



DEVELOPMENT OF THE CONCEPT OF CHAOS AND ITS INFLUENCE ON THE FORMATION OF CONSCIOUSNESS

Firyuza Salikhovna Yanchilina
Newspaper of the scientific community "Poisk", Moscow
119991, Vavilova, 30/6, Moscow, Russia

ABSTRACT

The article deals with such unusual quantum phenomenon as uncertainty, and its possible role in human consciousness is explored. It is discussed that the presence of uncertainty in the human consciousness makes humans fundamentally unlike robots. The hypothesis of the existence of Chaos outside the Universe and the connection of this Chaos with quantum uncertainty in the microcosm is considered. The possible influence of Chaos on human consciousness through quantum uncertainty is also discussed. This short work can be also useful for undergraduate, graduate, and postgraduate students for some additional education.

Keywords: Gravitation, chaos, order, human consciousness, quantum uncertainty, freedom, universe, collective unconscious.

INTRODUCTION

Scientists have long been interested in the phenomenon of consciousness. What is it? How does a person experience different feelings? How are thought processes going? More and more scientists are beginning to attract quantum mechanics to explain the human cognitive abilities. Some researchers analyze the possibility of the existence of optical channels in the brain and investigate the possible effects of biophotons in neural networks (Kumar, 2016). Mender (2015) suggests using a quantum-ecological approach to describe the functioning of the brain. Tang and Dai (2014) have studied how biophotonic signals in the brain can be transmitted and processed.

Once known physicists argued about the physical meaning of quantum mechanics. Nowadays scientists studying consciousness use knowledge from this field of physics to understand the principle of the human brain. This is justified: in order to understand how the brain works, we first need to find out the nature and cause of the strange behavior of subatomic particles. In the microcosm there are very unusual phenomena that evolution, most likely, should have used to achieve its goals.

The subject of the formation of consciousness is related to another complex subject about the origin of the Universe. Mankind has always worried about what is our world, whether it has borders, what is beyond it.

Corresponding author e-mail: Yafiryuza@yandex.ru

Formation of the Idea of Chaos in Ancient Thinkers

The idea of Chaos is important in the evolution of ideas about the Universe, as opposition to the Cosmos. If Cosmos is the image of our orderly world, then Chaos is the opposite thing. The Greek word "Chaos" ($\chi\acute{\alpha}\omicron\varsigma$) means emptiness, abyss. One of the first to use this word was the ancient Greek poet, a representative of the direction of the didactic and genealogical epos Hesiod. According to Hesiod, Chaos arises first, but it is neither creative principle that generates space, nor material for the Universe. Chaos is a pure negation for this ancient Greek poet; it generates the same negative forces – black Darkness and Night. Using the concept of Chaos, Hesiod tried to connect Chaos and Ancient Greek gods (Gaia, Eros, Tartar, Uranus and even Zeus) into a single genealogical tree (Richard, 2001). Ancient Greek thinker Aristotle made Chaos "place and space." The logic of his reasoning is that all things must be in something, including our Universe. The Old Testament also uses a concept close to Chaos. In the Book of Genesis it is written about "darkness over abyss", which was before the creation of the world. This "abyss" in its meaning is similar to the ancient Greek Chaos.

Philosophers often identified Chaos with Tartarus, an underground abyss, that irretrievably absorbs everything once alive and become dead. For the Roman emperor and philosopher Marcus Aurelius, Chaos was the abyss of time, "eternity endless in both directions," boundless insatiability, inexorably absorbing all that exists. The word "chaos" in the usual sense as "disorder and confusion" first appeared in the 16th century in Early

Modern English, and originally meant satirical exaggeration (Gosson, 1579).

Nowadays the concept of Chaos has lost its original meaning. Chaos with a capital letter is not used in modern science, including cosmology and cosmogony. Mainly philosophers and historians of science use this word. This word passed into the category of ancient terms. Under chaos with a lowercase letter, they mean disorder in broad sense, but in physics this word, in a sense, is replaced by the term entropy.

The Strange and Paradoxical Microcosm

The subatomic world continues to amaze scientists because microcosm does not always give in to logic and strict calculations. The famous American physicist Richard Feynman in his lectures on physics wrote that he can say with confidence that no one understands quantum mechanics (Feynman, 1965). One of the main incomprehensible phenomena is the passage of an electron through two holes simultaneously. If a plate with two holes is placed on the path of an electron, then the particle can fly through two holes at once. If this experiment is carried out repeatedly, one can see how an interference pattern is formed. Such a pattern would not have arisen if each electron had passed only through one hole (Feynman, 1964). Such behavior cannot be imagined in the ordinary world. If you throw a ball in a window, it will hit either one window or fly away from the wall. It is even impossible to imagine that the ball hit two windows at once. But this is a common phenomenon in microcosm. This is despite the fact that the electron is an indivisible particle. Such a strange phenomenon is explained by the fact that an electron, depending on conditions, can behave either as a wave or as a particle. This dual character of the behavior of a particle was called wave-particle duality. If the electron is prevented from moving, "grabbing" it at some point, at that moment it will become a particle. But if it is given freedom, it will behave like a wave.

Surprisingly, already the ancient Greek philosopher Epicurus believed that there must be some randomness in the motion of atoms. Otherwise, there will be no freedom in our world. Human behavior will be completely determined by the motion of atoms. By the way, many philosophers of antiquity, for example Democritus, believed this way, that is, they were supporters of determinism. But Epicurus was sure that man has free will. Therefore, he believed that an atom, moving in a straight line, slightly deviates from its path. Thus, he postulated that there must be randomness in microcosm (Marx, 1841).

Two thousand years later it was discovered that, as Epicurus had expected, the elementary particles could indeed deviate from the given direction of motion accidentally, without apparent cause. Of two identical

particles moving at the same speeds, under the same conditions, the first particle can deviate, for example, to the left and the other one to the right.

Scientists still do not understand why the quantum world is so strange. They perceive this feature as a unexplained reality. For a long time, many scientists did not believe that there is uncertainty and unpredictability in subatomic world. They believed that simply mankind had not yet "penetrated" the deeper quantum level in order to describe the world of the smallest particles. In this regard, we can recall the famous dispute between Einstein and Bohr. Bohr could not convince Einstein that wave-particle duality is a reality, and not a lack of our knowledge of the microcosm. Einstein did not accept quantum mechanics until the end of his life (Einstein, 1949).

Why is the quantum world so strange? Why is there uncertainty in the movement of subatomic particles?

Cause of Order in the World

Why is Order reigning in the Universe? The Order thanks to which our world is as it is, thanks to which the laws of nature work the same in all corners of the Universe: on Earth, the Moon, Mars, and even on some distant pulsar. I wrote the word "Order" with a capital letter to distinguish it from the usual order that we support on the table, in the room, in the street.

Processes in different parts of the Universe are subject to the same laws of nature. Astronomers do not observe that in different galaxies different laws act. The world is single by nature and it is harmonious. This Order seems obvious to us, and we cannot imagine anything else.

After scientists discovered a strange disorder in microcosm, they were very surprised by this. At first time, many of them did not even want to believe it. Until now, scientists are surprised by disorder in microcosm. But Order that exists in the world seems to them a normal phenomenon. But it's exactly the Order that must surprise us. Disorder is much easier to create. For example, it is easy to scatter things around the room. But in order to collect them and again put them in their places, on the shelves, this will take more effort and time. In addition, any order should be maintained. Order cannot arise spontaneously, from nothing. Why did order arise in the Universe? Perhaps there is something that causes stars and galaxies to obey the same laws. Perhaps, there is a kind of global force that keeps our world, not allowing it to turn into Chaos (Yanchilina, 2003).

Imagine for a moment that the laws of nature would depend on the place in the Universe: the first laws act in some galaxy, the second laws do in another one, and no laws are on the third galaxy. In this case, it would be difficult for us to obtain reliable information about the

world. Our world would be something like microcosm where atoms can spontaneously deviate from their trajectories, and electrons fly through many holes in the same instant; where it is difficult to predict and calculate anything.

Many scientists believe that it is the laws of nature that are the cause of the global Order in the world. But in fact, it is obvious that this is not so. Order is an objective reality: we observe it in the world. And the laws of nature are description of reality, perhaps not quite accurate. Order in the Universe can be compared with the order in airports. At airports, planes fly strictly on schedule. But no one will argue that the timetable is the main reason for a well-organized flights.

What is the reason for Order in the Universe?

In the 19th century, the Austrian physicist Ernst Mach put forward the hypothesis that the observed motion of bodies is somehow connected with the distribution of the matter in the Universe. In particular, he argued that the centrifugal forces acting on the rotating carousel are caused by its rotation relative to stars.

Mach's hypothesis interested many scientists. Some of them tried to give it a mathematical form. Einstein called this hypothesis "Mach's principle" because he was sure of its truth. He hoped to introduce Mach's principle into his theory of gravity. But after the construction of general relativity, it turned out that stars of the Universe only slightly curve the surrounding space. However there is no deep connection between the whole matter of the Universe and the laws of nature in general relativity (Dicke, 1969).

Order from Chaos

At the end of the 20th century, Yanchilin put forward the hypothesis that Chaos is outside our Universe. He came to this conclusion in 1984 and published his hypothesis only in 2000. In his work, a new and small formula was proposed (Yanchilin, 2000):

$$\hbar^2 \Phi = \text{const}$$

Here \hbar is Planck's constant, Φ is the gravitational potential created by all the masses in the Universe. Planck's constant characterizes the uncertainty in microcosm. If this constant tends to zero, then we come to the classical mechanics of Newton, where there is no uncertainty and therefore the motion of bodies is completely determined.

According to the formula it turns out that the Planck's constant depends on the gravitational potential of the Universe. For example, if we begin to remove stars from the Universe one by one (carrying them off to infinity), then the gravitational potential of the Universe will gradually begin to decrease, and the Planck's constant will

increase. It is known that Planck's constant determines the size of the atom. If Planck's constant increases, then atoms will begin to increase in size. Consequently, all bodies will increase in size, since they are composed of atoms. But at first this change will be difficult to detect, we will not even notice the disappearance of several space objects. When the amount of matter in the Universe becomes much smaller, Planck's constant will increase substantially, uncertainty in microcosm will become greater. The behavior of quantum particles will become more uncertain, and large objects will also possess quantum properties. With further increase in Planck's constant, the uncertainty in the microcosm will be so high that it will penetrate our world. The atoms and atomic nuclei will begin to decay. All objects of the material world will be destroyed. The world will turn into a mash of randomly flying elementary particles (Yanchilin, 2013).

Does Planck's constant change in the modern Universe? The gravitational potential has different values in different parts of the Universe. However, these differences are very small. Nevertheless, where the gravitational potential is less (for example, between galaxies), Planck's constant is slightly larger. Where the gravitational potential is greater (for example, near a massive star), Planck's constant is less.

Far from the Universe, where the influence of stars and galaxies decreases sharply, that is, the gravitational potential drops to zero, Planck's constant increases without limit. The laws of motion are gradually degenerating, and space and time lose their physical meaning. This state, where space and time are destroyed, can be called Chaos. This Chaos is somewhat reminiscent of Chaos of ancient thinkers.

In our world, Planck's constant has a very small value, because the gravitational potential of the Universe is very large. Huge masses (stars and galaxies) filling the Universe limit the uncertainty in each other's movement, and therefore Chaos manifests itself only in microcosm. Only the smallest particles are able to "feel" its presence. It is the presence of Chaos in a small amount that makes the behavior of elementary particles unpredictable. Planck's constant can be called an indicator of Chaos, a measure of uncertainty in microcosm.

How was it in the early Universe? In the initial period of the development of our world, the gravitational potential was very large. So, according to the above formula, Planck's constant was very small, much less than now. This means a negligible amount of Chaos, much less than now. And this, in turn, indicates that there was very little Chaos in the early Universe, much less than now. So, the uncertainty was also much less. The particles were "less

strange" and more similar in their behavior to larger bodies! The world was classical.

In the distant future, when the Universe becomes much larger due to its expansion, the gravitational potential will be much less. According to the formula, Planck's constant will be much larger. There will be more Chaos in the Universe.

What prevents Chaos from seizing power over our world? The most powerful counteraction to Chaos is the gravitational potential, that is, stars, galaxies and everything that fills our Universe and has mass.

In this connection, Order in the Universe exists because of the gravitational interaction of all bodies in the Universe.

Influence of Chaos on the Formation of Consciousness

The unpredictable nature of the movement of elementary particles can be compared with our thoughts. We are never sure which thought will seize us in the next instant. Since the particles in microcosm are chaotic, that is, they have the uncertainty in their motion, then the human consciousness also has an uncertainty, since the brain consists of particles. This uncertainty creates free will. The uncertainty that is present in a man on a deep subatomic level determines his behavior, his ability to think, and make his own decisions. Chaos that permeates our world creates in a man uncertainty, and, hence, freedom in his behavior. Thanks to Chaos, people are fundamentally different from artificial intelligence, which operates according to the algorithm embedded in it.

All elementary particles exhibit strange quantum behavior, the cause of which can be the effect of a negligible presence of Chaos in our world. Moreover, the influence of Chaos can have a cumulative effect. All events that occur with any particle of microcosm do not disappear, they are reflected in its quantum history, which is expressed in an increasingly more complicated quantum state. This quantum state continues to grow more complicated until the reduction of the wave packet of the particle, that is, its collapse. Then a new story of the particle begins.

A man, including his brain, consists of elementary particles. Each of them has a complex quantum state, as a result of the influence of the uncertainty in microcosm, that is, due to the presence of Chaos. The aggregate of particles in a man creates a complex quantum state that cannot be mathematically calculated by any of the computers that exist now. This manifestation of an insignificant presence in the world of Chaos is fully manifested in living beings. It can be noted that some scientists who have studied the brain came to the conclusion that some part of consciousness may have a source outside the brain (Bechtereva, 1997). Other scientists believed that consciousness cannot be reduced

to neural mechanisms within the brain (Eccles and Popper, 1977). The well-known English mathematician and physicist Roger Penrose argued that consciousness should have certain special properties through quantum effects. He believed that to understand the mind we need new physics (Penrose, 1994). Rupert Sheldrake hypothesized that all natural systems, from crystals to plants and animals, including humans and the entire human society, possess a collective memory (Sheldrake, 2002).

Thought processes, incomprehensible intuition, extrasensory abilities, talents, everything that is connected with intellect and creativity, is possibly based on the influence of the "substance" that is outside the Universe.

At the time of forming of the Universe and in the early periods of its evolution, Chaos in the world was even less, much less than now. Gradually Chaos began to penetrate into our Universe, each time more and more filling it with itself. This, in turn, complicated the quantum state of elementary particles. Moreover, it created the possibility of forming a set of particles with an even more complex, interconnected state. Such "agglomerates" of complex quantum states had been enlarging and becoming more complicated.

At some stage in the evolution of the Universe, the first signs of consciousness became possible, this was manifested first in a rather primitive form. The consciousness of each individual was becoming more complicated with time. The state of the aggregate of consciousnesses of individuals was becoming more complicated, this formed a common consciousness. Thus, each individual, being formed in his consciousness, contributed to the common consciousness. At some point, the state of common consciousness became more complex, passing to a new evolutionary stage, creating the possibility of the formation of human consciousness. It is something that looks like the collective unconscious of Jung, but has a physical nature. Thus, consciousness could not arise at any arbitrary time, it could arise at a certain stage in the development of the Universe, when it became possible accumulation of a complex set of complex quantum states of elementary particles. Each event has its own time.

The evolution of consciousness does not stop, it continues. Human consciousness evolves along with the Universe. It will continue to grow more complicated.

The formation of a person's consciousness did not happen as a single random act. It occurred when the collective consciousness of all mankind was formed (Yanchilin, 2008). This speaks of the generality of the consciousness of all people. The cumulative nature of the formation of

consciousness also explains the unexplained phenomena of the community of human development, beginning with birth. After all, no one explains the newborn how to swallow, and then chew. The consciousness of any child is already prepared for life in this world. How to explain such a phenomenon? Perhaps the consciousness of mankind was formed together. Knowledge, experience of many people are stored in the "common database" on the quantum level, which we formed with our ancestors. Our future generations will continue to develop it.

CONCLUSION

Living beings are radically different from inanimate objects. The human behavior is not at all like the behavior of a robot. Unlike a robot that acts according to the program, a person is capable of illogical acts. In his creative activity, a person often goes beyond the bounds of ordinary logic. This behavior remotely resembles the behavior of quantum objects. To explain the paradoxical behavior of subatomic particles, we relied on the hypothesis of the existence of Chaos outside the Universe. This Chaos, which influence is limited to stars and galaxies, affects the processes in microcosm. It is possible that the same Chaos affects the behavior and consciousness of a person. It is possible that moving in this direction, we will be able to better understand why we differ from the rest of nature and we will be able to understand our place in the world.

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Accepted: Feb 1, 2018.

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