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АНТРОПОЦЕН: ФИЛОСОФИЯ БИОТЕХНОЛОГИИ

**Стабильная адаптивная стратегия Homo sapiens,
эволюционный риск и эволюционная семантика**

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ANTHROPOCENE: A PHILOSOPHY OF BIOTECHNOLOGIES

**Stable adaptive strategy of Homo sapiens, evolutionary risk
and evolutionary semantick**

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В современной науке теория эволюции сложных, включающих в себя человека систем и алгоритм ее построения представляют собой синтез эволюционной эпистемологии и философской антропологии с конкретно-научной эмпирической базой. Иными словами, в эпоху технологий управляемой эволюции натурфилософия вновь обретает статус стержневого элемента теоретического естествознания. Разрабатывается коэволюционная концепция трехмодульной стабильной эволюционной стратегии *Homo sapiens*, на основе которой формулируется принцип эволюционной дополнителности: величина эволюционного риска и эволюционная траектория антропогенеза определяются одновременно двумя параметрами — спонтанно-дескриптивным (эволюционная эффективность) и креативно-телеологическим (эволюционная корректность), которые невозможно инструментально редуцировать друг к другу. Соотносительные значения обоих параметров определяют векторы биологической, социокультурной и технорационалистической эволюции человека через два передаточных механизма — генно-культурную коэволюцию и техногуманитарный баланс. Результирующую каждого из них можно оценить через соотношение социопсихологических predispositions гуманизации/дегуманизации менталитета. Предлагаются объяснительная модель и методология расчета креативно-телеологического компонента эволюционного риска NBIC технологического комплекса. Ее неотъемлемым элементом является эволюционная семантика (изменяющийся во времени семантический код, обеспечивающий соответствие биологического, социокультурного и технорационалистического адаптивных модулей).

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ANTHROPOCENE: PHILOSOPHY OF BIOTECHNOLOGIES.

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The theory of evolution of complex, including the human system and algorithm for its constructing are a synthesis of evolutionary epistemology, philosophical anthropology and concrete scientific empirical basis in modern science. In other words, natural philosophy is regaining the status of a theoretical science in the era of technology-driven evolution. The co-evolutionary concept of 3-modal stable evolutionary strategy of Homo sapiens is developed. The concept based on the principle of evolutionary complementarity of anthropogenesis: value of evolutionary risk and evolutionary path of human evolution are defined by descriptive (evolutionary efficiency) and creative-teleological (evolutionary correctness) parameters simultaneously, that cannot be instrumentally reduced to others ones. Resulting volume of both parameters define the vectors of biological, social, cultural and techno-rationalistic human evolution by two gear mechanism — genetic and cultural co-evolution and techno-humanitarian balance. The resultant each of them can be estimated by the ratio of socio-psychological predispositions of humanization/dehumanization in mentality. Explanatory model and methodology of evaluation of creatively teleological evolutionary risk component of NBIC technological complex is proposed. Integral part of the model is evolutionary semantics (time-varying semantic code, the compliance of the biological, socio-cultural and techno-rationalist adaptive modules of human stable evolutionary strategy).

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SUMMARY

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 Storrer and Nobel laureate Paul Crutzen, it was expressed in 2000. 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 not worldview 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 macro description 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.

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 systemforming 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). 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, complexforming 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 not projectional 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 adaptogenesis 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 adaptogenesis 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 adaptogenesis 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 adaptogenesis. 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 - *interpretants*.

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 adaptogenesis. 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 adaptogenesis - 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 adaptogenesis 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. this 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 Stable Evolutionary Strategy of Homo (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).

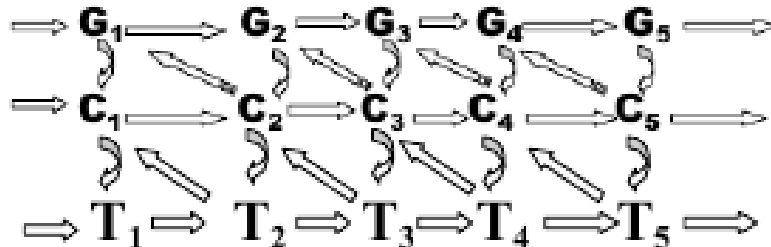


Fig. 1. The block diagram of gene-culture co-evolution and techno-humanitarian balance

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 adaptogenesis 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.

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

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 ($E_{\mathbf{v}}(\Delta \mathbf{z})$) – 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 $E_{\mathbf{v}}(\Delta \mathbf{z})$ 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, $E_{\mathbf{v}}(\Delta \mathbf{z})$ – 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 adaptogenesis takes the form (Mouden C. El et al., 2014)

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

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

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

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 technogenesis 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 may be 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,

$$D_a = \frac{|\sum(A_k - A_i)|}{N},$$

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

Informational and semantic components of the organization of the stable evolutionary strategy of *Homo sapiens*

The mechanism of the effect of each module on the evolution of the two remaining modules of SESH a priori can be ambivalent:

1. Direct selective pressure, i.e. the change of the adaptive values of the individual features/innovations that are controlled or supported genetically, technologically or through training;
2. Semantic coevolution, i.e. the change in the qualitative or quantitative expression of a particular trait during its implementation as a result of contact with the factors that are the adaptive elements of other SESH modules.

With regard to the gene-cultural coevolution the examples of selective pressure, which consists in changing of gene frequencies in populations with changing socio-cultural environment, were given in this study more than once. Semantic coevolution in this case involves epigenetic modification of the process of realization of genetic information under the influence of sociocultural factors (ethical imperatives, rituals, beliefs, behavioral acts, etc.). All similar factors have the potential to cause psychosomatic response and, over time, to become self-sustaining cycles. In some sense, the mechanisms of interaction of genes and culture of this kind is similar to the placebo effect. The latter, as it is known, is a certain psychosomatic therapeutic action or acts of communication, rituals, physical acts that have no direct pharmaceutical value. According to the recent, though still hypothetical builds, the placebo effect may be due to the changes in the activity of the nerve centers of the brain and activation of the synthesis of various neurotransmitters. Under the action of the latter, the synthesis of specific information molecules (RNA, proteins) either is activated or inhibited (Hall K.T., Loscalzo J., Kaptchuk T.J. , 2015). As a result, the functional relationship between behavioral act and physiological response, which is based on the initial psychological predisposition is established. Introduced by the authors of the cited work, the concept of "placebo" (placebome), in our opinion, can be a particular description of more general phenomenon - the existence of a common epigenetic intermediate mechanism through which adaptive interaction between sociocultural and biological SESH module is installed. It is important to note that in this way not only co-evolutionary links between genes and elements of culture are formed, but to each of them a certain adaptive value is assigned.

Separation of the category "adaptivity" on two parameters (introduced by us) -objectively-spontaneous (evolutionary efficiency) and subjective-teleological

(evolutionary correctness) allows, in our view, to transfer the semantic concept of co-evolution into the sphere of empirical verification. According to the views of its author (S. D. Cousins, 2012) the integrity of the co-evolutionary binary opposition of genes–culture is supported by the informational correlations as well as semantic correspondences. If in the first (informational) aspect the co-evolutionary connection between two areas (modules in our terminology) of adaptive information is provided by the correspondences between informational modules (adaptations) that are supported by biological and socio-cultural inheritance, in the second (semantic) aspect we are talking about rules of such conformity.

In the framework of the three-module model of SESH the co-evolutionary semantics is interpreted as analysis of the informational code that is being changed in the course of human evolution and providing inter-modular interaction within a coherent system of SESH. Therefore, we are talking about the evolution of the double mutual connotations between elements of biological and socio-cultural, socio-cultural and techno-rationalistic modules. Because of such interactions, that are changing in the course of evolution, a peculiar picture of substantial relations is set: the elements of biological module serve as the substrate basis, providing the substrate foundation for the available pool of socio-cultural adaptations; the elements socio-cultural module serve as a selective filter that quickens or hinders the development of technological innovation.

This transmissional mechanism by which the system of adaptations of one module pre-forms selective topos of another one, S. D. Cousins (as in the center of his attention there is culture as a set of psychological intentions and pre-dispositions) names the *intendant* (Cousins S.D. , 2014). From our point of view, more adequate and lexically neutral in different linguistic context will be such term as “*operator*”. But in any case the content of this term is revealed through ideal image, that emerged spontaneously or rationally, of the totality of objective targets that pre-determines self-replicating (in future) structure of relationships of adaptability/disadaptability of separate elements of each module. This structure further indicates the direction of SESH evolution in whole and its individual elements in particular.

So, a specified model of the three-module model of organization of SESH includes (1) three informational modules (bio-, cultural - and techno-rationalistic), each one with its own system of generating, encoding and inheritance of adaptive information and (2) three semantic operator (transmission mechanism) that connect the modules to each other, and semantic connotations of the members of the co-evolutionary bundle vary in time.

In socio-humanitarian and natural-science conceptual and categorical framework of evolutionary theory, meta-semantic compliance of the categories of paradigmatic significance in which the system of objective interests and evolutionary correctness – systems of values - corresponds to the evolutionary efficiency is established. Thus two pairs of categories provide the intersection of socio-prescriptive and descriptive parts of the transdisciplinary theory of anthropogenesis (due to overlapping of their

content). Configuration of semantic code is determined by the system of value priorities and the system of rationally justified interests (techno-rationalistic module). A priori we can assume that the semantic code of inter-module interaction is going through periods of relative stability followed by periods of uneven rearrangement initiated by the reconstruction of the value system (socio-cultural module) or objective knowledge and its practical application (techno-rationalist module). (Change of the semantic code that defines the correspondence between the statuses of the individual modules, by definition, is initiated by the module, the rate of evolution of which is greater.) Such restructuring of the semantic connotations is fraught with sharp adaptive intensification of conflicts by increasing the size of the evolutionary load and evolutionary risk. The size of the risk reaches an existential level, when the vectors of evolutionary efficiency and evolutionary correctness are incompatible (antiparallel).

Therefore, semantic analysis can be applied equally to all co-evolutionary cycles (operators) inside SESH – to gene-cultural coevolution, and the techno-humanitarian balance, and to the forming cycle of techno-biological transformations. The study of the semantic differences between the elements of binary techno-cultural and genetic cultural bunches serves as the basis for defining the current vector of the evolution and size of the current evolutionary risk of *Homo sapiens*.

Rational and techno genesis as the form and the mechanism of adaptation supposes availability of a cognitive (semantic) code. Its unique feature is the hegemony of random system of correlative correspondences between thoughts (interpretants), serving as promoters for the adaptively important behavioral acts, and as appropriate symbols. The availability of interpretants joins the mechanisms of functioning of the socio-cultural and rationalistic part of SESH. The difference between them consists in random coding system of adaptive behavioral acts that is capable to change physical, social or mental reality by increasing or reducing individual and/or group adaptability of their carriers. This idea is not something fundamentally new. In 1987, for example, in one of the articles it was claimed that the basis for the evolutionary uniqueness of man is the ability to conceptually abstracted from the situations modeling of the actions necessary to achieve the objectives that correlate with adaptation. The ability, speaking the language of the theory of cognition, to create the idealistic rationalistic models of objective reality, is called the "cognitive niche" (Tooby, J., DeVore, I. , 1987). Given argumentation of the specific (not to say uniqueness) of SESH can be formulated as a postulate about ***rationalization of the process of adaptogenesis of Homo sapiens*** and other hominids. Metaphysical statement about teleological anthropogenesis with the emergence of the technologies of controlled evolution (NBIC-technological complex, convergent technologies, High Hume technology in a broad metaphorical meaning which doesn't change the essence) became quite compatible with the concept of the objective nature of the evolutionary process. Moreover, the observation of the simultaneous existence of several conjugate evolving systems of

generation and inheritance of adaptive traits, on the assumption of the inequality of the speeds of adaptaciogenesis in each of them, makes teleology quite "natural".

Co-evolutionary semantics of evolutionary risk

As a result, the second aspect of the implementation of the SESH functions is constituted – it is semantic aspect. Co-evolutionary semantics is a time-varying code of correspondence between members of pairwise co-evolutional bunches. The role of the operator that sets the rules of the biological and socio-cultural, socio-cultural and rational-technological, rational-technological and biological informational areas performs either the system of objectified **interests** (praxeologically oriented knowledge), or the system of subjective **values** (psychological pre-dispositions). Replication of the interests is carried out in the framework of the rational-technological module based on the mechanisms of symbolic inheritance, value priorities – within the framework of socio-cultural module and, accordingly, socio-cultural inheritance (cultural tradition). If the main "purpose" of interests is material survival of the carriers of SESH (evolutionary efficiency), then the content of the same parameter (evolutionary correctness) of values is determined by their ability to ensure self-identity preservation.

Such organization is able to spontaneous increase of system complexity, and at different stages of socio-anthropological genesis the role of the leader is taken by some of its components. Approximately 350-400 years ago as a result of transmutation of the socio-cultural component of the SAS the technogenic civilization emerged, the main feature of which is a permanent extension of the "socio-ecological niches" (sphere of control) of Homo sapiens and parallel escalation of risks of the anthropo-technological impact

Postponed effects of genetic conflicts within biological module of SESH and between biological module on the one hand, and technological and socio-cultural modules on the other stretched out on millenniums. For example, changing a habitual way of eating (diet), that was peculiar to man until the Neolithic revolution, caused a modification in the metabolism of lipids, proteins, carbohydrates that emerged in late - and post reproductive age. These effects, therefore, are closed for the effect of the biological forms of natural selection. As it is supposed now, the increase of frequency of cardiovascular (stroke, heart attack, atherosclerosis), oncological pathology, diabetes of type II, etc. are linked exactly to them. In addition to this, there is imbalance in the development of the sexual sphere, manifested in the discrepancy between the timing of the start of the menstrual cycle and other components of puberty of women. All this is a clear trend of size of the evolutionary risks inherent in a Western type of technological civilization. (The details of these problems are outlined in a recent book by the Swedish nutritionist, adept of the evolutionary medicine Stefan Lindeberg (2010); the coupled evolution of the human genome and culture, causing to the genesis of the "diseases of civilization" are also examined in the book by Daniel Lieberman (2013). Both researchers consider the

transition to a non fruit diet, that was determined by socio-cultural heredity, as a systemic factor that reformatted the structure and meaning of the relationship between biological and behavioral, and then non-genetical adaptations. Later, using the arguments of these researchers we will try to justify the semantic concept of co-evolution as an explanatory model of the transmission mechanism between SESH modules.)

The rating of reduction of adaptability according to this indicator on reaching a certain threshold zone of values or as a result of the same threshold of changes of ecological and cultural environment is cable of fast growth, that demands the immediate adaptive response (solving of the problem of survival). Such leap, in fact, is the **actualization of evolutionary risk**. One of the symptoms of this updating is a systemic effect – distribution beyond the bounds of the initial module to the other components of SESH. So the above-mentioned diseases of Western civilization during the past twentieth century was transformed from a purely medical (i.e. directly related to the biological module) problems on the areas that guide the evolution of socio-cultural module (including the economy).

The evolutionary risk reaches the maximum size in case of antiparallely of dynamics of changes in evolutionary efficiency and evolutionary correctness, when the characteristic size of risk very quickly crosses the boundaries of "physical" sense ($R_{int} > 1$). Reaching this point means irreversible semantic destruction (destruction of the system of value priorities, the central core of which is the concept of **humanity** and **human nature**).

It seems logical to make two clarifications. The periods of abrupt increasing of the size of evolutionary risk, obviously, are coherent to the periods of "scientific-technological revolution" and to the periods of radical reconstructions of value systems prevailing in the society. Exactly then the structure of the co-evolution connections between the elementary adaptations of different modules of SESH and actually adaptive value of each element is destabilized and prone to unpredictable stochastic fluctuations.

The system of value priorities dominant in society has several-level structure - the individual (unconditional) interests, group (conventional) requirements, an abstract (universal) values [K. Prehn et al., 2015; Kohlberg L., 1969]. Here, primarily in the field of group norms and predispositions regarding specific attributes of humanization/dehumanization, relatively rapid reconstructions radically changing the semantic of relations between cultural module and biological and technological ones are possible. As a result, the adaptive landscape, in which evolution of, for example, biological module (adaptive significance of individual elements) takes place, is quickly reformatted. As an example we can take a radical revision of value priorities on group and individual level towards traditional and non-traditional sexual orientation in the Western mentality in 1970s-2015s. Universal values are practically not involved in this, not-yet-finished process of transformation of socio-cultural and psychological predisposition.

Thus, we can assume that out of three levels of values priority (and their corresponding socio-cultural predispositions) individual interests, group norms and universal values, the most susceptible to evolutionary transformations are the group norms.

More stable are the individual interests (as most closely associated with the vital needs, determined by biological module) and universal values (as the most abstract, distant from objective reality and close to the rationalistic module). However, the effect of perturbations of group norms - attributes of humanization/dehumanization - diffuses by the means of evolutionary semantic transmission mechanism on the biological module, destroying, in its turn, the rules, of semantic matching of this module with two remaining. Because of this secondary effect the elements of the biological module of SESH are distributed first to the system of objective "interests" and then to other levels of the socio-cultural module. The fixation of a particular set of group norms and then the review of universal values, as the latter are projective reflection of the group norms and individual interests, are taking place.

So, a certain part of the biological adaptation in a new socio-cultural context becomes the elements of genetic load (inadaptive or selectively neutral), and, conversely, a part of harmful or selectively neutral components of the genome are acquire adaptive value. With regard to the technological innovation, together they are definitely aimed at the fragmentation of the biological adaptive complex.

If the value of scientific and technological revolutions (shifts of paradigms) has been investigated (suffice it to recall the classical monograph of Thomas Kuhn of 1962), the evolutionary significance of social and cultural transformation begins to clear up only now. Meanwhile, the socio-cultural inheritance is also able to radical rearrangements of its structure and composition. It takes only to mention the radical change of predisposition regarding sexuality that has occurred in the Western mentality over the past half century. Relative independence of each module is an additional complicating circumstance, as the result of this independence, for example, "macromutation" of the system of cultural and psychological predispositions aimed primarily at preserving the structural distribution of subcultures within a given civilization type, and only then, at the selection of relevant biological elements of SESH module.

However, in the conditions of the relative balance of genetic-cultural ("Gene-culture co-evolution".) and techno-cultural ("Techno humanitarian balance".) co-evolutional semantics and the lack of direct preformative impact of technorationalist SESH module on the two left (biological and sociocultural), the configuration of the entire system also did not allow an uncontrolled jump of risk to the existential level.

In our previous works we have already formulated the terms of such semantic stability in terms of socio-humanitarian knowledge: the core of the mentality of the West is the desire of a person to a certain maximum ideal ("Per aspera ad astra –

through the thorns to the stars"). It is complemented by the second pivotal construction, paralyzing and, simultaneously, challenging the limits of this ideal ("Ad imaginem suam ad imaginem Dei – In the image and likeness of God") and focuses on the chosen-ness, the absolute priority of the uniqueness of the human person ("Unus ex nobis – One of us" as God says about Adam). Thus the actualization of the desire to bring together the world as it is and the world as it should be gains the character of the movement towards the absolute, the ultimate goal ("the omega point", as named by Teilhard de Chardin).

In objectified, dismissed from the metaphors from the same argument boils down to the statement that one of the basic predisposition of mentality of industrial civilization in its Western form, is a trend to release the social roles and social status of an individual from the preformation by conditions of his biological substrate (the genome) as a criterion of social (and evolutionary) progress. This trend, in turn, is balanced by the irrational fear of a possible intervention in the human psyche from the outside that violate the free will of the individual and forcing him to act against his "human nature". This trend can be traced back at least to biblical times and legends about werewolves and vampires, through the Gothic novels of the eighteenth century to modern thrillers and science fiction of the most recent years.

The sociocultural system of counterweights, ensuring the self-identity of *Homo sapiens*, turned out to be very stable, but only until the birth of the technologies of driven evolution, when ontological antinomy Evolution versus Intelligent Design was finally overcome. As a result, the restrictions arising from the limited technological means for reality transformation turned to be overcome, at least *in potentio*. The only built-in inside SESH stabilizer of the current of global evolutionary process remains the semantic code of humanization/dehumanization, which in itself allows significant stochastic fluctuations, and is open to technological interventions and therefore needs continuous monitoring.

With the emergence of High-Hume technologies the level of risk is reached the existential level of significance. At this existential level of technological risk means by definition evolutionary risk, because it leads to the genesis of the possibility of the extinction of mankind as a species (but not necessarily intelligent life and the noosphere).

Conclusion

In the era when evolution itself becomes a subject of rational control and/or manipulation, it is necessary to calculate when making a projection and determining the amount of innovative risk those features of social response to scientific and technological development, which stems from the substantial foundations of human consciousness and culture and are the result of the previous biosocial evolution.

Modification of techno-cultural balance, which is an adaptive response of the SESH sociocultural component to the processes described above, led to the transformation of classical science to its postacademic form. In the framework of the

same global-evolutionary transformation we have to consider the emergence of bioethics as one of the varieties of contemporary (trans-disciplinary) scientific concept, which combines the features of the Humanities, classical scientific theory and social utopia. Not so long ago E. Koonin, was very observant when diagnosed a curious feature of the explanatory models of modern evolutionary biology: all of them are narratives with more or less, but always available portion of teleology. Consciously or not they have, in explicit or implicit form, logical constructs such as "arise for...", the language of these narratives (though it contradicts the methodology of classical not modern, transdisciplinary science) best suits to the describe evolutionary processes and phenomena, and the creation of hypotheses which can be verified by experience (Koonin E.V., 2011).

Especially it is true for the modern phase of the evolution of SESH, which is characterized by a universal process of rationalization and technologization of the course of evolution., The introduced concept of evolutionary risk, in which objective and scientific (evolutionary efficiency) and subjective and humanitarian (evolutionary correctness) criteria of the value of this parameter combines, in accordance with the principle of subsidiarity serves as the example of such an explanatory model.

The problem of evolutionary risk and its components is coming within the conceptual field of anthropic principle, since one of the parameters of the equation of the doomsday simultaneously becomes not only a global constant that is crucial to the human genesis in the Universe, but also a derivative from the characteristics of sociocultural and biological evolution. It did not fail to specify One of the pioneers of the anthropic principle Brandon Carter (2012) didn't fail to point at this fact.

In 1960 Heinz von Foerster has formulated the law of hyperbolic growth in the number of Homo sapiens, also known under the non-academic title "Doomsday Equation". In accordance with the Foerster's equation, the population growth for approximately the last 10 thousand years, obeys an equation of the hyperbola, i.e. increases with increasing acceleration and about up to 2025 will be infinite, i.e. loses physical meaning. It will mean the end of the evolutionary history of Homo sapiens, although not necessarily imply the death of intelligent life at all. Rather, it means the passage of a certain point of the evolutionary singularity, the achievement of the value of evolutionary risk close to unit.

In the Foerster's equation there is the parameter T^* , which had been empirically calculated by the authors and according to them was about $2 \cdot 10^{11}$. Brandon Carter in the work cited above considers this option as a member of the pool of world constants that determined the emergence of human and the formation of the laws of nature of civilization that are able to reflect.. In his understanding this value is a function of the amount of information (10^{10} bits) contained in the human genome and the duration of existence of one generation (20 years). By reducing this parameter below the threshold value, the transition from biological to sociocultural,

and then technological phases of anthropogenesis (phases II-III in our periodization of the evolution of SASH) becomes impossible.

And phenomenological interpretation and explanatory model of the Foerster's Doomsday Equation quite consistent with the notion about the organization of SASH and the mechanisms of formation of evolutionary risk, advocated in the present study.

On the one hand, the population growth increases the frequency of technological and socio-cultural innovations/adaptations and the speed of their distribution in the population, which in accordance with Lamarck's module flows through contagious mechanism. Thereby the ecological niches available for the development of *Homo sapiens* are expanded, and the conditions for further acceleration of population growth are created (korotaev A.B et al., 2005).

On the other hand, the integrity of the structure three-module SASH means the availability of some inter-module communicational correspondences between the elements of biological and socio-cultural modules of the co-evolutional semantics. Even under the condition of the ambiguity of semantic connections between modules with exceeding of a certain threshold in the number of adaptive socio-cultural elements in comparison with the pool of biologically determined signs, that are comparable to them, the efficiency of genesis of adaptation decreases sharply. Externally it is manifested in the accumulation of genetic and cultural imbalances, inconsistencies between the demands of the sociocultural environment and psycho-physiological capabilities of the organism (evolutional load). In the first approximation, the threshold, beyond which the area of the fracture of the curve of population growth begins will be attainment of the volume of adaptive information that is replicated with the help of socio-cultural inheritance, the value comparable with the volume of information accumulated in the genome. This situation has two fundamental but alternative evolutionary solutions.

The first ("hard") decision means the technologization of biological evolution of human, i.e. the improvement (enhancement) of *Homo sapiens* through genetic engineering, etc. technologies, resulting, as already mentioned, in the completion of the evolutionary history of humanity (the loss of self-identity of generations of intellect carrier).

"Soft" solution involves the creation of a radically transformed version of the evolutionary semantics for regulating the flow of gene-cultural co-evolution and techno-humanitarian balance. The newly established co-evolutionary semantics should provide the best match of the biological and techno-rationalistic modules to the so-called universal value priorities, preserving the self-identity of the carriers of the mind.

This final observation, in turn, determines civilizational and evolutionary function of bioethics. Bioethics is largely methodological one. In other words, it is a metatheory, which, we hope, can serve as a stabilizer for the system of attributes-identifiers of human self-identity, as well as for the system of cultural-mental

predispositions formed on their basis. This system maintains the existence of the current version of evolutionary semantics NBIC-technological complex within the "universal values", ensuring the preservation of humanity in the process of permanent development of technologies, directed to the subject of the evolutionary process.