Exploration

Biophysical Genesis of Memory

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ABSTRACT

The article examines the periods of the constituent stages of the relativistic physical process of memorization. The aim of this study is to explain the result of synchronization of brain activity with the external environment, and to correlate this mechanism with the units of synchronicities in the universe. In general, the scientific view of this study is based on the perception of memory as a biophysical grandeur. The methodical study of the psychic process of synchronization, in mathematical form, does not deny the transcendence and individual beliefs of a being, but it seeks to add to scientific data the creativity, which is needed to approach the interpretation of the analyzed object, which is considered as the reality (God or Gods).

Keywords: Biophysics, Genesis, memory, physical process, synchronization, brain activity.

1. Introduction

Different cultures have always perceived their reality through the dualism between the physical and spiritual world. However, almost all of them have said farewell to God (Marques, 2016, p. 24). What if we could modify this divergence in thinking and conciliate the capacity of explaining God´s existence through rationalism and materialism? Could the universe be a Great Mind with memory (God or Gods)? Memory has been an object of study since ancient times, involving social science and neurophysiology. Both areas have pointed up its most relevant attributes and concepts. Memory is a brain function by which connections between the neurons are established; it evinces the external environment and the perception of time. Obliquely, we perceive the environment through the accumulation of nerve impulses.

Therefore, there is a need of a paradigm that sustains the relation between the spiritual metaphysics and the science of material world (Marques, 2016, p. 47). To find the scientific paradigm of invisibility that will not only have a pacifying role between different beliefs of each human being, but also between different sciences and religions, we suggest immersing into the concept of memory and also into the General Theory of Relativity. This article supports the hypothesis of time dilation (that there is a difference of elapsed time between two events differently situated from a gravitational mass); it tries to explain the synchronism and the existing relation between memory and the present time. It also infers the existence of a Universal

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Mind which would be responsible for keeping the remnants of memory, and which prevents us from living in distinct temporal dimensions. Finally, it assumes that the memory of the universe (God) is a continent for possible uneven impressions due to time dilation. As a result, we can maintain a healthy memory, which can act as more than a mere deposit of various stimuli.

2. Methodology

This study is a bibliographic review of books and articles from journals in the area, which are available in digital form. The chosen theoreticians were Albert Einstein (2003 [1922]) due to his credibility, rationality and scientism, Benjamin Libet (1979) for presenting the concepts of physical time from the moment of sensorial stimulus, through nerve impulses until the formation of thoughts in the brain. Juracy Marques (2016) for synthesizing the meaning of conciliation of transcendental and material concepts: it is possible to reach "peace" through the virtue of knowing how to unite these concepts; and Amit Goswami (2015), who influenced the formation of the present ideas with his concept "Self-Aware Universe".

3. Discussions

There is a 0.5-second gap between the reception of a stimulus and verbal information of this experience. There is a substantial delay in brain activities between sensory stimulation and a "neuronal adequacy" to induce any sensorial and conscious experience. Regarding stimuli near the sensation threshold, the delay would be approximately 500 milliseconds (ms), whereas for a stronger stimulus this delay could probably be reduced to as little as about 100 ms (Libet *et al*., 1979, p.205). The external stimuli are always perceived shortly after our nerves send the impulses to our brain, or through synapses that send the information to the Central Nervous System where the information is interpreted. The awareness of, reaction to, and final understanding of what has happened are elaborated, and also how we acted before the event.

After the neuronal adequacy, the subjective time of the experience is automatically routed back in time. There is a "time signal" in the form of initial response of cerebral cortex to the stimulus; an electrophysiological response detectable in the primary cortical sensory area, which receives the oldest (and the most localized) neural message within 10–20 ms after the peripheral sensory nerve fibres are excited by the stimulus. The experience is therefore "anticipated", and to the subject its timing seems to occur without the real substantial delay necessary prior to neuronal satisfaction to provoke the attained experience (Libet *et al.*, 1979, p. 206). The substantial delay does not occur. If this delay accumulates, it does not accumulate enough to hold us back in time, or in the instant changes that take place in the environment in which we live for at least a second. Therefore, there is no big accumulation of infinitesimal delays of nerve impulses sent to the brain

(first principle). In order to understand the mechanism of memory, which must have a physical explanation, we base and focus our studies on this phenomenon.

Life is the result of interpretations and reactions to the set of small delays in relation to the external environment. We would tend to drift back in time more; however, the nervous impulses are constantly interrupted, and consequently a record of what has happened is produced, and subsequently the awareness of it. We have not yet considered the motor response, once it may, or may not, come about.

Let us imagine that we have thought of a question for our parents, and let us suppose that we have done it **now**. However, in what space–time has this question been really made, or what space–time could be called **now**? Is it the moment we say it, the moment we hear it, or the moment our parents hear it? This is because the intervals between those moments are very small (a fraction of a second), which we do not perceive.

Regarding voice recognition using neural networks, for a biological neuron we can express the time of action potential from the time of depolarization, through the time of absolute refraction, to the refractory period in less than or close to 0–10 milliseconds (Oliveira Andrade, 1998, p.7). In addition, based on studies by Oliveira Andrade (1988), we speculate that the message of a question reaches our brain in 0.01 s. This will only occur after we hear our own voice when we ask. The speed of sound is about 340 m/s. If the distance from the mouth to the ears is about 0.17 m, then the sound travels to our ears in about 0.0005 s (0.17 ÷ 340). The total travel time is 0.0105 s (0.01 + 0.0005), which is higher than in the external environment. However, the delay may still be higher than the presented above, as our mind continuously registers other sounds and these, in turn, follow a logical sequential delay. In this context, in every moment of our life, the mind drifts away from reality and universal time to an introspective time due to the existence of a sequence of external messages to be perceived in orderly manner.

The environment and our mind allow us to communicate with our parents right away through a predictable dialogue. If the delays of nerve impulses to the brain were accumulated, everyone would be backward in time, especially the older generations, since they have generated more nerve impulses than younger people have. The accumulation would consequently cause a greater relative delay in older people, and the lack of synchronization in a dialogue or a conversation. Therefore, our first principle is justified as consistent.

Another query do be solved: according to physics, all images present a delay as light travels in space. A fixed look at an object should progressively delay our perception of time. For example, a stopwatch starts at 0 s; while a white book is being observed, (it is at rest about 30m away). The light that forms the image travels at 300000 km/s (Einstein, 2003 [1922]). The stimulation of the visual cortex with low rhythms (less than 10 per second) causes a characteristic silence of

100 ms, followed by an activation (Liberson, 1957, *Apud* Sua, Para and Tionen, 1958). The real difference between two images for the human eyes is: real time = 0.03 km ÷ 300000 = 0.0000001 s. Based on studies of Sua, Para, and Tionen (1958), we add this difference to 0.1 s, which is the time the nerve impulse takes to reach the brain (an impulse from the optic nerve to the occipital lobe of the brain).

The constant addition of time the light takes to travel the distance, and considering the frequency or numbers of nerve impulses per second, would delay the information by 0.1000001 s per message. We would lose 0.1000001 s of time every 0.1 s. A continuation of this process would lead to a loss of 1.000001 s every 1 s. There would be an acceleration of time loss equivalent to about 0.1 s per square message. This delay would tend to occur for every image we see. We would always see and record images shortly after they appear in the surrounding environment. If added up, this process would lead us to drift back in time progressively. This fact does not allow us to drift away from time in the external environment once or forever, or the memorization of changes in this environment. Delayed remnants of the previous message, which have been absorbed by the retina and transmitted to the brain as a nerve impulse, gradually disappear from the conscious brain analysis of the external environment and act on the brain structure of memory.

The difference between (*1*) the time an event takes place in the external environment and the time it reaches us, and (*2*) the time the brain takes to form the message is equal to the time of memory of what has happened. The time in the external environment can also be the initial point (0 s). As message formation by nerve impulses is delayed (*2*), the time, which represents this formation, has a negative sign, and the difference of time is abbreviated as "ddt", and expressed with a positive sign. Representation:

t (time of an event in the external environment) - t (time of message formation in the brain) = ddt = M´

The total memory time [M (t)] of an individual is the sum of the individual's partial memories n-times.

$$M(t) = M'(1) + M'(2) + M'(3) + \ldots + M'(n)$$

According to Guyton (2006), in the Textbook of Medical Physiology, memory can be short- or long-term. The ddt possibly refers to the formation of short-term memory, which may subsequently become a long-term memory. The ddt, which can be converted into so-called *temporal energy*, when added to the organic biochemistry (variation of electric energy of the nerve impulse) is equivalent to the energy of partial memory. The electrical energy is negatively

correlated with the time of message formation in the brain and ddt. The mass of the total memory consists of the mass of the neurons related to it.

Subjective experience must precede, or at least coincide with, a specific onset of brain processes that mediate the voluntary act (Libet, 1993, p.269). This sequence of mental processes in physical time, as described by Libet (1979), leads us to conclude that the processes in our brain are converted into memory before mediating the act. Memory can be called constant, if we calculate it according to a constant cerebral frequency, or variable, if we consider variations in cerebral frequency. Our time delay is fast in the beginning and ends interrupted, then it is restarted. As the second (International System of Units) is the best way of measuring the perception of time, we are going to use this unit to underpin our thesis. If the idea of temporal balance of memory were not coherent, then a person who was born first, because he generated more nerve impulses, would be late in time relative to someone who was born later. Therefore, there is an inner balance so that both people live in a temporal unified environment.

The process of memorization is followed by a response of the nervous system or a nervous response to what is being memorized. It is utterly important to define that the interval between two consecutive ddts (represented as Δt), spans from the end of the first ddt to the end of the second one. In fact, the interval is between the periods of time, which the brain takes to form messages. The interval can be either constant or not, depending on whether we calculate it according to cerebral frequency, which can also be either constant or not. In other words, between the moments of message formation in the brain, there is a moment of response that may be conscious or unconscious. Without the performance of our memory through ddt, we would not be able to reconcile with the external environment and life would be chaotic. Empirically, the interval symbolized by "Δt" between two consecutive ddts is preceded by a moment of nervous response, which is symbolized by "Ψ'". If this interval did not occur, we would not react to the external environment nor reflect in our memory, which would have no function at all.
Representation:

Δt – ddt = moment of nervous response (Ψ')

The sum of the moments of nerve responses [represented by Ψ (t)] is n-times equivalent to the conscious and unconscious activities of the brain. It is important to highlight that the higher the biochemical energy generating nerve impulses is (electrical energy), the more intense the impulses are, and a lower ddt may occur if the impulses are faster. The degree of consciousness (sensitivity) is directly proportional to the intensity of biochemical energy. However, there is a maximum threshold of biochemical energy for the individual to be conscious, beyond which humans may experience disorder. An insufficient degree of biochemical energy makes the moment of consciousness equivalent to unconsciousness, subconsciousness or even a lack of consciousness.

In order to support this thesis, we must establish a relation of the mind to the universe. How can the temporal balance or synchrony, which is a feature of the mind, occur in the universe? We have already mentioned that the distance between the surface and the gravitational center of a celestial body is different from the distance between the atmosphere and the gravitational center of the same body. That is the distance from the atmosphere to the gravitational center of the planet minus the distance from the surface of the planet to the gravitational center of the same planet. As the theory of relativity proposes, time passes differently in these environments: subtly slower on the surface than in the atmosphere. Planets are not perfect spheres — some of their regions are closer to the nucleus (center of gravity) where the curvature of light is gradually steeper than in regions farther from the nucleus. There are some peculiarities regarding the passage of time in these different regions of space. Representation:

t (passage of time in the atmosphere) – t (passage of time on the surface)

= ddt = M´

The theory of relativity must lead to a theory of gravity in which the path of light in relation to a coordinate system is curvilinear (Einstein, 1978, p.3). Researchers have been able to prove that stars behave as proposed by the general relativity, and the curvature of space–time generated by the presence of matter has been confirmed (Antoniadis, 2013). There is scientific proof that time passes slower on the ground than in the atmosphere by comparing two atomic clocks: one on the ground at rest and the other in an airplane in the atmosphere (Cattani, 2010). The main idea of this article is based on the assumption that these small time delays on the ground do not accumulate, eventually causing a significant time delay (about an hour, for example) in relation to time in the atmosphere, it was proved that time elapses differently in these places. Therefore, it is obvious that there is synchronicity between points differently situated from a gravitational mass.

Ecology, studied profoundly by Marques (2016) who was impressed by “the voice of nature”, has a strong connection with us regarding the contemplation of equilibrium and our synchronicity with the environment. There is no accumulation of time delay on the ground in relation to time in the atmosphere due to the existence of biogeochemical cycles. This biological “communication” of nature would be impossible if there was an over accumulation of time or if it were a lot different, what would produce images and characteristics discontinued in time. The macroscopic world is continuous and progressive for our normal perception of time. Unquestionably, there is evidence that in settings located at different distances from earth’s gravity, where the waves are inclined to have a different curvature, there is a constant equilibrium, which neither delays nor advances the **sequence** of events preceding, for example, the uttered sound. This sequence enables the communication between people at different distances.

The external environments of a star are "**synchronized**" by the International System of Units, the second, (for the planet Earth), or any other system of measurement, considering extreme gravity stars. This is our second principle**.** The greatness of external memory or a celestial body renders time continuous, instantaneous (there is communication) and prevents time from being fragmented. If there were different epochs on the same celestial body due to the accumulation of time at different altitudes, there would also be "transition tracks" between these epochs. We can consider transition tracks the discontinued changes or jumps and disappearances in time–space that would occur if the delays of relative time between the surface and the atmosphere were accumulated. Transitional tracks do not exist in a synchronized setting but between different celestial bodies. Therefore, these tracks are observed in the void of the outer space, which corresponds to what many physicists consider in their studies of relativity. As if the stars and planets had their own time and were immersed in a vacuum of transitional tracks.

According to Patterson (1956), Earth is about 4.6 billion years old, which corresponds to approximately 40296 billion hours. If every hour in the atmosphere was delayed by 2 nanoseconds in relation to the surface, there would be a total of 80592 seconds of difference between the atmosphere and the surface. This equals to about 22 hours of difference between the atmosphere and the surface. Such difference is impossible — it would be incompatible with the balance of time on the planet.

We base our theory on the temporal and visual memory, considering the following laws:

1. What synchronizes our perception of time with events in the external environment is our mental capacity of memory.

2. What synchronizes two perceptions of time of individuals at heights under different influence of gravity is a constant of memory of the external environment.

3. The units of capacity of memories together perform a specific gathering function guided by the theory of relativity and form the Universal System of Memory (USM)

We consider a set of collapses of the capacity of memory and a set of moments of nervous response that occur in the universe analyzed as a Universal System of Memory. The collapses are related to the variations in gravitational fields of celestial bodies. As the universe is constantly changing, based on Edwin Hubble's (1929) studies, the USM produces ***a phenomenon of multiple collapses of its capacity of memory***. The Universe is a great Mind, which is God. His memory is endless, even if everything else ends. We question two aspects of the tendency of everything to move apart: (*1*) will the universe ever be full of innumerable black holes and forces of attraction between celestial bodies that surpass the forces of repulsion between these bodies? (*2*) Can entropy be naturally delayed?

Let us now move on to the second aspect. According to Frautschi (1982), the Universe leans towards progressive entropy. However, we believe that the time lag is a force bordering on entropy — we consider it as force that hinders entropy, or otherwise "disentropy"

Memory is a bigness, which is produced by the small delays of nerve impulses. There is also the production of consciousness between the intervals of partial memories, which also limits the perception of the degree of local disorder, and consequently allows us to respond to such disorder. Memory and consciousness generate disentropy: they seek to "acquire" time. This is the essential proof of the existential character of memory and the Mind of the Universe (God). The universe has no opposition. Its existence is undeniably a fact. It is sufficiently protective to preserve life and material existence or averse to their end. It is a character that tends to hold disorder back, and to maintain the stability of material existence. In essence, the Universe is the most sublime and eternal form of memory, every existence is always useful, life is always worth it.

Memory as a concept is used in both abstract and concrete languages; however, it has not been possible to conciliate objectively its subjective attributes so far. These attributes correspond to sources that may be responsible for the genesis of memory. This study enables us to draw a rational and coherent line of reasoning that conciliates subjective and objective concepts of memory. Based on that, it is possible to find a broad-ranging reasoning that could in the future help different sciences to complement their ideas for the sake of the whole.

4. Conclusion

Based on the above, we can consider materialism as pure metaphysics — there is no other way of objectively proving that everything, including the mind and consciousness, begins with matter (Goswami, 2015, p.18). Founded on the theory proposed in this study, which considers the Universe as a Great Cerebrum and Mind (God or Gods), the phenomena of consciousness and memory may be viewed as part of the material world, without violating its principle of energy conservation in the physical world. The idea that we inhabit a Great Being reiterates the concept of singularity: we are derived from the same origin, or we are ecological components of the same organism.

The theoretical study presented above is based on the argument that the Universe is a Great Mind with memory: God. This Mind is protective and existential. Physics has presented innumerable innovations and elaborated calculations, which indicate that there is a great system of synchrony acting in the theory of relativity. Such system is the main component that explains the existence of the mechanism of memory in nature. Our queries and scientific advances show us that we must be humble to understand the greatness of physical laws, of which we are part. It is very

important to emphasize that science can be a great ally in this discussions. It will help us understand the role we play in the physical universe, as well as connect us in a more altruistic and meaningful way to the Universal Memory, which is God.

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