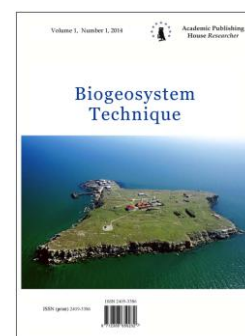


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### Configuration of Stable Evolutionary Strategy of Homo Sapiens and Evolutionary Risks of Technological Civilization (the Conceptual Model Essay)

<sup>1</sup>Valentin T. Cheshko<sup>2</sup>Lida V. Ivanitskaya<sup>3</sup>Yulia V. Kosova

<sup>1-3</sup>V.N.Karazin Kharkiv national university, Ukraine  
sq. Svobody, Kharkiv, 61122  
E-mail: cheshko@karazin.ua

#### Abstract

Stable evolutionary strategy of Homo sapiens (SESH) is built in accordance with the modular and hierarchical principle and consists of the same type of self-replicating elements, i.e. is a system of systems. On the top level of the organization of SESH is the superposition of genetic, social, cultural and techno-rationalistic complexes. The components of this triad differ in the mechanism of cycles of generation - replication - transmission - fixing/elimination of adoptively relevant information. This mechanism is implemented either in accordance with the Darwin-Weismann modus, or according to the Lamarck modus, the difference between them is clear from the title. The integral attribute of the system of systems including ESSH is the production of evolutionary risks. The sources of evolutionary risk for stable adaptive strategy of Homo sapiens are the imbalance of (1) the intra-genomic co-evolution (intragenomic conflicts); (2) the gene-cultural co-evolution; (3) the inter-cultural co-evolution; (4) techno-humanitarian balance; (5) inter-technological conflicts (technological traps). At least phenomenologically the components of the evolutionary risk are reversible, but in the aggregate they are in potentio irreversible destructive ones for bio-social, and cultural self-identity of Homo sapiens. When the actual evolution is the subject of a rationalist control and/or manipulation, the magnitude of the 4th and 5th components of the evolutionary risk reaches the level of existential significance.

**Keywords:** Evolutionary Strategy; Conceptual Model; Homo sapiens.

#### Introduction

For mass, everyday consciousness and institutional philosophical tradition it is intuitively obvious that having the ability to control the evolutionary process, Homo sapiens came close to the borders of their own biological and cultural identity. In other words, the Anthropocene era may soon be replaced by epoch of post-Anthropocene, i.e. post humanistic one.

The Anthropocene is not formalized unit of geochronological scale, geological era characterized by the transformation of human activity in the primary factor that determines the direction and regularities of the course of geological processes.

The idea of the Anthropocene belongs to the environmentalist Eugene Storer and Nobel laureate Paul Crutzen, it was expressed in 2000 (P. J. Crutzen, 2002). This idea completes the process of rationalization of the initially irrational concept, seeking to overcome the hegemony of

technocratic determinism. The onset of the Anthropocene is not an abstract, theoretical, especially notworldview and humanitarian problem. It is the question of empirical verification, i.e. the search of criteria (the symptoms) of the new geochronological period set purely empirically. The management of the evolutionary process includes the man himself as both object and subject of manipulation transformations.

Explanatory models of evolutionary phenomenon called "**Man**" always rocked between Scylla of biological and Charybdis of social reductionism. In recent decades, tremendous progress of new research technologies of onto - and phylogenesis pushes the researcher towards reductionist biology, and awareness of the extent caused by the same technological innovation humanitarian and civilizational crisis – socio reductionist approaches.

This conflict itself is a serious challenge to the humanity, which consists in the necessity of overcoming the cognitive dissonance between the two components – the unitary nature of Homo sapiens and created by him technogenic civilization in their natural and social images. At the same time, it is the most powerful risk-causing factor of the existential significance level, that can lead to loss of self-identity as the supporting structure of human nature.

As we assume, the uniqueness of the phenomenon of man is a system feature arising from nonlinear interaction of biological and cultural modules of Homo sapiens' adaptation. The role of the key evolutionary factor of social and cultural anthropogenesis plays a network of relationships between different adaptive modules of stable adaptive strategy of Homo sapiens (SASH). This network can be adequately interpreted under macrodescription of hominid evolution and with the use of macro-parameters of this process, which can serve as the radical expansion of adaptive information created and replicated outside the genetic inheritance modus.

This idea is not unique. It is almost identical with the ideas of Australian evolutionist Kim Sterelny (Sterelny K., 2012, p.13).

The purpose of this article is to develop a conceptual model of evolutionary stable strategy of Homo sapiens, an integral attribute of which is evolutionary risk, steadily approaching to the existential level.

### **Stable Evolutionary Strategy of Homo Sapiens**

Self-organizing (evolving) systems are objects that contain patterns that act as carriers of spontaneously replicating and mutating information that is necessary for the existence of these objects (a), and as operator ensuring the process of realization of this information (b).

Within the theory the evolution is the process of change of informational fragments of self-organizing objects.

Adaptation includes any internal informational fragments, the presence of which in the system increases the stability and replenishment of the information contained therein.

In the end of the XIX century, James Mark Baldwin was the first who drew attention to system forming role of epigenetic inheritance in its cultural form in the evolution of man: not only the biological characteristics, but also a set of social patterns of behavior, values, and norms that are passed on from one generation to another and ultimately have a strong influence on what the direction of anthropogenesis will prevail (Baldwin effect) (Baldwin J.M., 2001). According to the modern researchers (Burman J.T., 2013), Jean Piaget moved in the same direction and, out of his own social positions. According to Jean Piaget the child's psyche is formed during the successive transformations as a result of the integration in the pre-existing socio-cultural environment. The common idea of the Baldwin and Piaget's concepts is implicit concept of self-sustaining co-evolutionary cycle of transformations - genome → culture → ecological niche → genome, the basis for which is epigenetic conversion of genetic program (Young J. L., 2013).

Obviously, one of the common temporal trends of the evolutionary process in general and the process of adaptogenesis in particular can be considered multiplication of systems of generation, replication and translation (realisation) of adaptive information and, accordingly, multiplication of types of such adaptations (Jablonka E., Lamb M.J., 2005). At present in relation to human and hominids there are at least four such systems: genetic, epigenetic (in its turn, subdivided into subsystems of methylation, complex forming with histones, alternative splicing); cultural (behavioural); semantic (natural and artificial languages).

Etienne Danchin and Matteo Mameli postulate an inclusive, or shared inheritance - integrative result of the operation of all mentioned above systems of heredity in process of the global evolution (Mameli M., 2004, p. 35; Danchin E., 2013, p, 351). The empirical basis of this thesis is the inability of reduction of inherited components of phenotypic variation to molecular genetic variations of the genome (Zuk O. et al., 2012; Danchin E., 2013, p, 354).

In the organization of the inclusive meta-system of adaptive information inheritance two alternative evolutionary modus of generation, replication and implementation of adaptive information - Darwin-Weisman modus and Lamarck modus - are implemented simultaneously.

Darwin-Weisman modus is a stochastic one it is not intended to rigidly determined informational structures and/or controlled by them signs, (a)indefinite - is not adequate and does not correlate with changes in the external environment (b), it is notprojectional and not constructive, i.e. not capable to change the adaptive landscape, in which the evolutionary process takes place, directly (purposefully or not purposefully) (c); and it's not recursive - it cannot be changed other than as a result of repeated stochastic event (d); the speed of fixing of new adaptations higher, the smaller the size of the population is (e); in the process of distribution of newly generated adaptations the horizontal transfer (diffusion, contamination as a result of communication) is significantly inferior to its specific weight to the vertical one, i.e. inheritance from ancestors to descendants (f). The modus is based on the genetic code and is provided by the so-called Eigen's hypercycles (Eigen M., Winkler R., 1983) – the binary bunch of nucleic acids and proteins with a strict division of the functions of replication (DNA, RNA) and implementation of adaptive information (proteins). The adaptive value of informational fragments is acquired and recorded during the stochastic selection, not connected by the direct functional dependence with the generation of information. Selection and replication of adaptive information in this case is only in carried on along the vertical direction. Modus in relatively pure form actualized during the biological phases of evolution (the biogenesis).

Lamarck's modus is teleological, it aims at the certain informational structures and/or signs controlled by them, (a), it is adequate and/or correlates with the changes in the external environment (b), it is projective and constructive, i.e. capable to the direct change of the adaptive landscape and (cultural and) ecological niche, where the evolutionary process is taking place, moreover, to their purposeful reconstruction (c), and it is recursive – available for the correction during the implementation (d);speed of fixing of new adaptations higher the bigger the size and density of population (e); in the process of distribution of newly generated adaptations the horizontal transfer (diffusion, contamination as a result of communication) is comparable as regards of its specific weight with the vertical one (f). Modus is based on socio-cultural code and is provided by systems of mimesis (cultural heredity) and speech (symbolic inheritance). Adaptive value of information fragments is acquired and recorded simultaneously with the generation of information and in direct functional dependence on the latter one. Selection and replication of the adaptive information in this case is carrying on both in vertical, horizontal directions (diffusion inside and outside of the simultaneously existing social communities of different rank). Modus in relatively pure form actualized during the social phase of evolution (sociocultural genesis).

From the mentioned above it follows the principle of complementarity of both evolutionary modus: Darwin's modus is more inertial and reliable when vertical transmission of the adaptive information in comparison with Lamarck's one. The substrate basis of Darwin's modus (alternative of genetic variability) is more inertial after elimination of factors of selection and remains longer and, therefore, provides a more sustainable temporary trend. Lamarck's modus is much more efficient comparatively with the Darwin's modus in the process of horizontal transfer (it would be more precise to say - diffusion) of the adaptive information. Thus, the optimum co-evolutionary configuration will be either a mixture of both modes, or extended period of childhood, which provides the overlapping of the periods of dissemination of cultural adaptations beyond one generation. The third factor, which provides rapidity and reliability of distribution of adaptations, - socio-controlled expansion and lengthening of the later stages of ontogenesis outside biologically justified norm of reaction. Concern for the aged members of a social group turns them into natural biological "flash storage" of adaptive information useful for the survival of the group. (All three of adaptive evolutionary solutions are seen in hominid).

In genetic sense (in the sense of origin), the most probable model of the relationship of both modi a priori is the genesis of Lamarck's modus due to autocorrelation of spectra of generation of

adaptive and inheritable/diffusing innovations over time. In its turn, the autocorrelation in this model is a phenomenological result of superposition of several autonomous parallel processes of adapt genesis taking place at different levels of self-organizing systems. This hypothesis dates back to the evolutionary epistemological schemes of Donald Campbell (Campbell D. T.) and Karl Popper, of which we have borrowed another idea - a deep intrinsic homology processes of biological evolution, cognition and learning. All in all the whole history of the formation of classical molecular-genetic and epigenetic paradigms does not contradict this interpretation. Some researchers link this concept with another one- about the necessity to distinguish each member of the binary bundles if the autonomous functions of inherited information - replication of its carriers (replicator) and implementation (realization) of this information (interactor). Actually this autonomy makes it possible binary mechanism of transmission of adaptively relevant information: by actually replication and by epigenetic contamination contagion (Hodgson G. M., Knudsen Th., 2010, p. 80).

We assume that (Cheshko V. T., 2012)

a) **biological adaptations** is encoded in the genome peculiarities of structural-functional organization of the individual that increase the probability of fixation and replication of fragments of genetic information which determine their appearance;

b) **cultural adaptation** is behavioral stereotypes prevalent in concrete social group as the result of imitation and communication between the individuals and increasing the probability of its (group) survival and growth of number of commits and replication of fragments of information that determine their emergence by means of emotional and symbolic communication;

c) **rationalist or technological adaptation (innovation)** is the material means and methods of purposeful and efficient conversion, cognitive-projective activity and pieces of information common for this social group as a result of symbolic communication between individuals through written and oral speech, using natural and artificial languages and increasing the probability of its (group) survival and growth of number of fixation and replication determining of their (means and methods of transformation) the appearance (c).

External, coming as a result of contact with other individuals, the stimulus of generation act of adaptive information (cases b and c) provides for the induction of a specific sequence of epigenetic modifications caused by selectively specific external stimulus. If the latter is a contact with a carrier of a particular type of epigenetic modified trait, we are talking about inherited cultural adaptation. If this stimulus is the result of perception of some informational messages transmitted through artificial code, we are dealing with rational adaptation.

One of the most difficult and controversial aspects of the concept of adapt genesis of Homo sapiens as a superposition of three autonomous modules stems from the functional dependence of the integral adaptive effect from interdependence of influences of all components of the adapt genesis process. Thus, the use of tools as a group means of adaptation (now it is one of the key elements of rationalistic adaptive module) provides for the simultaneous implementation of several premises (Biro D., Haslam M., Rutz Ch., 2013):

1. reliable and correct integration of instrumental activity in the behavioural repertoire of the person, including the existence of a trigger mechanism turning on/off stereotypes ensuring such activity and its situational transformation;

2. adequate physiological and morphological organization (grasping brush, tread, developed brain);

3. sufficient level and direction of cognitive and mental processes at solving routine adaptive tasks exactly this way;

4. synergetic pressure of the environmental situation and social structure, potentiating evolutionary success achieved through the usage.

From this list the I and III condition provides for the existence of biological and the II and IV - socio-cultural adaptive modules

Each of the three types of adaptations has its own substrate-substantive basis - the mechanism of heredity, i.e. generation, replication, implementation (broadcast) and selection of potentially or actually adaptive information. At the same time, the functional organization of all three mechanisms of heredity from the point of view of the system of relations between their basic

functions includes the same elements (Lewis H. M., Laland, K. N., 2012, p. 2171): mutations, modifications and recombinations.

This scheme is based on the classification and general model of hierarchical organization of mechanisms of inheritance, which is described in the monograph by Eve Jablonka and Marion Lamb (Jablonka E., Lamb M.J., 2005).

The difference between genetic and cultural adaptive modes obvious and is in various ways of replication of adaptive information – biological and socio-cultural inheritance. The difference between cultural and technological (rational) adaptive modules due to the character of relationship with biological (genetic) component of adapt genesis. The chain of cultural transformations of behavioral stereotypes can be very long, but its originating point is always biologically deterministic emotional reaction and this substrate base supports the whole chain of social and cultural adaptations. The final links in this chain can be almost completely autonomous from this basis, both in form and in content, but the destruction of the biological substrate like a trigger turns off the whole chain.

Adding of the third (rational) element in the original co-evolutionary link gene – culture transforms it into a triple helix – autonomous self-sustaining cycle of generation of system complexity. This cycle is organized according to the type of evolutionary fractal. Let us consider the basic features of its elements.

The mechanism of biological (actual genetic) heredity is based, as already mentioned, on **hypercycle (the genetic code)**.

The genesis of cultural adaptations associated with the intrinsic to the hominids (and not only to them) ability to mimesis (and imprinting). Obviously there is a definite correspondence - definite or ambiguous - between the structure of neural networks and behavioral stereotypes (**socio-cultural code**), as well as sensual images, it can act as ideal models of reality (**cognitive code**),

The third generation system is the fixation of adaptive information associated with the **symbolic inheritance**. This type of inheritance implies special rationalistic mechanism of occurrence, replication and implementation of information, implying the construction of an abstract ideal objects - **interpret ants**.

The emergence of another theoretical and methodological paradox - the question of the relationship of adaptability and truth of cognitive constructs – also connected with the development of rationalistic forms of adapt genesis. The appearance of forms of adaptation one or another way connected with cognitive processes (psyche) is equal to the creation of a new path informational interaction - reality and its ideal image. If this image is adequate to the reality, in theory of cognition it is treated at the same time as the true one and adaptive one in the theory of evolution. However, the reverse statement "any adaptive information is true," generally speaking, is not always true (McKay R.T., Dennett, D.C., 2009). There must exist a special class of cultural innovations, which are adaptive, but not true ("positive illusions" or "adaptive illusion" (adaptive misbeliefs) according to McKay and Dennett (McKay, R.T., Dennett, D.C., 2009, p.493). The balance of adaptive errors is positive despite the falling of suitability in some indicators.

Similarly, the modular principle of the structural organization of ontogenesis does not exclude but implies the emergence of functional conflicts between the individual elements of adapt genesis - due to the autonomy of their evolutionary origin (Crespi B. J., 2010; Wells J.C.K., 2012; Gibson M. A., Lawson D. W., 2014, p. 245).

With the growth of specific weight of the rationalist (Lamarck's) module in the overall process of adapt genesis of the humanity the value of the "positive illusions" and intra-genomic adaptive conflicts (see below) should decrease, while the value of the system (between-component) conflicts - increase.

Adaptability of all obviously true concepts, that circulating in cultural tradition, is correct only in a dynamic sense. The knowledge even true one, destroying the already established system of "adaptive illusions", can reduce the adaptability of their media - individual or social group.

According to our hypothesis:

1. between biological, sociocultural and rational forms of adaptogenesis there is evolutionary continuity and some gear;
2. the same mechanism and continuity exist between biological, socio-cultural and symbolic forms of inheritance that ensure them;

3. his gear has co-evolutionary nature, i.e. it implies mutual agreement of the autonomous in their origin series of adaptively significant features- socio-cultural and biological, for example;

4. a necessary condition for the occurrence of such mechanism is availability of the processes of epigenetic modifications of adaptive information, which is an object of external regulation by alternative systems of inheritance.

Functionally three components of SESH form a hierarchical system of information cycles. Each such cycle provides a consistent generation, replication, selection and fixation or elimination of adaptively significant information. However, concurrently a stochastic process of loss of information due to random errors of replication takes place.

In respect of the main vectors of evolutionary transformations each subsystem (module) of adaptive strategy depends on the other two elements of the evolutionary landscape and, in turn, acts towards them as a part of this landscape. Therefore,

- first, the evolutionary landscape of hominid becomes multidimensional in comparison with the evolution of other biological taxa;

- second, the share of external factors in the evolution of man and socioecological systems, which include it, generally decreases;

- third, the nascent imbalance in conjunction adaptive strategy - ecological environment periodically reaches a critical value, and results in environmental crisis.

There appeared a new, synthetic algorithm, where the original (constructive, intentional and mechanistic) cognitive components of the psyche united into a single system. This event can be regarded as the identical one with the phenomenon of "**adaptive inversion**", - sociocultural adaptation, the genesis of which reached the highest point in the phenomenon of anthropogenic civilization. At the first stage of this process the constructive algorithm associated with the intentional in functional and with tool producing activity in the "substrate" respect, incorporates/replaces the mechanistic algorithm as a cognitive mechanism of the forecast of change of reality. Then this role is returned to the original (mechanistic) algorithm, but the adaptive transformation of the behavioral modes develops according to the constructive pattern. In other words, the change of behavior in accordance with (forecasted) changes in the environment is replaced by the changes in the environment according to a new behavioral stereotype. This scheme as a whole brings us back to the triad of conjugate evolving elements ensuring a progressive increase in system complexity in model "triple helix". So, the general scheme of the conjugate evolution of the biological (G) and sociocultural elements of SESH is an alternation of direct ( $C_i \rightarrow C_{i+1}$ ,  $G_i \rightarrow G_{i+1}$ ), recursive ( $C_{i+1} \rightarrow G_i$ ) and intermodule ( $G_i \rightarrow C_i$ ) communications-transitions of co-evolutionary process (Fig. 1).

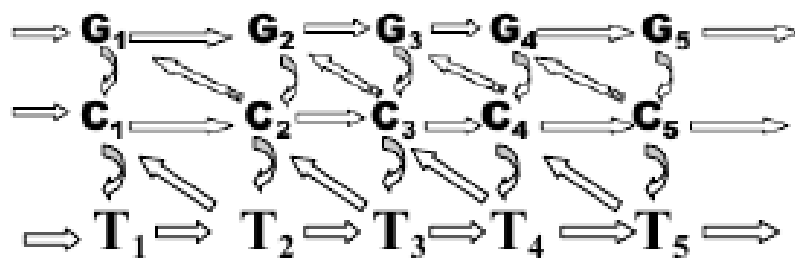


Fig. 1. The block diagram of gene-culture co-evolution and techno-humanitarian balance

If we translate it into the language of the ontology, we can see that as the result of adaptive inversion the "habitat" is split into "the world of objectively-existent" (world of real things) and the "world of projective-perfect" (perfect world) and thus becomes a "reality". A distinctive feature of reality from habitat is binary opposition of the subject (perfect world) and object (world of real things). The traces of bundle of intentional-constructive algorithms in the "evolutionary history" of anthropogenic civilization is clearly traced in the philosophical tradition of deism in XVII - XVIII centuries.

Theoretically, the same structure (Fig.1) practically without changes applicable to the second co-evolutionary link of SESH - techno-humanitarian balance.

Evolutionary success or failure of socio-cultural and then rationalistic innovation stems from its ability to transform the environmental components into the source of life sustain and extension of the number of carriers of the same innovations. From the point of view of evolutionary theory progressing multiplication of ecological niches available for Homo sapiens takes place. The biological nature of media of adaptive innovation remains the same, at least, in the final stages of anthropogenesis.

The emergence of anthropogenic civilization is a transformation of the SESH, more precisely, its socio-cultural component, which is characterized by the domination of technological innovation in adapt genesis and then in socioanthropogenesis in general. Such vector of hominid evolution implies as a side result the escalation of magnitude of evolutionary risk.

In systems theory and computer science of structure the models of SESH similar to the model described above is signified by the term "system of systems" – SoS(Lock R. 2012). As the speed of evolutionary transformations in different modules are not the same there are imbalances and inconsistencies between them. They, in their turn, entail the possibility of a general reduction of adaptability (evolutionary risk). **Thus, evolutionary risk is an attribute of multi-level self-organizing SoS arising from imbalance between adaptations of different levels of organization of such systems developing into conflict.**

Let us formulate this thesis with regard to the theory of stable adaptive strategies of Homo sapiens: the **evolutionary risk**, the value of which periodically reaches the existential level is the system characteristic of SESH.

### Evolutionary risk: structure and researches

Evolutionary trajectory of biological and socio-cultural forms of adaptation, as is commonly believed (Mouden C. El et al., 2014), is subordinated to the so-called Price equation.

$$\Delta \bar{z} = \text{cov}(\mathbf{v}; \mathbf{z}) + E_v(\Delta \mathbf{z}),$$

in which  $\mathbf{v}$  – adaptive value of the sign  $\mathbf{z}$ ,  $\Delta \bar{z}$  – change of the value of average population characteristic in one generation; the first member of the equation ( $\text{cov}(\mathbf{v}; \mathbf{z})$ ) reflects the characteristic change due to its impact on the adaptive value of his media, the second one ( $E_v(\Delta \mathbf{z})$ ) – the changing nature of distribution of the characteristic in the process of interaction between individuals. Obviously the first member describes the process of selection (sampling) of the individuals with different values. The meaning of the value  $E_v(\Delta \mathbf{z})$  is reduced to the impact of specific options of this sign on the distribution of media of different variants of the characteristic in the population. Thus, genes for altruism increase reproductive success of related individuals by reducing its own adaptability. So the value  $\text{cov}(\mathbf{v}; \mathbf{z})$  describes the selection process,  $E_v(\Delta \mathbf{z})$  – the process of communication (direct or indirect) between the individuals.

In the case of cultural inheritance (Lamarck's module) the effect of communication considerably increases its share and takes the form of direct contamination (**Contagion**). In the case of genetic inheritance of adaptive significant sign this effect is mediated by family ties of the participants of the communication. Then Price equation in relation to the socio-cultural component of adapt genesis takes the form (Mouden C. E et al., 2014)

$$\Delta \bar{z} = \text{cov}(\mathbf{c}; \mathbf{z}) + E_c(\Delta \mathbf{z}).$$

where  $\mathbf{c}$  – socio-cultural component of adaptability. . The authors of the quoted article does not consider the rational-technological component of SESH( $\mathbf{t}$ ), but by analogy it can be represented like this

$$\Delta \bar{z} = \text{cov}(\mathbf{t}; \mathbf{z}) + E_t(\Delta \mathbf{z}).$$

Note that due to the system of indivisibility of processes of generation and replication of adaptive information in the Lamarck's module the component  $E(\Delta \mathbf{z})$  plays much more significant role in adaptativeness compared with the biological component of SESH. At the level of individuals the components  $E(\Delta \mathbf{z})$  reflect nonselective trends of bio-, socioculture – and techno genesis respectively.

However, on the level of competition and selection of social groups they become a factor of evolutionary success or failure of the relevant groups, i.e. one way or another have adaptive value. From our point of view this is, the most correct interpretation of recent data (Derex M., Godelle B., Raymond M., 2014, p.89) concerning the high selective value of the speed of the distribution of technological and cultural information in the conditions of inter-group competition

Therefore, some researchers propose to divide it into two subcomponents - constitutional and induced (Heywood J.S. 2005). The first one corresponds to the "inherent" ability of culture to self replication by imitation and learning (phenomenon of cognitive preferences). As a result cultural stereotypes dominating in the society are reproduced with greater efficiency comparatively with their minor forms. The second one is the ability of some cultural or rationalistic innovations to serve as attractors for behavior in a social group because of the correlation between social status and carriage of certain cultural stereotypes. In essence, the same two subcomponent for the same reasons are present in rationalistic (technological) component of SESH.

It seems *a priori* clear that sustainable evolutionary curve is based on positive correlations between the three components (modules) of SESH (Mouden C. El et al., 2014, p. 236). However, we can make intuitively obvious conclusion that this configuration is a relatively rare event: introduction to the consideration of the third (technological and rationalistic) component.

Amplifier of rationalistic adaptations (primarily the use of a variety of tools) is the increase of stochastic oscillations or stable-high trend of changes in the environmental situation in respect of the source of resources of life sustain.

The hypothesis that explains the evolutionary dynamics of the development of tool activity, in modern anthropology is named as the hypothesis of environmental risk (Biro D., Haslam M., Rutz Ch., 2013, Collard M., Buchanan B., O'Brien M.J., Scholnick J., 2013).

The condition for high efficiency of rationalistic SESH module is the high quantity and density of population, providing sufficient intensity and reliability of social inheritance and a relatively high intensity of generating process of adaptively significant innovations of culture and technology (Kline M.A., Boyd R., 2010).

In combination with each other, they create the effect of **deferred risk** associated with the release of risk-causing factors beyond already existing ecological niches. The removal of potential (deferred) form of evolutionary risk associated with "pulling up" of more slowly evolving biological module to a new evolutionary landscape (fig. 1, branch  $T_{n-1} \rightarrow T_n \rightarrow C_{n-1} \rightarrow C_n \rightarrow G_{n-1} \rightarrow G_n$ ). With the passage of stochastic oscillations or sustainable trend of changes of environmental conditions and speed of adaptive evolution of rationalistic and sociocultural modules of certain threshold the stage  $G_{n-1} \rightarrow G_n$  falls or is late and it is replaced by adaptive changes of other participants of adaptogenesis:

$$T_{n-1} \rightarrow T_n \rightarrow C_{n-1} \rightarrow C_n \rightarrow T_n \rightarrow T_{n+1} \rightarrow C_n \rightarrow C_{n+1} \rightarrow \dots$$

However, with the further growth of speed of technogenesis the falling of the stage of adaptive cultural transformation takes place. In this case (due to lower the speed difference of the evolution of techno and cultural genesis relatively with biogenesis) general scheme of SESH evolution is turned to be dualistic:

$$T_{n-1} \rightarrow T_n \rightarrow T_n \rightarrow T_{n+1} \rightarrow C_n \rightarrow C_{n+1} \rightarrow \dots$$

or

$$T_{n-1} \rightarrow T_n \rightarrow C_{n-k} \rightarrow C_{n-k+1} \rightarrow T_n \rightarrow T_{n+1} \rightarrow C_n \rightarrow C_{n+1} \rightarrow \dots$$

As a result, the value of deferred risk is equivalent to the evolutionary risk. It tends to permanent increase with time as in the above described scheme technogenesis becomes self-catalyzing process. Advancing development of social, cultural and rationalistic modules of SESH leads to increase of tension of genetically cultural co-evolutionary bundle and techno-humanitarian balance (the growth of inconsistency between technocultural habitat of *Homo sapiens* and genetic and physiological adaptive norm). The situation of deferred evolutionary risk is solved by the rapid growth of all kinds of variations of the elements of biological adaptive module, which, in turn, is accompanied by increased frequency of genetic and epigenetic abnormalities, called "diseases of civilization". Deferred ecological risk passes in its current evolutionary form.

From now the "**existential evolutionary risk**" will be understood under the term evolutionary risk. Thus, in the first approximation this term will be referred to:

(1) in terms of disciplinary matrix of biological (physical) anthropology - the probability of long-term evolutionary trend, ending in an irreversible decline in the numbers (extinction) of biological media of stable adaptive strategies (in this case - of *Homo sapiens*);

(2) in terms of cultural (philosophical) anthropology the judgement about the loss by the intellect carrier his cultural self-identity are equivalent;



(3) finally, from the point of view of the theory of technology (anthropology of technology), this point is fixed as the coming of posthuman future. (If the process of technogenesis continues we have to speak about occurrence of post-humanism in the evolution of techno - or noosphere - depending on the source system of values and ideology of the author).

All three aspects, in an explicit or hidden form, appeal to the unavoidable and cumulatively accumulated imbalance between individual and group adaptability, which upon reaching a certain threshold makes them incompatible. By achieving this bifurcation point, there is a sudden (catastrophic) disintegration (irreversible decline of adaptability) of this SoS. Further evolution maybe developed according to one of three alternative scenarios:

(1) **Extinction of Homo sapiens** - complete elimination of carriers of this SESH  $N(\text{SoS}) \rightarrow 0$ ;

(2) **Posthumanity** – replacing of one SESH by another one, with the elimination of one or more components -  $N_1(\text{SoS}_1) \rightarrow N_2(\text{SoS}_2)$ . "Elimination" of SESH component in this context refers to the inability of evolutionary transition between the SESH-predecessor component and the newly formed SESH. In a certain sense, this peculiarity corresponds to a well-known model - "irreducible system complexity", according to which the object cannot come into existence through step-by-step evolution of the previous object;

(3) **Divergence (irradiation) of intelligent life** - decay of the initial set of media of this SESH on several  $\text{SoS}_1 \rightarrow \Sigma(\text{SoS}_i)$ . In terms of the theory of niches constructing and evolutionary ecology this case is equivalent to the fragmentation of the initial ecological niche. If actual or potential intention to unlimited expansion will remain at least in one of the newly emerged media of intelligent life the evolutionary reduction in the third to the second scenario is inevitable.

### Existential evolutionary risk of modern technological civilization

Technology makes our genetic constitution and the content of our consciousness the subject of rational control. The result of the development of both types of information technologies is unified: the technologies of manipulation of consciousness (changes of socio-cultural code) and technologies of changes of the genetic code are both technologies of controlled evolution (Cheshko V.T., 2012, p. 337).

Reducing the amount of evolutionary risk caused by uncontrolled (stochastic) microevolution the rationalistic component of SESH, ipso facto raises the amount of risk up to the next level - meta-evolutionary risk at this case caused by the possibility of destruction actually of the SoS of homeostatising ensemble. Let us consider the common mechanism of formation of evolutionary risk related to the possibility of disintegration as a result of destruction of coevolution and communication relations between the SESH components.

The sources of evolutionary risk are multiple vectors of the process of adaptogenesis, in which it is also involved a certain set of elementary adaptations affecting more than one significant adaptive trait simultaneously (pleiotropic), evolving in different directions and at different speeds.

Its partial empirical manifestations are the growth of the genetic load (gene-culture co-evolution) and increase of the scope and depth of civilization ecological crisis (techno-humanitarian balance). Both of these options can be used as parameters of the actualized evolutionary risk of SESH. However, linear approximation, implies the adoption of alternative risk component equal to a constant. It prevents us from adequate assess of its (evolutionary risk) value. In addition, both parameters, although characterize integral population adaptability, but are determined by the individual (genetic load) and group (the environmental crisis) adaptability - effective mechanisms for the implementation of the biological and socio-cultural component of SESH. Finally, in addition to genetic load individual adaptability is determined not only by genetic but socio-cultural heredity (way of life).

Due to these reasons we need to introduce a new concept - adaptive differential ( $D_a$ ), which in this context means the impact of this evolutionary innovations on the adaptability of other innovation, already existed and registered in the population. The adaptive differential of the individual adaptations of this complex may have a different character and a different value with respect to other adaptations, regardless of their nature. So,

$$D_a = \frac{|\Sigma(A_i - A_j)|}{N},$$

where  $A_k$ ,  $A_i$  – relative adaptability of this inherited innovation (biological, cultural or rational) and of other innovation from their  $N$  totality.

Values  $D_a$  lie in the range from zero to one, and with the approach of the  $D_a$  to unity, it makes relatively greater contribution in the total amount of adaptability. Considering the hierarchy of the speed of the separate components of SESH, the adaptive differential of innovation (socio-cultural and technological) that are evolving more quickly increases. However, more slowly evolving components supply adaptation, which are the substrate basis for the more quickly evolving ones.

Consequently, the tension in the overall system of SESH is growing and this process continues until the disintegration of meta-structure of adaptive complex providing functioning and possibility of further transformations of the social, cultural and technological components. Obviously, evolutionary risk is the property of any self-organizing (evolving) systems. For example, in cognitivist and evolutionary epistemology famous theory of "cognitive load", according to which the assimilation of the new data, which is not hereditary in a biological sense, is possible by ultimate in size informational fragments, not exceeding seven elements. With all the differences of this situation, we are talking about similar information processes, since the acquisition of new knowledge, adequate to reality, is equivalent to the generation of adaptive information by living organisms. After that there is an avalanche removal or replacement of components of adaptive strategies. The end result will be either complete elimination of carriers of this SESH, or the emergence of a new SESH

### Conclusions

Modern stage of anthropocene (the technology of controlled evolution phase) is considered as a possible onset of a new, transhumanistic era of global evolution. Sources of evolutionary risk for stable adaptive strategy of Homo sapiens are an imbalance of: (1) the intra-genomic co-evolution (intra-genomic conflicts); (2) the gene-cultural co-evolution; (3) inter-cultural co-evolution; (4) techno-humanitarian balance; (5) inter-technological conflicts (technological traps). At least phenomenologically the components of the evolutionary risk are reversible, but in the aggregate they are in potentio irreversible destructive ones for bio-social, and cultural self-identity of Homo sapiens. When the actual evolution is the subject of a rationalist control and/or manipulation, the magnitude of the 4th and 5th components of the evolutionary risk reaches a level of existential significance.

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