AROMORPHOSES PHENOMENON IN THE DEVELOPMENT OF CULTURE: A VIEW FROM THE STANDPOINT OF NEURAL NET THEORY OF COMPLEX SYSTEMS EVOLUTION

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Abstract:
It is shown, that investigation of cultural aromorphoses allows development of non-Darwinists concept of evolution of complicated systems. Complicated system of any nature may be considered as analogue of some neural network. At first stage of evolution the structure of correspondent neural network is changed without significant variation of properties of separate elements. At the next stages of evolution reconstructed network give possibility for appearance of elements of some other nature.

Key Words: Evolution, Complicated Systems, Neural Networks, Aromorphoses

Introduction:

The nature of evolution of culture is far different from homogenious, as confirmed by numerous historical examples. One of the most discussed in this context is the "Greek miracle" - a splash of creative and other types of activities of one nation, inexplicable rapid appearance of almost all the attributes of modern civilization in a relatively small area.

"This intellectual revolution seems so sudden and profound that it was considered inexplicable in terms of historical causality and therefore scientists spoke of the "Greek miracle" the mind (logos), was like suddenly freed from the myth, just as the veil falls from the eye [1]".

Analysis of the different points of view on the phenomenon of the "Greek miracle", as well as other aromorphoses that took place in the history of culture (and beyond), was carried out in [2]. There was an attempt to interpret the appearance of such aromorphoses from a position of heliobiology, i.e. for the explanation of the phenomenon extraterrestrial factors associated with variations of "space weather" were involved.

The argument for this point of view in [2] is also based on the following considerations. B.M.Vladimirsky notes that almost simultaneous occurrence of mathematics, logic in the modern sense of the word, philosophy, and the rudiments of science does not exhaust the content of the "Greek miracle".

Precisely at this time a particular form of political system - democracy appeared, it is possible that no less important was the emergence of ethics as a system of independent views. This also includes fireworks of historically fundamental cultural ideas, in particular, the philosophy of history, as well as heyday in the arts. Those days saw the birth of fiction, laws of perspective were opened in Performing Arts and it is worth noting that the plays of that time are being staged nowadays.

However, the most significant for the point of view in [2] is that such outbreaks of creative activity occurred almost simultaneously in regions quite distant from Greece. "Intelligent life in India in VII-VI centuries BC was a picture of dramatic rise and growth, like the jungle in the rainy season" [3]. China Chunqiu period (722 - 435 years. BC), “Numerous sages raised, like a swarm of bees, all scientists [hundred schools of thought] tried to argue with each other". [4]

The considered phenomenological picture can be summed up with a quote from [5]:

"China and India have progressed or experienced setbacks in the same rhythm as the West, as if all of humanity obeyed the dictates of some primary cosmic destiny, in comparison with which all the rest of his story would be minor."

Karl Jaspers emphasized [6] that this period was also a time of simultaneous appearance of major religious reform movements. "The founders of Buddhism and Jainism in India were contemporaries of Kong Zi (Confucius) and Lao Tzu. Iran began to develop his theory named Zarathustra, also at the same time the Palestinian prophet Jeremiah stood out – they were almost contemporary to Thales and Anaximander, "[2]. Karl Jaspers called this the height of intellectual activity "axial age", and now this name is a common term. However, the generally accepted explanation of this phenomenon still does not exist. It is partly recognized that a very serious problem [2] is to find some kind of "trigger impulse" that instigated the global surge of creative activity. (The concept of "cultural borrowing", as well as the concept of influence of climatic factors have been criticized in several works, including [2], and considering them will serve no purpose.)

There are several interesting studies describing attempts to interpret the phenomenon of cultural aromorphoses, in particular, the Greek miracle from different positions.

Ii is shown than nature of cultural aromorphoses may be interpret on the base of neural network model of evolution of complicated systems in this report.

Main part

Background:

There is a model that considers the phenomenon as the result of a combination of specific social and psychological factors that freed the creative energy which had existed in society in a latent form described in [7].

The basic thesis [7] is: every more or less normally functioning society prevents any spiritual creativity not affiliated with any practical activity, and, thus, inhibits the development of culture. For this reason, flourishing of culture occurs very rarely, which is why every time it should be associated with a temporary weakening of the system that protects society from too rapid renewal. "

The concept of A. Zaytsev deserves serious attention because it reflects objectively existing **innovative resistance** inherent in any society, first of all caused by individuals' desire to maintain stability (or sustainable development) of the environment familiar to them. However, the interpretation given in [7] cannot be considered complete.

First, axial time of Karl Jaspers cannot be regarded as a unique phenomenon. For a variety of factors, that are also noted by many authors, including [2], the Renaissance, the "age of genius" (15 and 17 century) fits in the same row.

Moreover, the rise of scientific thought, which came on the turn of the 19th and 20th centuries, can also be interpreted from considered positions [8]. Of course, this rise was slightly blurred, mainly due to the current attitudes in public about the linear and ongoing progress. But the subsequent history, in particular, the stagnation of creative and scientific activity [8, 9], which began in the second half of the 20th century, refutes it.

As emphasized in [10] on the basis of R.Gordon's, Cambridge, scientific and technological progress is in deep crisis and this is confirmed by comparative studies. Most of the technical inventions, according to the rating "The greatest technical achievements of the twentieth century", National Academy of Engineering have been made prior to 1950. Only three of the twenty most important inventions relate to the period after the Second World War - semiconductors, computers and the internet.

The main argument against the position of A. Zaytsev related to elaboration "... not related to any practical activity," which is contained in the above quotation. Simplifying, according to Zaytsev, the community prevents overly rapid renewal where this renewal does not bring material benefits. However, this inhibition occurs even when potential gains are evident, and, moreover, when there are institutions designed to stimulate the development in the society (at least in the military-technical field). In matters of practical importance, of course, it refers to a period of stagnation of intellectual activity, mainly scientific and technical work in the second half of the 20th century [8-10].

B.M.Vladimirsky [2], we note once again, attempted to interpret considered phenomenon from the point of cosmic effects on the biosphere. This kind of representation originates in Chizhevsky's works [11], opinion on which is mixed.

However, for the purposes of this paper the competence of concept [2] is not significant. In any case, there must be a mechanism that converts the external action (even if there were one) into the set of phenomena that make up the "cultural aromorphosis."

This mechanism is still unsolved. Moreover, it can be assumed that the problem of cultural aromorphoses allows to answer questions of general scientific nature, in particular, to understand whether there is a naturalistic view of evolution, alternative to Darwinist. (Proving is the goal of this paper.)

This question is more than relevant. As noted in [12], based on the results [13] and some other paleographic studies, the situation concerning the origin of life on Earth is highly debated: "Ironically, the Humanity knows about biogenesis less than it used to 40 years ago."

Studies that were carried out during this time have shown inconsistency of the previous point of view based on the idea of spontaneous mutations (correctly - variations of properties) of macromolecules in certain "primordial soup." The main problem is that the occurrence of the genetic code, according to the concept of "fixed mutations that create benefits for the carrier of genetic / protogenetic information" needs extremely long period of time (longer than the lifetime of the Galaxy, in accordance with simplest estimations mentioned in [12]).

In addition, at this stage of the research, it became clear that "protobacteria" cannot occur by itself. The organism of any type can and does exist only within certain relatively closed ecosystem, which makes stronger case [12] about the need of holistic appearance of such a system. Somewhat simplifying, we can say that evolution could not have followed the path of individual organisms' development, and the relevant ecosystem could only occur at once, abruptly. (For a more detailed criticism of the dominant point of view on the mechanism of evolution in popular form read the [12], p.241-244.)

The conclusion, which is specified in [12], is as follows. "For today, there is no reasonable exactly working hypothesis, to explain the biogenesis and start of mechanism of biological evolution."

However, one should take into consideration that all existing ideas about the mechanism of evolution, somehow repelled from the concepts that go back to Darwin's theory. The common view for today is based on the following principles set forth in [12]:

1. Only genetic information is inherited.
2. Genesis of species has mutational nature, i.e. new signs are due to modifications of the genome under the influence of external factors (radiation, chemicals, etc.)
3. Mutations occur at random.
4. Mutations that are favorable to the "survival" persist.

Darwinist view of evolutionary processes emerged first and initially convincingly described the observed processes. Therefore it is quite justified to apply it not only to the interpretation of the origin of species, but also extend to other areas, in particular, apply to the study of social processes, as well as to the origin of life.

Consequently, the problem stated by the author in [12] can be considered from a quite different angle. Specifically, the question is, can anyone suggest **a natural scientific** concept of evolution, an alternative to Darwin's.

Neural networks and evolution of complicated systems:

Paradoxically, the answer can be found in the analysis of the problem of cultural aromorphoses. A neural net model of the noosphere, that has much in common with the concept of "information objects" discussed in [12], is proposed in [14].

The human brain consists of individual neurons, each one of them by itself has no signs of consciousness. Intellectual activity appears as a result of the collective effect: neurons, forming a net create a different quality.

The theory of neural nets [15, 16] historically appeared from attempts to understand the nature of thought. For this purpose, in particular, the concept of the formal neuron was developed, and now it is widely used for various purposes. Nets, which are consist of formal neurons, also entail a different quality. Functions of separate formal neuron are very simple - to change the state of the binary outputs depending on the amplitude and sign of the signal at the input. However, in total, i.e. forming a net, neurons can perform much more complex operations. The most studied is the pattern recognition, which is used in many applications [15, 16].

Neural net model of noosphere [14] establishes a correspondence between the neuron and the individual (single person), the existing information links between individuals assign to the nerve fibers connecting the individual neurons together. (Note that in the theory of neural nets it is not specified that the signal should have any particular nature, for example electrical.)

Used analogy is eligible for the following circumstances. The communication channel, when the information does not pass through it, does not affect the operation of the system. Therefore, it would be enough if it existed only at the time when the signal passes. Therefore, the transmission of information from person to person can be regarded from the analogy with the transfer of the signal from one neuron to another. In [9] it is also shown that such links do have some weights (or rather their analogues).

Formed by a set of individuals analogue of neural net generates a new quality, which can be identified with the noosphere as a whole (or its certain relatively independent piece, for example, ethnical structure). With a certain degree of conditionality it can be said that it represents a kind of super-intelligence. However, it is more correct to say that any of the individuals are involved in processing information at least on two levels - at the individual and the over-personal.

It is acceptable to talk about over-personal level of information processing for the following reasons. Just as an individual neuron does not affect the mental activity of the brain in general and particular individual only in a very small extent, can affect the processes that determine the performance of the neural net as a whole.

Let us recall that the neural net is tolerant to errors, and stays unaffected by a loss of a single neuron. With age the brain loses up to several tens of percent of the cells, but the system as a whole retains the ability to function. From the point of view of the theory of neural nets it is interpreted through a well known fact that information is not stored in a separate "logic cell," but in the network as a whole. From this perspective, the neural network is similar to a hologram (a part of the hologram can restore the same image as a whole, but with lower quality [15,16]).

Another important property of the analogue neural nets that exist in society, is their rapid evolution. In other words, **the whole network can evolve without changing the properties (and even the parameters) of a separate element.** This statement was confirmed by simple mathematical models constructed in [17].

Further, if we accept the conclusion of the existence of an analogy between the community and the neural net, from the above it follows that the "over-mind" can and must evolve much faster than individuals, i.e. its components.

At a certain stage of evolution, a higher level of information processing begins to affect the underlying. With some exaggeration, the analogue neural net begins to "independently pick" component elements that have the desired properties. Hypothetically, this can take place until the emergence of individuals with communication channels with higher levels of processing and storing information (it is possible that on this basis the phenomenon of the prophets and other individuals who made significant contributions to the history of civilization can be interpreted.)

However, at this stage of research it is safe to say only that the analogue of neural net in the process of development can reach levels that can filter necessary items.

This approach allows us to interpret the appearance of cultural aromorphoses based on the following mechanism.

1. The primary is the evolution of analog neural net and its elements are individuals (there are no means of monitoring the process of this kind, because there is no verifiable way of reading data from an over-personal level, so the question of the stages of evolution is hidden).

2. In the next step a higher level is converted into a filter that "chooses" necessary items. The mechanism of this selection is not clear yet, but we can say a priori that its speed is much higher than determined by random mutations, because there is an additional factor that generates the desired effect on the elements of the system and fixing definite changes.

3. The emergence of "new" elements can be massive, because the above factors affect the system as a whole and this determines the abrupt nature of the observed changes.

Appearance of the considered mechanism can be seen from the example of development of human communities. Moreover, many features of this mechanism are almost obvious, since the emergence of the urban environment requires the appearance of people with hitherto unknown skills, etc.

Conclusion:

The existence of a mechanism alternative to the Darwinian point of view can be clearly substantiated by examples from the field of social science. However, there are serious reasons to believe that the mechanism is common. In particular, it can be shown that many macromolecules also have neural net properties. This suggests that the protobiological evolution could occur with the same mechanism.

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