hear every sound in our environment, nor do we always notice everything that passes before our eyes.
2/ Attention: The ability to focus on a specific subject, to concentrate on what is important amidst multiple stimuli, and to sustain that focus over an extended period.
3/ Memory: Retaining meaningful information and retrieving relevant data from past memories for use. This encompasses not only names, forms, and locations but also concepts.
4/ Concept: A concept is formed by combining necessary memories with newly acquired information.
5/ Learning: Strengthening concepts through repetition and constantly aligning them with experience—this is made possible by cognition. This constitutes learning.
6/ Abstract Concept: Forming concepts based on ideals, ethics, or symbols—such as currency, mathematical systems, or religion.
7/ Language: The ability to recognize and interpret symbols or signs leads to the creation of spoken language, followed by written language.
8/ Reasoning and Decision-Making: The ability to draw conclusions based on various pieces of information through the application of logic.
The mind's functional capacity is measured by assessing each of these elements.

The Origin and Development of Cognition – Observing the evolution of the mind makes it easier to grasp the concept of cognition.
Lower-level creatures—such as insects, fish, and birds—can protect themselves through reflex actions; for instance, they avoid a harmful stimulus after sensing it. This implies that they learn from their environment and act accordingly. This represents a very primitive form of adaptive behavior.

Even a rat learns to avoid a place where it has been pricked by a needle, while repeatedly returning to a spot where it finds food—meaning it learns the processes of self-preservation and survival; this marks the beginning of cognition. This ability gradually evolves into more sophisticated forms in higher animals like dolphins, dogs, and chimpanzees. At this stage, they are capable of simple thought processes involving mental imagery; they can form and retain mental images of objects or events. A dog can recognize its owner and distinguish between friends and foes in its environment. Human emotions—such as anger, love, hatred, jealousy, and empathy—emerged as the culmination of the adaptive behaviors that originated in lower-order animals; these are behaviors that serve to protect the individual. However, unlike humans, animals cannot exchange thoughts with one another, nor can they formulate abstract concepts. This is because such capabilities require the emergence and use of symbols—specifically, language.
It is through language that one can describe an object or event and convey it to others. This enabled the human mind to develop the capacity for forming abstract concepts—that is, concepts regarding matters that cannot be visualized or physically presented as tangible objects. Examples include notions such as ethics or morality, ideals, mathematical concepts, or the idea of God. This development marked the beginning of culture.

How did culture originate?--Culture entails perceiving, interpreting, and conceptualizing the surrounding environment, as well as sharing these experiences with

others—processes made possible through preservation and exchange via language or other symbols such as images and music. This fosters the development of the beliefs, habits, knowledge, and traditions that define a community's identity. The ability to empathize with others and collaborate on tasks through the shared exchange of information is known as "social cognition." Because culture is transmissible, it spreads rapidly—a phenomenon known as "horizontal transmission"—while also undergoing modification and refinement across generations, thereby enduring over time in alignment with the community's continued existence but changing in 10 or 100 of years .

Alongside this, we observe that biological evolution proceeds at a slow pace over thousands of years, driven by natural selection. It involves vertical transmission—where genetic changes in parents can be passed on to their offspring. Culture gave humans the ability to form groups of immense size.

Aggregation in lower animals We observe large groups and social cohesion in other animals that do not possess fully developed cognition; chimpanzees, monkeys, elephants, and deer, for instance, live in herds or troops. Members of such groups build a mental database about one another through sight, touch, sound, taste, and smell. To keep this mental image updated, they must regularly groom or interact with each other. Since this process consumes time, time constraints prevent the group size from expanding beyond a certain limit—typically no more than 100 to 150 individuals. This limit is known as the "Dunbar number," a concept calculated and demonstrated by social anthropologist Robin Dunbar in 1998.

Marine fish also form incredibly large schools; for instance, a single shoal of Atlantic herring or sardines can stretch five to seven kilometers in length and comprise three to four billion fish. The members of such massive schools operate based on a few simple rules—such as maintaining a specific distance from neighbors and matching their speed and direction while monitoring any changes in movement. To achieve this, these fish possess receptors along both sides of their bodies that constantly relay information to the nervous system in fractions of a second; consequently, thousands of fish move, change direction, and alter the shape and size of the school in unison, acting like a single, massive organism without the need for a leader. Flocks of birds and swarms of locusts employ similar methods to move in groups. However, the strategies used by these creatures—or by animals like deer and zebras when migrating or gathering in large herds due to food scarcity or natural disasters—cannot give rise to the kind of advanced societies or communities created by modern humans.

Human gregariousness Cognitive abilities have empowered humans to organize around any objective in numbers far exceeding the limit defined by Dunbar's number. People can form groups based on society, nation, or various shared goals—such as theater troupes or political parties—and a single individual can simultaneously belong to multiple groups for different reasons; such flexibility would be impossible without

cognition. It is essential to understand this capacity for group formation because it illustrates how simple adaptive processes evolved into complex cognition, thereby elevating human social cohesion and enhancing our ability to ensure survival. A prime example of this is the survival of *Homo sapiens* amidst three distinct human species 70,000 years ago; while the other two—*Neanderthalensis* and *Denisovans*—vanished from the earth within the subsequent 30,000 years, *Homo sapiens* endured by virtue of acquiring cognition, a key evolutionary trait. Much like other living beings, the dialectical relationship between humans and nature drives our development; in the relentless course of evolution, only those possessing traits favorable for survival endure, while others face extinction—such is the ruthless law of evolution.

Among the variations arising from genetic mutations in organisms, traits favorable to the environment survive through natural selection; these advantageous traits are preserved and propagated as the animal or human reproduces. In the course of evolution, humans have developed culture, enabling knowledge acquired by an individual to spread across society or the entire human race—a process independent of biological reproduction. When Michael Faraday invented the electric motor, that knowledge spread globally within a few years because culture endowed us with the capacity to learn and teach. Consequently, a single useful idea can rapidly transform the lives of all humanity—a phenomenon observed across the entire spectrum of knowledge acquisition. This drives the rapid pace of social evolution.

The development and dissemination of culture occur through the cognitive functions of the human brain. Just as genes—located within an organism's cells—serve as the basis for biological evolution, the human brain—where cognitive functions operate—serves as the foundation for social evolution.

Artificial Intelligence (AI) has taken this culture a step further. AI relies on computer chips, algorithms, and global networks. Essentially, it is a vast information-processing system existing outside the human brain, capable of analyzing and processing the accumulated knowledge and thoughts of countless individuals with incredible speed. Consequently, knowledge spreads and consolidates more rapidly, paving the way for new forms of collaboration and coordination. Yet, a fundamental aspect remains unchanged: AI cannot set its own goals; humans must define its purpose and application. In other words, it is driven by the human brain—much like culture itself, albeit on a vastly larger scale. Viewed from this perspective, AI is propelling the long-term evolutionary trend—the inherent drive to make life more organized, integrated, and secure—to the next level.

Where are we heading? - If one observes the course of evolution, a clear pattern emerges: the drive to make life more advanced and secure is what transforms unicellular organisms into multicellular ones. Multicellular life gradually grew more complex, achieving a unity of many parts and thereby creating a more cohesive form of life. The primitive mind evolved into cognition and culture, enabling humans to form groups more rapidly and in ever-increasing numbers. Artificial Intelligence has now emerged as a vital tool in the continuation of this trajectory. Indeed, the evolutionary trend toward forming progressively larger groups is significant, as it fosters the creation of expansive communities—structures that organize, protect, and facilitate the development of life and humanity. Yet, it is through that very same faculty of cognition—fueled by abstract concepts—that various divisions such as class, religion, and nation-state etc. have arisen within these groups; these entities engage in mutual conflict, sometimes escalating into fierce hostility where one seeks to utterly annihilate the other. In that sense, it is a cruel irony of nature that the very capacity—evolved to preserve and organize life—is now, through economic and political conflicts, giving rise to situations that could ultimately imperil life's very existence.

Only if the root causes of social inequality and class division can be eradicated it is possible to put an end to fundamental, antagonistic conflicts. In such a scenario, human consciousness might increasingly favor cooperation over competition. Under these conditions, the evolutionary potential of human consciousness would gravitate towards social structures and arrangements that prioritize collective well-being, mutual aid, and cooperative development—aligning with the fundamental goals of evolution. Among the philosophical questions regarding the future trajectory of human social evolution, the possibility of such a transformation stands out as a primary subject of contemplation today.

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