New Informational Stage of the Biosphere Evolution. Ethno-Population, Ethno-Species, Ethno-Ecosystems

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Abstract. In this article the new epoch of modern biosphere evolution is discussed. This epoch can be characterized as a period of strong increasing of non-genetic informational exchange between individuals of new *Homo* species. The peculiarities of this informational epoch are connected with the following: ecological features of any human ethno-population depend on not only "genetic luggage" but mental outfit, in other words human culture. The ethno-population culture is conditioned on the total of collective experiences and, hence, the informational exchange between the population members. The accumulation of the experiences along evolution needs specific mechanisms of memory. The knowledge libraries which are outside of man organisms are one of such ways. To understand main traits of the modern biosphere evolution we can try to translate some known regularities for biodiversity and ecosystem evolution to the ethno-populations.

Keywords: evolution, biosphere, informational processes, ethno-population, ethno-ecology

1 INTRODUCTION

The most of works in the field of evolutionary biology discusses the biological evolution before the appearance a human in the Earth. The human civilization develops by not only biological rules and change the condition in the planet very fast; so many known regularities of biological evolution can't be applied to the modern time. One of the purposes of this article is to outline some approaches, which can describe evolution of the biosphere with human sub-populations. The investigation of the real role of human beings in the modern biosphere evolution is obviously not only historical examination but anticipatory too.

In this article the new epoch of the biosphere evolution (or, in western tradition, Gaia evolution – see [1]) is discussed. This epoch can be characterized as the period of strong increasing of non-genetic informational exchange between individuals of new *Homo* species and, obviously, it has begun when this species appeared in the planet. The peculiarities of this informational epoch are connected with the following: ecological features of any sub-population of man depend on not only "genetic luggage" but on mental outfit. In other words, ecological features of any concrete human sub-population depend on its human culture. Note, that the word "culture" will be understood in this article in ethnography context, i.e. as collective experience which is incarnate in mental and material objects. It is more correctly to use the term "**ethno-population**" in this context. The ethno-population culture is conditioned on the total of collective experiences and, hence, the culture is interconnected with informational exchange between the population members. The accumulation of the experiences along human evolution needs specific mechanisms of memory; the abstract thinking and speech promote to invention of different ways to transfer and to storage the experience. The knowledge libraries which are outside of human organisms are one of characteristics of such way.

Every ethno-population plays specific role in the concrete ecosystem this population inhabits. It can be in equilibrium with environment and carry out the role of usual species population of ecosystem. Then we have an "**inscribed**" ethno-population in animate nature; this is most probably for so called traditional cultures. But ethno-population can change the maternal ecosystem very quickly. This is a "**converting**" culture (i.e. "reformatory" culture for wild nature), seemingly technological one which prefers as rule to use nonrenewable resources of its surroundings. Taking into consideration that human is one of main factors of the changes in modern biosphere it is

important to understand mechanisms of influence of cultural factors on biosphere evolution. One can hope that translation of some known regularities for biodiversity [2], [3] and ecosystem evolution [4] in the field of ethno-populations development as well as the consideration of ecological traits of ethno-populations will help in the solution of this task.

2 EVOLUTION OF LIFE AND DEVELOPMENT OF INFORMATIONAL EXCHANGE IN THE BIOSPHERE

The biological evolution has begun about 3.5 milliards years ago, at the same time as biosphere evolution began. In biosphere evolution we can see the growth of the quantity of organic matter which is used in vital processes and circulates within the biosphere. This leads to essential changes of conditions in the planet (the conditions are principally non-equilibrium and they are being supported by planetary life). The vital processes need energy; the intensification of them is one of the consequences of increasing of the energy flow through biosphere i.e. physical biospheric evolution [2], [3].

We know not enough about early stages of planetary history before the origin of simplest biological organisms but one can suppose the existence of stage of pre-biosphere or so called embryo-sphere [2], [3], [5], [6]. In any case, it is clear there were circulation of matter and were planetary chemical evolution which has made ready the conditions of pristine life.

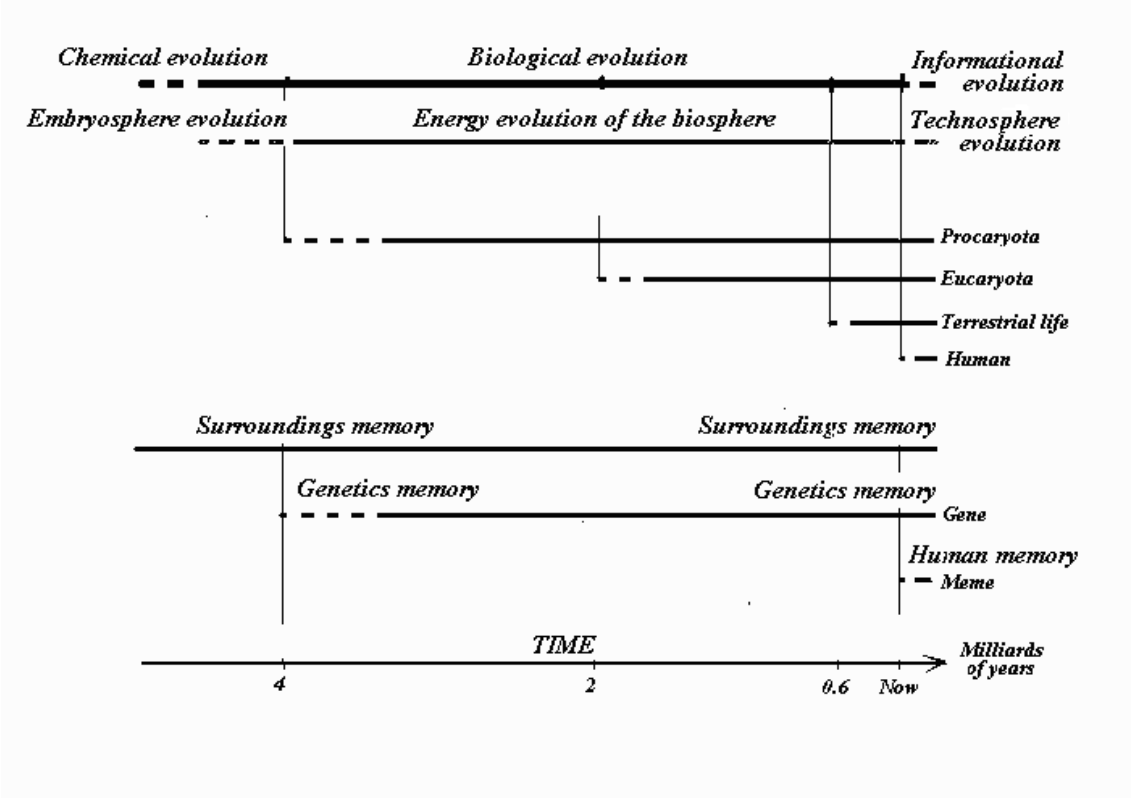

FIGURE 1. The comparison of different evolutionary processes which passed in the planet and the appearance of different mechanisms of memory along planetary history

Upper: the stages of pre-biological and biological evolution in contexts of classical natural sciences: chemical, biological, informational. In the same part of the picture the different stages of planetary history are presented in context of ecological sciences: embryo-sphere evolution, biosphere evolution, techno-sphere evolution. Some important events (origin of procaryota, eucaryota, terrestrial life, human) are given there too.

Below: three kinds of memory which determined the evolution of the life in the planet: "surroundings memory" (the non-reversible changes of abiotic components of surroundings), genetics memory (starting with the procaryota origin), "cultural memory" (starting with the human origin). The abscissa axis gives the time in milliards of years.

One of the general regularity of all stages of planetary history is the non-reversible changes of Earth conditions, in other words, we have the effect of the **surroundings memory**. The capacity of surroundings memory can be estimated in terms of non-reversible modifications of the planetary conditions.

For the stage starting with the origin of pristine life (i.e., when the biosphere had started) the new kind of memory begins to play main role in functioning of the biosphere: this is **genetics memory**. In fact, all biological evolution arose from genetic changes and the biosphere evolution interconnected with them. Principally new type of memory arises with the origin of man: this is **cultural memory** i.e. the knowledge libraries which are situated outside of human organisms. These are not only libraries in commonsense meaning but are totality of human cultures including so called collective unconsciousness [7]. Abstract thinking and speech (or other linguistic means as well) promote dissemination of individual experiences, which can help members of human sub-populations to survive; the human cultures reflect and save these experiences in symbolic form.

As is well known the unit of genetic memory is the gene. For the unit of cultural memory the term "**meme**" was proposed by Dawkins [8]. This term, referring to some quanta of cultural information, applies also in order to describe processes of cultural transmission [9].

The figure 1 briefly illustrates all described above stages of the biosphere evolution. It is not difficult to see that classification of different stages of planetary history using such characteristics as kind of memory allows subdivide this history into three main stages. The first – pre-biological – and the second – biological – stages are being discussed enough frequently. Concerning the thirds stage – techno-sphere – there are not numerous scientific publications; existent publications in this exciting theme are mainly philosophical [10], [11], [12], [13] and fantastic. Nevertheless, we have to legibly understand that since the *Homo sapience* begins to create the special means of work it becomes "techno-biological creature", in other words, new symbiotic *Homo* species – *Homo mechanicus* or rather (if to use traditional Latin) «***Homo machinalis***». In order to originate new appliances and technical instruments it is necessary at least two things: at the first, specific means of storage of human experiences and at the second, intensive informational exchange between members of human population. Therefore, this technical stage of biosphere evolution can be called as informational too.

3 ETHNO-POPULATIONS, ETHNO-ECOSYSTEMS AND THEIR ROLE IN THE BIOSPHERE

The discussion about evolution of human as the evolution of *Homo machinalis* may include very many different aspects but below only general ecological aspects of the problem will be discussed.

The informational exchange by symbolic way was established before human. For example, superior animals can use sound and smell signals as well as different forms of imitational behavior [14]. But as a rule this exchange fulfils the transfer of current information about some concrete situation (for instance, about danger) or performs some physiological function (for example, it promotes reproduction function).

Although the animals are able to be taught, their experiences are not almost being accumulated in "culture" of population as general knowledge, i.e. any individual experiences are forgotten as a rule through several generations. *Homo sapiens* have principal features which distinguish him from animal: abstract thinking and speech. Just this circumstance allows to him to increase the fund of general knowledge of human sub-populations along time and to add some individual experiences into the general knowledge, into human culture and collective unconscious [7].

In classical biology and ecology it is latently supposed that fundamental (potential) ecological niches [15] of any species population is determined by only morpho-physiological characteristics for species and, therefore, the main particularities of any ecological niche is uniquely connected with genotype of species. But in the case of human we have another situation: new knowledge, skills can modify the successfulness of existence in some surroundings conditions; hence the fundamental and realized niches of any human sub-population are substantially interconnected with its non-biological informational "baggage". In fact, the appearance of the possibility of fast informational interchange between humans modifies their ecological properties. And what is more: the ecological properties of man of any human sub-population depend directly on common knowledge, skills, culture, which characterize this sub-population. One can say also that sphere of survival (in context of ecological niche) of any human sub-population depend directly on its culture.

It is interesting to note that transfer of genetic information is normally going “vertically” i.e. from generations of parents to the progeny generations. The appearance of informational exchange in symbolic form by results of individual experiences means the intensive "horizontal" information transfer has been established. Such process is similar the virus propagation in some aspects [9], [16], [17]. The mode of life of human species demonstrates great significance of transfer of non-genetic information and of mechanisms of its storage as well.

Thus, the advanced intellect and the possibility to transmit and to accumulate the results of experiences and skills in abstract form (as culture) along generations allow to *Homo sapiens* to turn into really intelligent human and to become super universal species among other animals. But new skills demand use of artificial means of work and non biological ways of storage of knowledge about them along time, therefore human turn into *Homo machinalis* almost at once. New knowledge and skills broaden ecological fundamental niches of human sub-population [3], the realized niches expand thereupon too [15]. The speed of these processes isn’t vastly limited genetically as in the case of all other species and may be very fast. One can see that new informational stage of the biosphere evolution is characterized by extremely fast expansion of *Homo machinalis* species in all places of Earth which are accessible for life. In fact, we are the eyewitnesses of such stage of the biosphere evolution, which is ultra-fast. At that, every step of the development of human civilization is conditioned by discovery of new ways of exploitation of the planet environment.

The consideration of processes of producing of new information by humans as well as propagation of the information gives possibility to deduce some simple equations for the net of interacted individuals [18]. These equations demonstrate extremely high role of the reality models which are produced by thought processes: factually, the value of any arriving informational message [19] and any new idea is appraised depending on intuitive or verbalized models of reality (in described simple model the producing of new ideas is regarded as the perception/non-perception of them from something similar to virtual “world of ideas”). In other words, any informational message, any idea are being estimated a priori within a framework of already existed conceptions and culture as a whole (this resembles Gödel theorem). Seeming as “important” informational messages are being disseminated along net, others are being eliminated:

$$P_i < p_i V_i^2 N(I_a + I_p) \tag{1}$$

and

$$D_i < d_i V_i^2 (I_a^2 + I_a I_p) , \tag{2}$$

where P_i is the producing rate of new informational messages in some unit of time, i – class of knowledge (for instance, some concrete field of science), N is the number of the sub-population, V_i is **a priori value** of informational message within class of knowledge i, I_a is actual number of informational connections from a participant of net to other ones, I_p is the number of virtual connections with members of previous generations (it characterizes knowledge, culture) in the units of I_a (the way of estimation of I_p may be the comparison of quantities of vitally significant information which were received from actual generation and previous generations), D_i gives the relation of quantity of some concrete informational messages after one step of their dissemination along net to the quantity of the messages before that, p_i and d_i – some coefficients for normalization [19].

As obviously, the real behavior of humans is conditioned not only by concrete events in some restricted period of their individual life but by culture which “covers” essentially bigger periods of time, including prospective future (of course, within a framework of concrete culture). Time in this context is not a point in physical space-time continuum; the time is here a gap as was written by M. Heidegger [20]. Hence, the culture as collective experience, which is incarnated in collective unconscious as well as other mental and material objects, anticipates and pre-determines the building of the human future along the way where “the possible becomes to be the real” [20]; see also [10], [11]. At that the gap restricts the permissible boundaries for **anticipatory activity**.

The development of culture changes the ecological characteristics of *Homo machinalis* species. The building of principally new scientific conceptions along with the creation of cultural wealth is one of important aspects of anticipatory activity [21], [22], [23]. Thus, the newest informational stage of biosphere evolution depends on creative anticipatory activity of human species and is consequence of cultural evolution [24], [25].

In order to consider the ecological regularities of development of ethno-population it is convenient to introduce several new terms. One can use the term “**ethno-species**” in the same context as in usual biological taxonomy: every ethno-population consists of individuals of some ethno-species with concrete ethno-cultural properties. It is

necessary to note that reproductive isolation between different ethno-species is very weak in contrast to usual species. The concrete features of ethno-populations depend on peculiarities of the sub-population culture. The ecosystem which includes some ethno-population can be titled as **ethno-ecosystem**. Any ethno-population in principle uses different resources of surroundings and returns them back to environment in exhausted form. If the resources are renewable by ethno-ecosystem mechanisms then the ethno-population is in equilibrium with surroundings and it can be called as inscribed ethno-population (see about the equilibrium and about so called sustainable development [26], [27]. If the resources are not renewable, for example, they are some minerals then the ethno-population is of converting type.

The changes of surroundings of ethno-ecosystem lead to culture modification of humans under pressure of survival necessity [24], [25]. In contrast to usual biological species the human ethno-species can relatively easy regress and progress (in cultural, technical and ecological aspects) if such changes helps to survive. Many changes of features of ethno-population are possible only as result of influences of non-traditional or principally new knowledge, technologies and (on the highest level) religions and ideologies. The most of human cultures have specific mechanisms of cultural immunity; the religions and ideologies with quite simple imperatives of behavior organize systems of restrictions for "alien" memes. It is interesting that any inscribed ethno-populations have specific continuum of common cultural traits. Another continuum is for converting ethno-populations. At that, the surplus or privation of the surroundings resources forms specific type of cultures. This permits to suppose that development of any culture has probably several succession phases (and probably succession cycles) with different levels of availability of different resources.

Some processes which are taking place at the ecosystems evolution happen also in the case of ethno-ecosystems. But it is important to note the ethno-ecosystems reorganizations happen at that not only as result of known biological processes which modify ecosystems [3], [4] but sometimes very quickly as result of cultural changes. As well as for usual ecosystems, one can say about different types of ethno-ecosystems changes. In particular, there are both **divergent** and **anagenetic** slow types of ethno-ecosystem evolution [4] when the ethno-ecosystem or some of its parts develop toward more exact adaptation either to the physico-geographical conditions or to their change along time (clado-genesis by Huxley [28] and Rensch [29]). Such manner characterizes so called traditional cultures with ancient roots. But if cultural immunity is insufficient the changes can be very fast at both **introduction** and **diversification** types of ethno-ecosystem evolution when the ethno-ecosystem evolves due to either introduction of non typical culture of other ethno-ecosystem or **ethno-speciation** just within maternal ethno-ecosystem as a consequence of technological and other cultural advances (ana-genesis in classical western evolutionary terminology). In both last cases the ethno-population culture, its attainments in environment exploitation, are modified. In this connection it is interesting to note that some individualities can change own ethno-species characteristics during the life time.

In order to find out else some regularities of ethno-ecosystems evolution one can consider known evolutionary rules for usual ecosystem. Of course, such way isn't enough correct but it can suggest an idea to new approaches concerning ethno-ecosystems evolution. In the article [3] the **evolutionary principles of biodiversity** were described. They were jointly proposed by Prof. Yaroslav Starobogatov and Dr. Sci. Vladimir Levchenko in 1995 and were published in several works in Russian [30]; these principles are based on some general statements (see [3], [4], [6], [19]):

1) **pan-biospheric paradigm** which may be conventionally called also as "life within the biosphere only";

2) **paradigm of auto-canalization**, which is close in some philosophical aspects to so called auto-poietic hypothesis and which describes some anticipatory phenomena of the biosphere evolution [10], [11], [31], [32];

3) **ecocentric concept of macroevolution** about the parallelism of biological evolution and ecosystems evolution (the macroevolution and evolution of ecosystems are different aspects of the same process [4];

4) **license-ecosystem approach** [3], [4], [6].

If to replace the words "population" by ethno-population, "species" by ethno-species, "ecosystem" by ethno-ecosystem and "biodiversity" by **ethno-diversity** then the above evolutionary principles of biodiversity will be transformed to the followings:

1. **The principle of necessary ethno-diversity of the biosphere**. Bio- and ethno-diversity are necessary for support of a stable functioning of ethno-ecosystems and modern biosphere in altering environments.

2. **The principle of imperfect ethno-specializations**. Only ethno-species displaying no hard restrictions to evolutionary changes can serve as supply material for further evolution.

3. **The principle of evolutionary dead-end for widespread ethno-species**. The main role in ethno-ecosystems and in the biosphere is played by abundant ethno-species well-adapted to the actual environment and, thus, good specialized. But, as a rule, such ethno-species fail to serve as material for further evolution.

4. **The principle of substitutions**. Abundant ethno-species are being replaced first of all in response to globally changing external factors. The necessary levels of bio- and ethno-diversity are maintained along the periods of changes by a rising quantity of new abundant ethno-species: specialists and older generalists.

5. **The principle of auto-regulation of bio- and ethno-diversity** in the biosphere. The biosphere "strives" for supporting of some level of bio- and ethno- diversities which are necessary under the inconstant conditions on the planet.

Some of these principles can look a little strange in context of human evolution and civilization history; of course, some of them have to be made more precise. Nevertheless, these principles does not contradict evidently to many known historical facts and demonstrate that some aspects of *Homo machinalis* evolution can be described in natural sciences. One of such aspects is the energy approach which was described in several works of Vladimir Levchenko [2], [3], [6], [33] for biosphere before human. The proposed above terminology allows to apply the regularities of this approach to the ethno-population evolution; in particular, the interruption conception helps to understand what can be after-effects for some ethno-ecosystem if the energy interruptions happen. Within a framework of this conception the energy crises have to lead to the changes of cultures of ethno-populations as well as to the reorganizations of some of them.

4 CONCLUSIONS

A perception of information from external world by bio-system is very important process in the context of survival of any bio-system: the information helps to use useful properties of environment and to avoid harmful influences. The biosphere determines some diapason of possible environment for living organisms and, thus, the diapason of diversity for objects of external world, which can be perceived in the process of cognition of the world by actually living organisms. On the other hand, the life on the Earth is changing the biosphere conditions during all time when the life exists. Hence, the following feedback exists: the living organisms are studying the biosphere, the traits of them are being changed as a result of that but they simultaneously are building new biosphere which influences the following life and the processes of cognition. We come to the fundamental evolutionary problem: has this process either finale one or not? The hypothesis is the following: if the life is structurally limited by planetary area and if the planetary conditions are relatively stable then this process gradually dies out and the system comes to the status of some "living machine" which is well tuned for settled conditions [2]. If the life is able to go abroad the planet then the evolutionary process is unlimited along the time.

Described approach ensues from known regularities of ecosystems evolution; it can be applied to consider some traits of development of cultures. Every type of environment in combination with native natural resources pre-determines specific spectrum of cultures which are successful in this place. The territorially closed cultures which don't use substantially additional external resources "strive" to be in equilibrium with environment, otherwise they risk to collapse (as, for instance, the culture of Pascua Island). But in order to achieve such equilibrium the culture has to have in its collective unconscious some reminiscence about successful existence in conditions of every phases of ecological succession of corresponding ethno-ecosystems. As since the periods of typical succession processes in the animate nature are as a rule hundreds of years then such inscribed cultures have to have not less periods for self-formations. Of course, the environmental changes by external reasons, cultural introduction, diversification etc can disturb the natural processes of the formation.

In order to survive the *Homo sapiens* begins at early history to use appliances for work, moreover it entrusts some part of own memory to external (regarding own body) means including artificial ones. This has entailed the irreversible consequences: the artificial means become symbiotic components of organisms and, thus, instruments begin to pre-determine the following evolution of this species. They come to power over humans and "compel" to support the existence and development of technological civilization. The *Homo sapiens* turn into *Homo machinalis* – one of "organs" of very quickly growing techno-sphere. The modern human cultures include in collective unconscious more and more of reminiscences about techno-environment.

The modern technical civilization demands of specific particularities of human culture: very quick irreversible changes of environment because of extermination of nonrenewable resources don't imply such types of culture which was appreciated in great civilizations of the past. The humans must now serve machines which request

more and more non biological planetary resources for own existence; the national frontiers as well as many moral imperatives of ancient epochs based on longtime human experiences hamper for such servicing. So, Renaissance human (for example) which unifies in own consciousness the emotional and cultural experiences of many human generations isn't appropriate kind of personality for modern moment of human history. The Heidegger' "time gap" which determines the boundaries of anticipatory activity of modern human is being again compressed up to size which is characteristic for primitive communities. This is obviously the "matrix" of globalization which is necessary for development of existed types of technologies.

How to avoid the total power of machines and to save the planetary animate nature? How to find again the power over instruments? It seems the modern *Homo machinalis* are not able to solve easily this anticipatory task. It is necessary for that to restore the correct relationships between components of the symbiotic "human-machine" system and to recover privileges of human as host. The human consciousness must become more self-dependent. The time gap has to be extended in spite of fast changes in visible material world. The Homo evolution have to turn from consumption evolution which is urged by machines to evolution of consciousness because the main wealth, as it is known, is in our brains; there are still the great multitude of non-cognized, potential emotions and reflections. The modern human needs seemingly for that new cultural jump which could emotionally unite humans of different ethno-populations [34].

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