An EVOLUTIONARY METAPHYSICS of *HUMAN ENHANCEMENT* TECHNOLOGIES

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”Welcome to the Anthropocene”.
Slavoj Zizek (2010: 327)

”The constructing person and the world he constructs constitute a procedural unity”.
Elena Knyazeva (2014)

”In our struggle against its own vulnerability, we create new vulnerabilities and thus transforming the world transform themselves”.
Mark Coeckelbergh (2013: 87)

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Foreword

The monograph is an English, expanded and revised version of the book

Cheshko, V. T., Ivanitskaya, L.V., & Glazko, V.I. (2018). Anthropocene. Philosophy of Biotechnology. Moscow, Course.

The manuscript was completed by me on November 15, 2019. It is a study devoted to the development of the concept of a stable evolutionary human strategy as a unique phenomenon of global evolution. The name "An Evolutionary Metaphysics (Cheshko, 2012; Glazko et al., 2016). With equal rights, this study could be entitled "Biotechnology as a result and factor of the evolutionary process".

The choice in favor of used "The Evolutionary Metaphysics of *Human Enhancement* Technologies" was made in accordance with the basic principle of modern post-academician and human-sized science, a classic example of which is biotechnology.

The "Metaphysics of Evolution" and "Evolutionary Metaphysics" concepts are used in several ways in modern philosophical discourse. In any case, the values contain a logical or associative reference to the teleological nature of the evolutionary process (Hull, 1967, 1989; Apel, 1995; Faye, 2016; Dupre, 2017; Rose, 2018, etc). In our study, the "evolutionary metaphysics" serves to denote the thesis of the rationalization and technologization of global evolution and anthropogenesis, in particular. At the same time, the postulate of an open future remains relevant in relation to the results of the evolutionary process.

The theory of evolution of complex, including the humans system and algorithm for its constructing are a synthesis of evolutionary epistemology, philosophical anthropology and concrete scientific empirical basis in modern science. ln other words, natural philosophy is regaining the status bar element 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 instrumental reduced to others ones. Resulting volume of both parameters define the vectors of blological, social, cultural and techno-rationalistic human evolution Ьy two gear mechanism genetic and cultural co-evolution and techno-humanitarian balance. The resultant each of them can estimated Ьy 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 blological, socio-cultural and techno-rationalist adaptive modules of human stable evolutionary strategy).

It is seem necessary to make three clarifications.

First, logical construct, "evolutionary metaphysics" contains an internal contradiction, because it unites two alternative explanatory models. "Metaphysics", as a subject, implies deducibility of the process from the initial general abstract principle, and, consequently, the outcome of the development of the object is uniquely determined by the initial conditions. Predicate, "evolutionary", means stochastic mechanism of realizing the same principle by memorizing and replicating random choices in all variants of the post-Darwin paradigm. In philosophy, random choice corresponds to the category of "free will" of a reasonable agent. In evolutionary theory, the same phenomenon is reflected in the concept of "covariant replication". Authors will attempt to synthesize both of these models in a single transdisciplinary theoretical framework.

Secondly, the interpretation of the term "evolutionary (adaptive) strategy" is different from the classical definition. The difference is that the adaptive strategy in this context is equivalent to the survival, i.e. it includes the adaptation to the environment and the transformation (construction) of the medium in accordance with the objectives of survival. To emphasize this difference authors used verbal construction "adaptive" (rather than "evolutionary") strategy as more adequate. In all other cases, the two terms may be regarded as synonymous.

Thirdly, the initial two essays of this series were published in one book in 2012. Their main goal was the development of the logically consistent

methodological concept of stable adaptive (evolutionary) strategy of hominines and the argumentation of its heuristic possibilities as a transdisciplinary scientific paradigm of modern anthropology. The task was to demonstrate the possibilities of the SESH concept in describing and explaining the evolutionary prospects for the interaction of social organization and technology (techno-humanitarian balance) and the associated biological and cultural mechanisms of the genesis of religion (gene-cultural co-evolution). In other words, it was related to the sphere of cultural and philosophical anthropology, i.e. to the axiological component of any theoretical constructions describing the behavior of self-organizing systems with human participation.

In contrast, the present work is an attempt to introduce this concept into the sphere of biological anthropology and, consequently, its main goal is to demonstrate the possibility of verification of its main provisions by means of procedures developed by natural science, i.e. refers to the descriptive component of the same theoretical constructions. The result of this in the future should be methods for assessing, calculating and predicting the risk of loss of biological and cultural identity of a person, associated with a permanent and continuously deepening process of development of science and technology.

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List of abbreviations

BHDT -biologic-humanitarian disciplinary and technological complex

SESH- stable adaptive (evolutionary) strategy of hominines

E- evolutionary efficiency (inclusive adaptability)

High Hume - technology of control and enhancement of genetic, socio-cultural and cognitive codes, allowing controlling the human biological and socio-cultural evolution, i.e. technologies of controlled evolution in application to *Homo sapiens*

HN- a complex of mental-psychological predispositions "human nature"

HU- complex of mental-psychological predispositions of "humanity"

K - evolutionary correctness

NBIC- Nano-bio-informational-cognitive technologies (technologies of driven evolution)

WEIRD - Western (transatlantic) version of socio-cultural type of technological civilization

W_g - adaptability of biological module (genome) of SESH evolving configuration

W_c - adaptability of socio-cultural module of SESH evolving configuration

W_g - adaptability of techno-rationalist module of SESH evolving configuration

Introduction. Biotechnology and rehabilitation of natural philosophy

Valentin T.Cheshko

The words of the cult philosopher-postmodernist of modern Western civilization, handed down in the epigraph, intuitively perceived as spiced with obvious irony, if not derision. The way it is. Anthropocene – not formalized unit of geological time scale, the geological epoch, characterized by the transformation of human activity in the primary factor in determining the direction and flow patterns of geological processes.

The famous line that ends with "The Divine Comedy" by Dante Alighieri (Dante Alighieri. La Divina Comedia. Paradiso, Canto XXXIII) ─

"Love that moves the sun and light (l'amor che move il sole el'a ltrestelle)"

Creates emotionally charged image of sensual evolving universe, which can be considered a brand of Western (Atlantic) civilization of the last millennium.

The fundamental principle of the image becomes the prime mover. Its substrate is based on the synthesis of reason and faith that together begets love, and, in turn, determines the trajectory and the final goal of evolution of the cosmos. Only the accents in this triad (Will ─ Reason ─ Love) are unstable and change in a regular way. In the era of Dante in Love Will carried through Reason. In the age of Enlightenment, impersonal, objective law was the basis of everything. This socio-cultural transformation has reached its peak in terms of Darwin's theory. As a result, the confidence of Dante into a classical Kantian antinomy: "Evolution (Law of Nature and Reason) *versus* the Divine Will (and Love) moves the sun and the light". As scientific and technological progress first fair was "Law and Mind driven by the sun and light" and then (with the advent of technology High Hume) ─"the Sun and light are driven by Laws of Nature and Will". The scenario

of the future course of evolution of the biosphere and man became a matter of personal choice and calculation. That is just the Divine Perfection in the interpretation of Alighieri hammered string quietly disappeared. However, the human mind and Love, as it is known, to err or not see obvious facts. The world has entered an era Anthropocene.
Anthropocene is usually dated to the 17-th century – the formation of an industrial society. In more advanced interpretation of this data is moved to the beginning of the Neolithic revolution (Zalasiewicz et al.: 835-836).

Thus, the concept of the noosphere and the Anthropocene are not equivalent. Noosphere implies a direct effect on the mind during the evolutionary process.

Therefore, the noosphere chronologically is later stage Anthropocene. However, these significant differences between the two concepts are not exhausted. Offensive Noospheric era of thought of the author – Vladimir Vernadsky – diagnosed, so to speak, with the help of "socio-humanitarian syndrome"–a complex of symptoms related to the social and spiritual life (see: (Cheshko et al., 2011, 2015)).

The latter include, for example, the elimination of war and the establishment of a world government, etc. The core and the backbone of the noosphere is a new feature of the mentality of human civilization, "the dictatorship of the Mind» as the root cause of the subsequent evolution. Thus, the origins of noospherization phenomenon lie in sphere of the ideal and are the responsibility of not only natural sciences but the humanities, too.

In our previous works, we have already mentioned that the concept of the noosphere of Vernadsky in terms of the intellectual tradition has a "hybrid" origin. Equally, it was influenced by the ideas of Russian cosmists starting with Nikolai Fyodorov and theoretical understanding of accumulated empirical and scientific facts. Vernadsky and Tsiolkovsky in the youth influenced by Russian cosmism and managed to reduce some of their ideas to scientist research and technological-innovation program. They rationalized the concept of Nikolai Fyodorov and made it acceptable to the scientific and technological mentality.

The idea of the Anthropocene was owned by Eugene Stormer, ecologist and Paul Crutzen, Nobel laureate in 2000 (Crutzen, 2002). (Crutzen, 2002). It completes the process of rationalization of the irrational concept that was

originally seeking to overcome the hegemony of technocratic determinism. Offensive of Anthropocene – it is not abstract theoretical, let alone ideological and humanitarian problem. It is a matter of empirical verification, i.e. search criteria (symptoms) of a new geochronological period clearly established purely empirically. Management of the evolutionary process includes in the least the man himself as, simultaneously, the object and the subject of manipulation transformations. This gives to the term Anthropocene metaphorical sense by installing it in not free from extra-scientific terminology and emotionality metaphorical associative array, starting with Frankenstein and "Brave New World". This series has obvious signs anti-utopia; color negative perception of the image generated them.

Since then, the sequence of diagnostics in a new era once again split into technological and natural science (changing composition of the atmosphere, the mass extinction of species, global warming); and humanistics and anthropology (ecological catastrophe, biogenetic reduction of human beings to the manipulated tools and general information and a digital control of our lives (Zizek, 2010: 327)). The first (natural sciences) series corresponds to a system of technological risks, and can be solved using algorithms established safety procedures. The second, socio-humanitarian series presented anthropological risk. At the end of both series have obvious destination intersection and merge evolutional existential risks.

The notorious "human nature" (the substantial basis of human existence) was taken out of brackets into the equations of social and global evolution as a kind of world constant. It was invariant condition during the preceding three or four centuries of the existence of technological civilization and its rationally humanistic ideology. This operation is primarily focused individualism, as a resultant of the genesis of society interests and individual life projects of its members.

In the post-Darwin era, it has been reduced to the establishment of the damping of the biological evolution of *Homo sapiens* and replacement anthropogenesis by socio-culture-genesis. This argumentum made logically consistent concept of human rights and consistent transformation of her naturalistic version (''natural law'') in a purely conventionalist doctrine. The basis of this macro-evolutionary and macro-social transformation of mentality is Kantian rationalistic revolution in the epistemological

paradigm: the liberation of Reason from the shackles of its material Substantiality, i.e. from non-rational features of the own material substrate. Intellect was considered as a basic attribute of human substantiality; and was asserted about his inherent ability to transform subjective and objective reality in accordance with ideal image – a goal unrelated to this non-rational reality, too.

After more than a century and a half, the desired goal of Teilhard de Chardin called the "Omega Point". The mind does not simply become the ruler of the reality, it becomes over it as a transcendental agent, programming and formats the evolution of the Universe.

There were during the first half of the twentieth century two events – (1) the rediscovery of Mendel's laws and the establishment of chromosome theory and (2) the creation of models of DNA and decoding of the genetic code. These mental innovations have made a person by the object of manipulating information technology. They radically had transformed our understanding of the evolution and the universe and of our own nature, and had radically changed the structure of science itself, its social status and, finally, had led us to the threshold of "post-human future" intelligent life.

These changes affected all aspects of human life – from the global environment to economic theory. In addition, it turned out that the new of spiritual priorities and guidelines evolutionary "rational model psychologically unrealistic" (Kahneman, 2003:1449). Specifically, it has the evolution of any self-organizing system involving human subjects. It is even more applicable to the evolution – biological, cultural, social – of the human (*Homo sapiens*).

The reverse side of rationalization and technological development of the evolutionary process was the increase in the magnitude of risk as an integral attribute of human nature to the existential (global evolutionary) level (Beck, 1980; Bernstein, 1996; Proske, 2008; Cheshko. 2012 et al.). Existential risk, unlike all the others, has a fateful difference −its magnitude accumulates over time with each crisis and asymptotically tends to one (Turchin, 2008). As a result, either the ideological foundation or the very existence of a modern (technogenic) civilization turns out to be in the zone of next evolutionary singularity.

The introduction to the mentality of the two concepts soon became the symbol brands of modern technological civilization. Transhumanism (J.

Huxley, the end of the 1950s.) and, in addition, bioethics (Van R. Potter, 1960s.) are a symptom of the deep multi-dimensional reconstruction of the evolutionary landscape in which the socio-culture-genesis process takes place. As one researcher recently wrote,

> "We do not need to know a lot of human nature, we had to ethical concerns on changed human nature by biotechnology... The concept "human nature" must be related to something real world, if we want to have the moral reasons for this, but we are not necessarily at the same time be able to say exactly, what means "to be a man" " (Kaebnick, 2012).

This dimly intuitionist anxiety in specific scientific research and empirical gets, because inevitably fragmentary confirmation. These arguments, however, violate a coherent hierarchy of deductive inferences linking limit abstract principles with individual fragments of human existence, and strengthening alarmist expectations of modern civilization.

The mentality of Western civilization characterized by an explosive mixture of absolute individualism, technological strength and humanistic intentions of the human intellect, embodied in the declared Karl Popper (1992:53-54) ideology of "social engineering of partial solutions."

In the age of genetic engineering technology and High Hume, this mixture threatens to blow up the line anthropogenesis by astrosphere of existential individual projects, which would mean the end of humanity as a certain integrity of intelligent beings. Because of the global constant, bracketing the equation socio-cultural genesis, the nature of man is transformed into a variable that could eliminate themselves the most.

There are a believe in the power of the human mind to overcome the results of its own evolutionary history; the independence of the system of human values from the biological component of human beings; as well as in the absence of the inverse effect on the evolution of human culture of the genome of modern humans. All these predisposition of modern civilization have become increasingly difficult.

Positions of philosophical and biological incarnations of anthropological science at this point seem almost mutually exclusive. Even Immanuel Kant argued that, man have gained intelligence, and as result found the ability and the duty to set goals, independent of the laws of nature, and thus moved from the kingdom of necessity to the kingdom of freedom. Two hundred years later the cult American social philosopher Francis

Fukuyama in his sensational turn of the century book "Our Posthuman Future" brought Kantian maxim that even thinking devils in hell will have to adhere to certain rules of morality (Fukuyama, 2004: 35).

The obvious interpretation of this saying, the world of moral norms has a transcendent reality, not reducible to the physical reality, and, consequently, the evolutionary-biological ones. Fukuyama, with the interpretation, by the way, does not agree. As the antithesis, Kant and Fukuama strong argument sounded equally compelling considerations of contemporary Italian theoretician and economist Hugo Pagano. The categorical imperative of Immanuel Kant requires that a person belonged to humans is not the means of achieving of goal. It comes indirectly from the inherent human capacity for compassion and empathy, the possibility to put yourself mentally in the place of another human being (Pagano, 2013:52). Its human ability is the result of structural and functional organization of the higher parts of the brain of the hominines, provided the appropriate genetic programs and there in the course of biological evolution. These general philosophical, abstract and theoretical calculations, paradoxically, come to a particular legal practice.

As demonstrated in some modern theoretical description of human neurogenesis, the formation of structural and functional organization of the higher parts of the brain and therefore the mental processes in the postnatal period have the so-called "second peak" synchronous with the period of puberty. Inherent in adolescence and early adulthood human plasticity and organization in stability of high brain regions is a manifestation of biological adaptation – a high level of intellectual abilities. The intellectual abilities, as we know, are associated with the process of cephalization (increase the volume and complexity of the structure of the brain), dilated during postnatal development of man up to two decades. However, this system is a biological adaptation entails adapting cultural and social ones – the need to adjust the application of legal rules (in practice double standards adjudication and execution), delayed on the age of the defendants.

In the process of development of the human nervous system, a period is observed when an individual experiences an increase in the threshold for satisfying sensory hunger (striving for new sensations) and increased emotional excitability with a relatively low ability to rationally control of impulsive behavioral acts. It leads to a high dependence on the social

environment, the propensity to engage in risk behavior, and soon. The social and socio-psychological characteristics of the age group correlated with the structural features of the prefrontal cortex. Correction of jurisprudence in the direction of increasing attention to the psycho-physiological ontogenetic factor is hard trends of Western legal culture, in particular the United States (Steinberg, 2013).

The same mutual connotations underlie modern explanatory models of social and historical dynamics of traditional culture and modern society (Turchin et al., 2013). Technological and economic progress is a factor of demographic changes at the stage of demographic evolution as a result of the increase in the quality of life.

The youth share of the population (as just mentioned, different high emotionality and activity) greatly increased. It in turn destabilizes the resistance of trends of social development and the stability of social order (Korotayev et al., 2005:288). Developmental dynamics features of the formation of the human nervous system is largely stem from cephalization, which, in turn, stimulated and stimulating socio-cultural genesis. Development of social intelligence as a condition for growth and complexity of the organization of competing societies brought the size of the brain beyond the morpho-physiological norm of prenatal period of gestation of a human being. So, stretched during childhood is predetermined by logic of the process of social development.

Then, socio-cultural genesis not only determinate by the biological reaction rate and morpho-physiological limits of human possibilities but also adapted to it. This concept is recently called a "culture– behavior–brain–loop» model and is gaining an increasingly empirical justification (Han, 2017: 190).

An obvious example in terms of social statics is the legal practice. From the perspective of social dynamics, such example would be the economic and political algorithms to ensure the stability of social development – without the turmoil and crises, or vice versa, exploiting social instability in the interests of certain social groups.

Within this framework the biological (genetic) and the social (economic) models in the sociology and anthropology, turn out to be unacceptable, and based on logical errors simplifications.

Therefore, on the one hand, the biological, socio-cultural and ratio-technological factors are included in the fabric of modern theories and technologies of social and political control and manipulation.

On the other hand –the basic philosophical and ideological systems of modern civilization formed mainly in the 17-18 centuries and are experiencing ever-increasing and destabilizing risk-taking pressure from the scientific theories and technological realities. Therefore, we are in a complex interlacing of the conceptual fields of axiology (the theory of values) and epistemology (the theory of knowledge). Let us consider the biotechnological problems in this social and epistemological foreshortening.

Natural philosophy and theoretical natural science in classical epistemology, i.e. since the days of L. Wittgeshtein and Karl Popper were considered as antagonists, whose paradigms form incompatible logical constructs and whose methodological principles of constructing explanatory models are incompatible:

(1) natural philosophy describes this world as a result of the realization of a certain personified rationalistic project (in theological interpretation − "Intellectual Design");

(2) Positivistic and post-positivist epistemology describes the Universe because of the actions of the objectified impersonal laws of Nature ("Evolution").

In other words, "Evolution *versus* Reasonable Design" is the basic philosophical antinomy of the theory of cognition of the modern era, and Evolution clearly prevailed in the classical science the first member of this logical opposition.

At the same time, classical theoretical science, due to the peculiarities of its conceptual and terminological apparatus and the accepted criteria of validity and reliability, was aimed at finding precisely the "natural" causes of the phenomena and processes that not have an intellectual nature. The researcher did not feel satisfied until he excluded the existence of the Creator (not necessarily transcendental, simply a being with the Reason and the intention to transform his own habitat) as the cause of the observed facts. That is why all attempts to find evidence of the existence of extraterrestrial civilizations prove to be ineffective.

The logical incompatibility of both paradigmatic concepts stems from the incompatibility of their projective intentions: the first concept (Reasonable Design) is focused on getting an answer to the question "What for? For what purpose? ", i.e. from the goal-setting causality of Aristotle; the second concept (Laws of Nature) as the foundation of reality presupposes the effective causal determination ("How? "). In other words, in the first case, the basis of the conceptual framework is the goal-setting intent realized through the categorical subjectively-projective categorical opposition "Good" *versus* "Evil", in the second − the instrumental intention realized through the objectively descriptive opposition "Truth" *versus* "Delusion ".

Thus, both paradigmatic concepts are the basis of two independent discourses, equally necessary for the sustainable functioning of technological civilization. In the latter, the first type of discourse dominates in the designation of socially and individually significant activity goals of reality transformation (socio-cultural and sociopolitical public discourse); the second type prevails in the development of means (technique) and methods (technology) for the realization of these goals.

In the "hybrid" zone (at the intersection of descriptive and axiological discourses), an activity-technological discourse is formed. Here the subjective goals of human intervention in reality and the objective methods of their attainment are weaved into the Gordian knot.

Their demarcation in modern versions of human dimensional theories is possible only situationally. This is the content of the most radical difference between "post-academician" scientific knowledge and its classical and non-classical options.

The triad of science-technology-axiology (it is a question of a person or a self-organizing (evolving) system that includes a person) forms "techno-knowledge"−an inseparable amalgam of logical arguments. This interpretation of the category "techno-knowledge" differs from the canonical (actually the technical sciences in the general classification of sciences). It is a matter of fundamental changes in the organization of the social institute of science and the scientific ethos that ensures its functioning (Ziman, 2004:83; Pruzhinin, 2013:110), in the structure of scientific knowledge (Stepin, 2000:408) and in the methodology of scientific research (Gibbons et al., 1994:90; Nowotny, 2003: 179).

For the industrial phase of the technological civilization development in its Western (Transatlantic) version, the trend is characterized by a clear demarcation of the conceptual fields of imperative-axiological public and descriptive-epistemological scientific discourses as a prerequisite for its sustainable development. This is the basic attribute of classical scientific rationality (the "principle of ethical neutrality of scientific knowledge") and the classical (industrial) phase of the development of technological civilization. They both are based on the Kant-Hume methodological dichotomy of "World of Proper" (ethics) and "World of Entity" (cognition), at the same time. According to the modern sociologist and philosopher of science Bruno de Latour,

> "The two branches of power that Boyle and Hobbes develop each for their part, have power only if they are clearly separated from each other: the state of Hobbes is powerless without the science of technology, Science Boyle is powerless without a clear delimitation of the religious, scientific and political spheres" (Latour, 2006, 92).

Everything changed with the transition of the technological civilization to the phase of the risk society and the symptom of this was bioethics as a social and epistemological phenomenon. The emergence of the phenomenon of bioethics at first as a social practice (from the mid-1960s) and then as a hybrid (ethic-epistemological) philosophical paradigm (Stepke, 2016) acted simultaneously as a precursor and precondition for civilizational transmutation − the transgression of technological civilization into the "information society" phase. The latter does not accidentally have another name − a "risk society", since the NBIC technological complex is the technological schemes of controlled evolution of man and eco-social systems, where human is the central element. Along with the biological nucleus of the bioethics disciplinary matrix, the natural-philosophical matrix begins to form their conceptual fields coincide or overlap.

A fundamentally important feature of this phenomenon is the clearly expressed trend of transdisciplinarity, the incorporation into it of new and new concepts and spheres of social life −the trend of social and epistemological evolution, noted recently not only by authors but also by many experts (Agazzi, 2015). Another statement, also supported by some experts, though rather as a statement of a concrete empirical fact, is the transformation of bioethics into a factor of evolution, at least, socio-environment (Valles, 2015).

Bioethics with a trail of associated conceptual fields (neuro-sociology, bioeconomics, biohistory, bio-politics, etc.) turned out to be not just the only rationalized regulator of the process of biological and socio-cultural evolution.

The effect extends further to all areas of philosophical thought and social life, and becomes the subject of heated debate. Philosophical anthropology and bioethics are becoming the paradigm core of transdisciplinary science, defining the content of the concepts of Good, Evil, Permissible and Unacceptable in relation to the future fate of Man, Civilization and the Noosphere (Agamben, 1998; Kaebnick 2011; Lemke et al. 2011; McDermott, Hatemi, 2014; Stapleton, Byers, 2015; Ojakangas, 2016; Agazzi, 2017; Mills, 2017; Han, Shihui. 2017; Cheshko et al, 2016, 2018; Boyer, 2018; Cavanagh, 2018; Saage, 2018; Hofmann, 2019; etc, etc.).

It became part of the methodology and theoretical foundation of natural science, forming an original inseparable amalgam of the concepts of humanitarian and scientific discourse (post-nonclassical or post-academician science). In fact, the nature of this phenomenon cannot be reduced to either ethics or science (biology), it is a social practice and a social institution designed to control the magnitude of the evolutionary and social risk of modern biotechnology. This is one of the main theses argued during this study.

In the modern disciplinary matrix of the theory of evolution and systemic ecology (the "theory of designing an ecological niche") a single conceptual framework is formed, consisting of three independent theoretical constructs −eco-evo-ethics (Bergandi, 2013: 45, next).

In the formal logical aspect, the two original members of this triad belong to the descriptive (scientific) discourse, and the latter (ethics) belongs to its socio-humanistic and therefore value antagonist. As a result, of the hybrid nature of this construct between the three autonomous modules and (due to the proliferation of the terminological apparatus into the interior of the module that does not belong to it) and within each module logical contradictions are inevitable.

In the content aspect, the members of the complex described above refer to

(1) The influence of modern technologies of controlled evolution on the system of ecological links between man and his environment (i.e., the

medical and hygienic aspect of self-construction of human and human-dimensional eco-systems (biotas);

(2) Preserving the self-identity of a reasonable human in the course of any technological manipulation with its genetic code (i.e. evolutionary survival of the biological species *Homo sapiens*); and

(3) the maintenance of the socio-cultural identity of human civilization (i.e., the basic "universal" value norms during the implementation of new technological schemes and their indirect or direct influence on the continuity of the socio-cultural tradition).

In any case, such a transdisciplinary concept assumes, first, a projective-axiological intent. The initial component of the theory and practice of controlled evolution technologies is the ideal image of the future cultural and ecological niche and the "human" (the mind carrier with its inherent system of value priorities as its system-forming component), which we call the humanitarian paradigm nucleus. The descriptive paradigm nucleus acts as a diagnostic tool for discrepancies between the ideal future and reality. Applied genetic and socio-engineering developments are a means of eliminating these discrepancies (Cheshko et al., 2014, 2015).

Ethical-epistemological hybrid logical constructs, by definition, can`t be regarded as fully equivalent to concepts based on epistemological (Truth / Delusion) or ethical (Good / Evil) binary oppositions. More adequate is the evolutionary opposition Adaptiveness / Maladaptivity. Adaptivity in this context is an integral indicator of the "success" of the integrity of individuals (in relation to man −the civilization type, humanity). It is empirically diagnosed by increasing the number of individuals who self-identify their belonging to the population by the presence of basic invariant attributes. In its turn, in humans, a set of such attributes disintegrates genetically deterministic ("natural") and socio-cultural ("artificial") self-determinants.

The system of value priorities specifies the parameters of the initial siting and the grid of rational / irrational perception of reality, goals and methods of transformational activity.

In the information civilization, the central metaphor of modernity ("The World is a Clock Mechanism") was replaced by another one: "The Universe is a Computer" (Lloyd, 2006). Accordingly, the classical Aristotelian opposition Matter *versus* Form was transformed into an opposition Hard *versus* Soft. Rationality becomes the programming factor of the evolutionary process, building an ideal world of the future by means of the possibilities of material objects (Hard) and in accordance with the *a priori* intelligent plan-program (Soft). In the disciplinary matrix of bioethics, its axiological core reinterprets facts relating to biological knowledge solely as humanitarian problems and theoretical constructs that need to be solved − as ways to solve them or the limits of permissible application of the same methods. Naturally, hermeneutics in this case precedes epistemology not only methodologically, but also meaningfully.

The paradox of the epistemological situation is that the definition of the content of the categories "natural" and "artificial" and, accordingly, the definition of the boundaries of our intervention in the natural evolutionary process in application to man is the prerogative not of natural science, but of philosophy and metaphysics. Thus, natural philosophy becomes the meta-theoretical core of the modern theory of anthropogenesis and the conceptual basis of biotechnology.

In other words, natural philosophy takes on the status of a basis for the theory of evolution − explicitly, in contrast to the classical attempt of evolutionary synthesis of the XIX-XX centuries (classical and neo-Darwinian paradigms). This means that bioethics turns out to be a modern version of natural philosophy and, perhaps, metaphysics in the era of biotechnology and genomics. In the conception an elements of public descriptive scientific discourses merge in the form of an indivisible amalgam, although not without internal logical contradictions. Biotechnology as the most developed technology of controlled evolution becomes the mechanism of the evolutionary process and rehabilitates natural philosophy as an explanatory model of scientific theory.

CHAPTER 1.

CONCEPTUAL FIELD, EVOLUTIONARY FOUNDATIONS AND IDEOLOGICAL HISTORY OF THE THEORY OF STABLE ADAPTIVE STRATEGY OF *HOMO SAPIENS*

Valentin T.Cheshko, Valery I.Glazko

Any explanation of the above-described phenomena in socio-humanitarian and natural science in planes very quickly brings researchers to the problems that in one way or another connected with the underlying mechanisms of the evolutionary process in general, and with the evolution of intelligent life in particular. Evolutionary-anthropological theorizing always oscillates between the two poles – the Scylla of a biological reductionism and Charybdis of a sociological reductionism. Despite the intentions of the authors of the various natural or natural-philosophical interpretations of socio-culture-anthropogenesis up their reflections on the substantial foundations of human existence ultimately directed to one of these alternatives.

In this study, we try to offer third logically consistent solution – the theory of stable adaptive strategy *Homo sapiens* (SESH) that, in turn, in accordance to the original working hypothesis should serve as Prolegomena to a new conceptual model of the evolutionary risk NBIC-technological complex.

The formation of a holistic concept of stable adaptive (evolutionary) strategies humanity has a key, even globally crucial importance. In any way, without claiming to establish a complete theoretical construction, we would like to express the own views on the preliminary starting point of the search.

Evolutionary success of *Homo* achieve through a purposeful transformation of the environmental niche in accordance with the needs of survival and reproduction. The supporting element of this algorithm is ahead reflection of reality based on ideal images in the human psyche. "The means of providing" is the hyper-socialness peculiar to hominines and the equally super-cooperativeness of the actions of certain members of the social group in achieving the general group goal (survival). However, this speaks only as a prerequisite for the development of the concept.

The initial premise of this concept is the postulate of the co-evolutionary nature of the human essence, consisting of several autonomous, but conjugate modules, ensuring our evolutionary success (Jablonka, Lamb, 2005). The total number of such modules is three (biological, socio-cultural and techno-rational). The basis for selecting a separate module is the availability of its own system of generation, coding, replication, realization and fixing of adaptively relevant information. That is why the epigenetic component of the adaptive evolution is included in the biological module as a subsystem, and not isolated in a special module, since it is also based on one coding system − genetic.

The co-adaptive and conjugate-evolving inter-modular relations of the socio-cultural and techno-rationalistic modules with the initial (biological) analogue and with each other boil down to the effects of supplementing, replacing and enhancing the adaptive functions of the elements of the latter. These relations are not static, but procedural, i.e. are realized in the process of evolution and do not arise discretely.

However, first, it is necessary to introduce a terminological specification of the concept of "risk" from the point of view of the theory of evolution and, the theory of anthropogenesis in particular. This specification will be philosophical ones, if necessary. According to the generally accepted definition, risk is an indicator determined (Flaus, 2013; Hansson. Zalta, 2014; Banks. 2015; Gardoni et al., 2016: 1-7) as a product of the probability of adverse events (P_r) that may occur as a result of certain actions or their absence from relative damage by some vital parameters

$$R = \frac{P_r(E_{opt} - E_r)}{E_{opt}}. \quad (2.1)$$

Here E_{opt} is the initial value of the parameter at risk; and E_r is the value of the parameter after the onset of an adverse event (i.e., the actualization of the risk). In practice, the value of the effective risk is calculated as the ratio of the number of adverse events N over time t; Q is the number of objects exposed to the risk factor *f* –

$$R = N(t)/Q(f) \quad (2.2)$$

Accordingly, if the emphasis is on the likelihood of damage, the risk should be compared with reliability. If the initial parameter is taken action or inaction, leading to the occurrence of risk, the latter is opposed to the danger. (The risk arises as a result of a certain act; the danger is spontaneous, due to the impossibility of active actions).

In his time, Niklas Luhmann (Luhmann, 1993: 5-7, Luhmann, 1994) identified the dilemma of "risk" *versus* "danger" in comparison with the opposition of "risk" and "reliability" as the most heuristic philosophical antinomy. Indeed, the opposition of "danger" (as a spontaneous threat that has an objective external source to a person) and "risk" (as a by-product of purposeful human activity in transforming reality) most clearly reveals the basic attribute of the stable evolutionary strategy of *Homo sapiens*. The argumentum for this thesis is that the survival of humankind as a biological species consists in the transformation of reality (the habitat and its own body organization and psyche), and not in the reactive adaptive change in the physiological-somatic basis. This conclusion leads us to the thesis about the need for a general theory of SESH creation.

If we talk about risks generated by biotechnologies and other varieties of the NBIC-technological complex, it is very significant that they are divided into three components *a priori*:

(1) Biological component, associated with the invasion of foreign genetic information;

(2) Social (cultural, legal and political) component, caused by a violation of social stability and /or its ideological foundations, and

(3) Evolutionary component, which leads to the loss by humanity of viability or self-identity. This aspect is reflected in the number of our publications on the problem (see: Glazko, Cheshko, 2007, 2009; Glazko, Cheshko et al., 2016).

In recent decades, the enormous progress of new technologies in the study of ontogenesis and phylogeny has led researchers to biological reductionism; and awareness of the changes caused by the same humanitarian technological innovations and civilizational crisis leads to approaches of sociological reductionism. Their conflict is a serious challenge for humanity, consisting of the need to overcome the cognitive dissonance between the two components of the holistic nature of *Homo sapiens*, and created by technological civilization in their natural and social manifestations. At the same time, it is also a powerful risk-taking factor on existential significance level, fraught with the loss of self-identity of human intelligence, beauty and goodness as the supporting structure of human essence.

There is the introduction to the book under the symptomatic title "*Homo* novus − humanity without illusions", that published in the series "Advanced Frontiers of Science" (Frey et al., 2010). The editors proclaim their aim to refute six myths rooted in the mentality of the Western (technogenic) civilization as the basic principles of its ideology and contradicted the totality of the data of anthropology and the theory of anthropogenesis (*Homo novus*, 2010: 1-2):

1. The human is a unique creature in the universe;
2. We depend on our evolutionary-biological history;
3. Biological laws do not determine the development of human society and the individual;
4. Biological past is not reflected in the content of our consciousness;
5. Morality, religion and culture are only social constructs;
6. We are free to moral choice.

In order that these theses are illusions and myths we can agree, but with no less validity can be challenged and opposed opinions:

1. Man is a natural result of the laws of biological evolution in particular, the global process of evolution of the universe, in general;

2. We are dependent on our evolutionary-biological history;

3. Biological laws dictate the development of human society and the individual;

4. Biological past determines the content of our consciousness;

5. Morality, religion and culture are solely the result of biological evolution;

6. We are not free in their moral choices.

If the first set of myths describes the basic postulates of the philosophical and cultural anthropological disciplinary matrix, the second set characterizes the disciplinary matrix of physical (biological) evolutionary anthropology. In addition, the validity of this conclusion follows from the internal logic of interpreting empirical observations and theoretical concepts in the study of humanities and natural scientists, regardless of the methodological declarations of their authors. We can say that the concept of humanity and human nature, whose content is determined by the said two sets of postulates-myths steel supporting structures antinomy implicit knowledge in the natural sciences and humanistics as fields of theoretical science in general.

At the intersection of the objective-scientific and public-ethical discourses the meta-theoretical generalization of both sets of myths leads to the antinomy of two misconceptions − "Naturalistic fallacy" ("Everything natural is equivalent to Good by definition'') *versus* "Moralistic fallacy" (''Every Evil must be recognized as unnatural by definition''). The antinomy presupposes the primacy of Knowledge (the World of Entity) or Values (the World of Proper) as the imperative criterion of Truth. Meanwhile, *the rationalization and technological development of the evolution makes the relations between them a procedural unity.*

So, out of this antinomy of our understanding of ourselves is, in our opinion, in the postulate of co-evolutionary essence of human nature, consisting of several independent but related modules, providing our evolutionary success. Hence, an empirically established parallelism and coherence of historical reconstructions based on an analysis of the socio-cultural, linguistic and genetic phylogeny arises. Such comparisons have been conducted by L. Cavalli-Sforza, since the 1980s (Cavalli-Sforza et al., 1994, 2014), and later became accepted methodological basis of the historical and evolutionary ethno-genetics.

The source, based on the empirical data of anthropology postulate is a statement of the complex phenomenology of (socio-techno-culture) anthropogenesis. The emergence of anthropogenesis appears in unpredictable macro-significant results of micro-evolutionary deviations. (There is the famous metaphor of the "butterfly effect" from one of the fantastic stories of Ray Bradbury). This emergence of a new macro-mutation change occurs suddenly, on reaching a certain threshold of complexity, manifested in the appearance of a plurality of threshold micro-mutationsonsequently, we are dealing not simply with the evolution of man as a biological species, but with the evolution of some complex adaptive system, which has been given the name Homo sapiens. This process is now in the singularity zone, transition through a critical level of complexity.

Biological and socio-cultural substrate foundation of rationalist human existence has ceased to be a constant in the world anthropic global evolution equation. As one of the well-known researchers, political scientists, Peter Hatemi said recently, in fact, co-evolution of the nature of the relationship of genetics and culture,

> "Biology and Genetics, of course very important, but their role is not fixed. We are forming a policy that creates evolution" (McDermott R., Hatemi, 2014).

Therefore, as result the juxtaposition of the two disciplinary matrices – biological reductionism (evolutionary anthropology) and sociological reductionism (culture anthropology), a new conceptual framework is empirically unverifiable ideological antinomy. A researcher and his co-authors in another paper referred to the proven, in their view, one-sided and incomplete of "paradigm of socialization" (Man Is, 2014:101, next).

Therefore, the uniqueness of the human phenomenon is characteristic of a system arising out of the nonlinear interaction of biological and cultural adaptation modules of *Homo sapiens*. In addition, therefore, it is unpromising to look for a "key evolutionary factor" that initiated the process of anthropogenesis and that determines the evolutionary history, and the evolutionary success of humanity. The role of this factor plays a network of relationships between various factors of anthropogenesis. Such a network can be adequately interpreted in the framework of the macroscopic description of the evolution of hominines and the use of macro-parameters

of such process. This macro-parameter can serve as a radical expansion of the adaptive data that generated and replicated mode of genetic inheritance.

This idea is not unique. It is almost exactly same as, for example, the ideas of Kim Sterelny, the Australian philosopher and evolutionary scientist. He stated in his lectures given in Paris and dedicated to the memory of Jean Nicot,

> "In the evolutionary concept of the origin of man has been dominated by the search key innovation modules. It tried to show that the unique features of human life and mind emerge more or less inevitable, as a single critical adaptive innovation ... I am skeptical about all such notions of a certain magical moments (evolutionary history of man), a key innovation of the module; I guess instead, the existence of co-evolutionary, positive feedbacks are responsible for large-scale and rapid phenotypic divergence us and our closest animal relatives" (Sterelny, 2012: 13).

As suggested by the author of the above quotation, a measure of the complexity of such a system of progressive inter-module communications is the growing number of adaptive information transmitted by extra-biological (extra-genetical) way.

Research and description of the network structure between autonomous units encountered during adaptation genesis of hominines, are the subject of this essay.

Self-organizing (evolving) systems are objects that contain a structure, acting as carriers spontaneously replicating and mutating the information necessary for the existence of these objects (a), and the operator providing the process of this information implementation (b).

Within the framework of the theory, evolution is a process of change of information fragments into self-organizing objects.

Adapting means any information internalizing fragments, whose presence in the system increases stability and replicability of the information contained therein.

At the end of the 19th century, James Mark Bollduin first drew attention to the role of epigenetic inheritance as system shaping factor in cultural form of human evolution. It consist not only biological signs, but also a set of social patterns of behavior, values and norms that were essentially passed from one generation to another, and have an equally strong influence on

which direction of anthropogenesis will prevail ultimately (Baldwin effect (Baldwin, 1913, reprint 2001). According to modern scholars (Burman, 2013), in the same direction moved Piaget, based on their own socio-humanitarian positions. According to Piaget, the psyche of the child is formed in the course of successive transformations because of integration into the preexisting socio-cultural environment. The general idea of the concepts Baldwin and Piaget is the implicit concept of a self-sustaining cycle of co-evolutionary change: − GENOME – CULTURE − ENVIRONMENTAL NISHE −…, which are the basis for epigenetic transformation of the genetic program (Young, 2013).

Obviously, one of the common time trends of evolution process, in general, and adaptation-genesis, in particular is multiplication of systems of generation (or induction), replication and translation (realization) of adaptive information, and accordingly, the multiplication types of such adaptations (Jablonka, Lamb, 2005, 2008; Mesoudi, 2011; Bonduriansky et al., 2012 et al.). Currently, there are, at least in relation to human and hominines such systems: genetic, epigenetic (in turn divided into subsystems methylation, complexation with histones, alternative splicing); cultural (behavioral), symbolic (natural and artificial languages).

Etienne Danchin and Matteo Memeli, emphasizing the multidimensionality and poly-substantiality of inheritance information evolving objects, postulated the existence of the phenomenon, inclusive, (a common) inheritance as integrative result of the operation of all systems of heredity in the global process of evolution.(Mameli, 2004; Danchin, 2013).

(E.Danchin and other statement (Danchin et al, 2011:484), that it is in the article of the Italian economist Matteo Memeli first formally identified the concept of "non-genetic inheritance", is equationted, in our view, in the abstract, and because – not correctly. It, incidentally, follows already from the desk review of sources cited in the article Memeli (Mameli, 2004: 35-37). So to speak, the concept of "social heredity (inheritance)" in this context is a "remake" of the idea of the 1930s, occupying, for example, an honorable place in the creative legacy of the Russian-Soviet economist Nikolai Kondratyev (see Ivanitskaya et al, 2011). Contribution M.Memeli much more precisely equationted himself, designating as its main objective to show the "reality of relations between non-genetic form of inheritance and non-genetic form of natural selection. "We add, thus, the author

associates non-genetic forms of heredity with the general process of adaptation-genesis (Richerson, Boyd, 2005:5) and the problem of organizing a stable adaptive strategy of humanity as a biological species).

There is impossible to adaptively significant reduction heritable component of phenotypic variation in molecular genetic variations in the genome. This fact is the empirical basis for the confirmation of the reality of an inclusive system for generating and recording of information. The association of mononucleotide substitutions in the genome can explain no more than 5% of the inherited phenotypic variant, taking into account large-scale (over 500 thousand) molecular genetic markers, according to E. Danshin and some other researchers, based on a meta-analysis, of a large number of publications (Zuk O. et al., 2012). The reality of inclusive, integrated in nature, inheritance, adaptive significant features is the real explanation of "phantom inheritance", and however, is not the only possible one.

(This refers to the genome-wide study of statistical association with single nucleotide substitutions heritable phenotypic traits (Genome-Wide Associations Studies, GWAS). The structure of the genome (usually a sequence of nucleotides) certain carriers of hereditary traits and the control group of individuals compare.

The method allows identifying a statistically significant correlation between the presences in the genome certain alleles or nucleotide sequences and the presence of a particular phenotypic trait (Bush, Moore, 2012). An important indicator is the ratio of synonymous nucleotides substitutions to not synonymous ones. Prevalence of not synonymous substitutions allows making an educated guess about the selective and, therefore, the adaptive significance of this locus (A Scan, 2005). Based on the data can to calculate the ratio GWAS the heritability trait by taking into account mononucleotide replacements and similar methods of molecular genomics, heritability, and the same feature set in classical genetics. Currently, the calculated values of this magnitude are significantly less than one (Zuk et al., 2012). The assumption of the important role of non-genetic forms of heredity in the formation of these symptoms is not the only possible explanation. An alternative hypothesis is related to the possible role of epistatic gene interactions are not considered in the GWAS technology).

In the organization of the inclusive meta-information system of inheritance adaptive implemented in parallel two alternative evolutionary modes of generation, replication, and implementation of adaptive information – Darwin-Weismann modus and Lamarck modus.

Darwin-Weismann modus is

- a stochastic ones, i.e. is not intended to rigidly determinate information structures and / or controlled by signs (a),
- an unspecified ones, i.e. is not adequate and does not correlate with changes in the external environment (b),
- not projective and not constructive, i.e. is not capable of directly (intentionally or not intentionally) change the adaptive landscape, in which the evolutionary process (c) and
- not recursive, i.e. cannot be changed except by re-stochastic events (d);
- the fixation rate of new adaptations is the higher, the smaller the population size (e);
- In the dissemination of the newly generated adaptations of horizontal transfer (diffusion contamination as a result of communication) is significantly inferior to its importance to the vertical, i.e., proper inheritance from ancestors to descendants (f).

Modus based on the genetic code and provides a so-called Eigen` hyper-cycle (Eigen, Winkler, 1993) that is binary bonded nucleic acids and proteins with a rigid division of replication (DNA, RNA) and implementing adaptive data (proteins). The adaptive significance of information fragments acquired and recorded during the stochastic selection, not directly related to the generation of functional dependency information. Selection and Replication adaptive data in this case occurs only in a vertical direction. Modus in relatively pure form actualized in the course of biological evolution phase (biogenesis).

Lamarck Modus is

- teleological ones, i.e. –aimed at certain information structures and / or controlled by signs (a),
- adequate and / or correlated ones with changes in the external environment (b),

- a projective-constructive ones, i.e. able to direct changes in the adaptive landscape and (cultural) ecological niche where there is an evolutionary process, moreover – to deliberate their reconstruction (c), and
- recursive ones, i.e. available correction in the course of (d);
- fixing the rate of new adaptations increases in parallel with the growth of the size and density of the population (e);
- In the dissemination of the newly generated adaptations of horizontal transfer (diffusion contamination as a result of communication) is comparable in its importance to the vertical transfer generation-to-generation (f).

Modus is based on socio-cultural code and provides systems mimesis (cultural inheritance), and oral and / or written language (symbolic heredity). The adaptive significance of information fragments acquired and recorded simultaneously with the generation of information and direct functional relationship with the latter. Selection and Replication of adaptive data occurs in this case both in the vertical and horizontal (diffusion inside and outside simultaneously existing social communities of different rank) directions. Modus in relatively pure form actualized in the phase of social evolution (socio-cultural genesis).

All the described differences between the two modes can be generalized by the following integral criterion. Darwin-Weismann Modus provides advanced multiplication of carriers number of adaptive information, Lamarck Modus aims to increase the lifespan of carriers of adaptive information. Consequently, the unit of evolution in the first case is a set of individuals (population), in the second case, the evolving unit becomes a social community as a discrete whole. To substantiate this conclusion, we used the conceptual-terminological apparatus life history theory in the interpretation of evolutionary psichology (Guidice et al., 2015: 88-91).

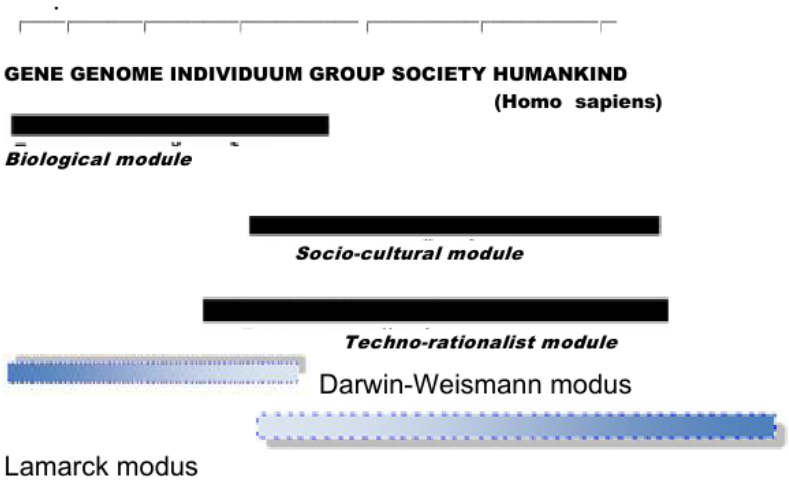


Fig.1.1 – The nomogram of action of Lamarck and Darwin-Weismann modes in relation to the application domain elements of SESH (explanation in the text)

As shown in fig.1.1, coverage of three components of SESH overlaps. The areas of application of alternative modes of adaptation genesis overlap too, and Darwin-Weissman and Lamark modes succeed each other continually, but not discretely. In general, the Darwin-Weismann modus dominates on genetic, genomic and individual (organismic) adaptation genesis and it is reflected at the level of the evolution of social groups (group selection). Lamarck Modus begins to manifest itself at the level of individuals and its value progressively increases as one move from group to humankind.

The final product of the functioning of human evolutionary strategy is the Human Adaptive Complex. It includes several distinctive life history features - a late onset of reproduction, an extended period of vulnerability

and dependence during infancy and childhood, and a long lifespan with extended post-reproductive life (menopause). This set of system-forming features is clearly contradictory within the concept of "adaptive value". This contradiction is an unconditional consequence of the parallel action of the three adaptive modules and the proof of the prevalence of co-evolutionary rather than directly communicative information links between modules. This contradiction arises from the switching of adaptive significance from individual adaptivity to its group analogue. Such switching of life strategies is differentiated in socio-cultural socio-cultural differentiation of adaptive meanings between civilizational types. It leads to a change in the adaptive status of the individual from the realization of individual fitness for the implementation of group adaptive advantage in the post-reproductive period of ontogenesis too.

The fuzzy hierarchical system of adaptation genesis is result. This complex gives a higher chances of survival, but at the same time, is fraught with an increased likelihood of conflict between the adaptive elements have arisen due to the existence of different evolutionary modes. Individual (namely biological), group (social) and civilizational (global-evolutionary, inherent in humankind as a species) risk types are generated due to evolutionary conflicts between adaptations (evolutionary risks). The points of its application are the population of biological individuals, the social group and humanity, respectively. (In this interpretation, the "evolutionary" risk is an attribute of a stable evolutionary strategy and an unavoidable form of risk for *Homo sapiens*)

The formation of the Lamarck mode and the stable evolutionary strategy of *Homo* entailed a radical acceleration of the evolutionary process and, in particular, an adaptive global (beyond the biological process) evolution of *Homo sapiens*. According to the estimates of S.P. Kapitza if taken as the starting point $1.6 \cdot 10^6$ years ago, the number of humankind at the time is 10^5. Then for 2000 years BC, it has reached $47 \cdot 10^6$; by the beginning of AD, population reached $100 \cdot 10^6$ as a minimum; by the end of the first millennium AD $-275 \cdot 10^6$; during the Napoleonic wars $-835 \cdot 10^6$, to the beginning of the last century $-1.7 \cdot 10^7$; and by 2025 will be approximately $7.9 \cdot 10^6$ people (Kapitza, 2005:90). Thus, the ratio of our biological species with the environment is far from the equilibrium models and indicates an

extremely rapid expansion of the evolutionary niche, i.e. the use of an ever-widening set of resources to sustain life. Such an evolutionary trend (adaptive irradiation) is characteristic for macro-evolutionary processes, i.e. evolution of high rank taxa, however, it is observed within a single biological species. Below we will touch on the reasons and mechanisms of this stable evolutionary trend.

Now we note that two integrative clusters of the characteristic parameters of the Lamarck Mode cause this kind of acceleration effect of adaptation genesis:

Firstly, special mechanisms of adaptively significant innovations (a-d) at the intra-population and intra-group levels and,

Secondly, the spread of adaptive innovations in the type of diffusion or contamination (e), whereby intergroup differences in the structure of communicative relationships acquire adaptive value (f).

The first of these clusters is concretized as an intensification of the process of the emergence of technological and socio-cultural improvements; the second is realized as a differentiated ability of socio-cultural types for socially determined learning and mastering of these improvements (Henrich, 2016:296). Together, it means simultaneously: (1) the transition of the mechanisms of the evolutionary process to the level of competition between social groups according to the concept of multi-level selection (Traulsen, Nowak, 2006); and (2) transformation of adaptation of a biological species to habitat conditions to adaptation of habitat to biological species according to the concept of constructing a niche (Laland, 2002, Odling-Smee, 2003, 2009). (This thesis will be considered in the future.)

The value of the second cluster turns out to be wider than the way in which adaptively relevant information is disseminated, however. (It is J.Henrich's (Henrich, 2016:296) “socially determined way of learning”). The communicative structure of a social group is formed and maintained by a certain ethos, and its core is a system of value priorities. The latter within the humanitarian conceptual field can be defined as elements of an ideal image of reality that preform the set generated by the first cluster.

Within the humanitarian disciplines, there is the term “meaning” as an equivalent to this definition. This, in turn, means the divergence of the

adaptive genetic mechanism into two components − selective and semantic. The second component can be called “semantic co-evolution” or “co-evolutionary semiosis”, which gives to the evolution of systems with a human dimension the teleological nature of movement toward a specific goal (that is the “Omega point” by Teilhard de Chardin).

In addition, Lamarck's modus prevails at the group level of evolution and provides an advantage to the members of the group − all or most, albeit to varying degrees. In other words, individuals within the group are more adaptive in the conditions of a given socio-environment niche. Competitive advantage is given to those socio-cultural types that form a more adequate socio-environment for their members in association with other societies and at a sufficient level of its (niche) sustainability. This consideration turns out to be a logical argument, eliminating the discrepancy between the construction of niche and multi-level selection concepts. Those effects that, from the point of view of individual fitness, are described as the re-transformation of the conditions of existence (the construction of the niche) at the group level are the result of competition and inter-group selection.

It has an extremely important consequence from the point of view of the theory of evolutionary risk.

The inevitability of generating evolutionary risk in the above mentioned SESH structure derived from an equation that describes the relationship between group (W) and individual adaptability (w) in systems combining selective inter-individual processes and inter-group levels (Gavrilets, 2015):

$$W_i = \left(\sum_0^{1/\alpha} w_{ij}\right)^{\alpha}, \tag{2.1}$$

where α is share of the group acts in the adaptive behavior of the individuals. Since the parameter α refers to the various level characteristics for individual and group adaptability, growth of group adaptability can be accompanied by a fall to a dangerous limit of some individual component. The famous aphorism about the army of suicide bombers, who are able to win the battle but not the war, is the Illustration. Of course, if the latter ones is carried out for quite a long time, but for the adaptive evolution of this condition is satisfied by definition.

From what has been said, the principle of complementarity of both evolutionary modes follows: Darwin-Weissman modus is more inertial and reliable with vertical transfer of adaptive information in comparison with

Lamarck's modus. Substrate basis of Darwin-Weissman modus (variance of genetic variability) is stored for a longer time and therefore provides a more sustained time trend after the elimination of selection factors. Lamarck Modus is at many orders more efficient in comparison with the Darwin-Weissman modus in the process of horizontal transmission (more precisely to say – diffusion) of adaptive information. Thus, the optimal co-evolutionary configurations are a combination of both modes, or stretched childhood that provides overlapping periods dissemination of cultural adaptations beyond one generation. The third factor that ensures the speed and reliability of the spread of adaptations is a socially controlled extension of the late stages of ontogenesis beyond the biologically justified norm. Caring for the elderly members of a social group makes them a natural biological "flash drives" of adaptive information useful for the survival of the group. All three adaptive evolutionary solutions seen in hominines.

Genetically (in the sense of origin), the most likely terms of the relationship model both modes seems genesis of Lamarck modus as results of autocorrelation spectra of adaptive significance and inherited / diffusing innovation over time *a priori* (see: Transformations of Lamarckism, 2011). The autocorrelation in the model is determinates by superposition of several autonomous parallel adaptive processes taking place at different levels of self-organizing systems.

According to the generally accepted definition (Barton, 2014: 206) complex adaptive system is an evolving entity, characterized by a dynamic transformation of its organization in time and space. Its structure and composition is determined by a built-in mechanism for the transmission and processing of information, which allows adapting to varying external and internal conditions.

In addition, we have to enter some teleological parameter, adaptive information organized and structured in the form of strategies. It is resulting from the terms of the behavioral repertoire of solving tasks of survival and auto-reproduction together with the rules of transition from one member of repertory set to another ones. We concluded that the central element of the explanatory model of anthropogenesis concept becomes stable adaptive (evolutionary) strategy.

This hypothesis goes back to the evolutionary and epistemological constructions of Donald Campbell (1974), Karl Popper (2002) P. Thomson

(1995). Here we did learned, another idea – the deep homology of essential processes of biological evolution, cognition and learning too. In general, the whole history of the formation of the classical (Mendel-Morgan), molecular-genetic and epigenetic paradigms do not contradict this interpretation.

The earliest concrete scientific source that the authors were able to discover is the book of the Canadian ecologist and anthropologist of Soviet (Ukrainian) origin Valery Geist. In considering the relationship between human evolution, "life strategy" and ecology, the author equations a concept that can be interpreted as follows (Geist, 1979:22):

1. The ecological niche that has evolved during the evolution provides the maximum phenotypic expression of species differences;
2. The process of anthropogenesis is a successive change in life strategies[1].

Taking into account the results of the subsequent development of the evolutionary theory of anthropogenesis (as will be discussed below), it is necessary to supplement these statements with one more thesis:

3. Features of the mechanism of socio-cultural inheritance (cultural transmission) as one of the leading components of anthropogenesis, give to the latter a certain teleological character and end with the transition to the strategy of creating an artificial (culturally-ecological and culturally-technological) habitat.

Without going into a detailed analysis of the concept of Geist, we note the fact. The interpretation of the problem of anthropogenesis as an evolution of an evolutionary strategy makes it possible to move from the substantial explanatory model to the relativistic model, i.e. from the search for key features of the sapientation to the organization of mutual connotations between them.

From contemporary sources are necessary to mention the monograph of Geoffrey Hodgson and Tornbern Knudsen "Darwin's Conjecture" in which the idea of superposition is associated with another concept. The authors postulate (Hodgson, 2010: 80) the need to distinguish each member from the binary bundle of autonomous functions of inherited information,

[1]Life strategy is a term that in V.Geist's interpretation is close in importance to the "stable evolutionary strategy") of our study.

namely, replication of its carriers (replicator) and implementation (implementation) of this information itself (interactor). In fact, this autonomy enables the binary transmission mechanism of adaptively important information: replication by itself and by epigenetic contagion (infection). A further argument in this study will be based on these two principles as the basic postulates of the whole concept.

Another concept that describes the evolution of human as a complex bundle of parallel co-evolutionary processes of biological and socio-cultural evolution is called hypothesis of socio-cognitive niche (Whiten, Erdal, 2012). This concept goes back to the ideas of the theory of niche construction, according to which epigenetic changes of adaptive genetic information change the conditions of its implementation, and therefore evolutionary landscape of selective processes.

In the original version of the concept of anthropogenesis, three main system-forming factors of sapientation (so-called hominines triad) exist. More precisely one should speak of two triads – morphological set (bipedalism; hand tools able to manufacture; and highly brain – the neocortex and frontal lobes) and psychophysiological set (abstract thinking; the second signal system – the language; deliberate and purposeful labor activity). It is easy to notice that the first triad refers the biological component and the second triad is adjacent to the socio-cultural anthropogenesis.

The concept of socio-cognitive niche expands the list of ligaments due to signs under common (genetic and socio-cultural) control. The main attributes of socio-cognitive niche, in this concept, are the ability to abstract thinking, empathy, language, cultural transmission, combined into a single adaptive complex and turns social group of its owners in the unit of group selection.

As a result, (1) there is a gradual drift of the parameters of the ecological niche, have the opposite effect on the direction of adaptation genesis; (2) an additional cycle of co-evolutionary interactions “evolving environmental – evolutionary objects – evolutionary system of objects”; (3) initiated the genesis of two parallel systems of generation and fixation of adaptive data (genetic and socio-cultural inheritance), and. therefore, – two autonomous “database” (Genome and Culture). In general, this configuration generates emergent evolutionary effect – the trend in the progressive change in the

cultural and ecological environment as a direct result of adaptation genesis of *Homo sapiens*.

We add, the prerequisite of an emergent cultural jump acts constructivism predisposition, i.e. directed outward desire to transform the surrounding reality, making it more comfortable for himself and his social group. In philosophy, this item is commonly referred to as the emergence of self-awareness, the separation of perception of reality on the "I" and "World".

Even closer to the stated views of the concept presented in the monograph of the British sociologist Walter Runciman (2009). Like our own model, according to his ideas adaptive human evolution involves emitting biological, cultural and social components. The authors shaped these views independently. The difference also lies in the fact that from the point of view of Runciman all three components evolve exclusively in accordance with the mode of Darwin, that is, by selection. In addition, a third (social) component of adaptation genesis is heterogeneous, and can be attributed in part to cultural and partly to the rational-technological adaptations. More, we consider this issue below.

We assume that (Cheshko, 2012, Cheshko et al., 2015)

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 stereotype prevalent in concrete social group as the result of imitation and communication between the individuals and increasing the probability of 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 language, using natural and artificial languages and increasing the probability of group survival and growth of fixation and

replication determining the appearance of their means and methods of transformation

As applied to the technology we are talking about originally projective (deliberate and rationalist) form of adaptation genesis. Thus, concepts "adaptation" and "innovation' are interchangeable. On the other hand, the name "adaptation process" indicates the mode of implementation and "rationalistic adaptation" indicates the way of generating of this class adaptations. Therefore, both terms in the context of the study will be used interchangeably.

Within the framework of the SESH concept, biological adaptations, cultural stereotypes and techno-rationalist innovations should be regarded as equivalent to the "evolutionary adaptation", at least in functional terms as phenomena that evolved during evolution and increase the chances of their carriers to survive. If, for culture, the synonymy of biological adaptivity and culture is already quite widespread, then this point of view has only begun to spread with regard to technological innovation. It is characteristic that the identification of adaptation and technology arises in such areas as the theory of the origin of language and music, in which these phenomena are considered as a communicative technology or / and simultaneously as an adaptation facilitating situational and intergroup communication (Lawson, 2004; Huron, 2001; Killin, 2017 et al.).

On the other hand, the name "technological adaptations" refers to the way of realization, and rationalistic ones refers to the way of generation of this class of adaptations. Therefore, both terms in the context of this study will be used as equivalent. In our previous publications, the preference was given to the term "technological adaptations".

Outside, coming into contact with other individuals, the stimulus generating act of the adaptive information (cases b, c), as far as can be judged, involves the induction of a specific sequence of epigenetic modifications caused selectively specific external stimulus. If the latter is the contact with a carrier of a certain type epigenetically modified trait, it is a heritable cultural adaptation. If this incentive is the result of the perception of a data message transmitted through artificial code, we are dealing with a rationalistic adaptation.

One of the most difficult and controversial aspects of the concept of *Homo sapiens* adaptation genesis as a superposition of three autonomous

units arises from the functional dependence of the integral adaptive effect of interdependence influences of all modules of the process adaptation genesis. In other words, the establishment of such a system involves initial coordination of all its modules. Thus, the use of tools as a means of group adapting (it is one of the key elements of the rationalist adaptive module now) provides simultaneous implementation of several prerequisites (Biro et al., 2012):

1. Reliable and correct integration of tool use in the human behavioral repertoire, including the existence of the trigger mechanism on / off patterns that provide such activities and its situational transformation;
2. . Adequate physiological and morphological organization (grasping hand, bipedalism, brain development);
3. Sufficient level and direction of cognitive mental processes to solve adaptive routine tasks in this way;
4. Synergistic pressure of environment and social structure to evolutionary success, achieved through using of the above-mentioned traits.

From this list of conditions, 1 and 3 ones provide for the existence of biological and 2 and 4 – socio-cultural adaptive modules. Each of the three types of adaptations has its own substrate and substantial basis – the mechanism of heredity, i.e. generation, replication, implementation (translation) and selection of potential or actual adaptive information. At the same time, the functional organization of all three mechanisms of heredity from the standpoint of relations between their elementary functions includes the same elements (Lewis, Laland, 2012:2171):

• Mutations (innovation) that are the appearance of qualitatively new features, imply the existence of a new fragment of heritable information;

• Modifications that are quantitative parameters varying of existing signs with regard to the conditions of the information fragment translation;

• Recombination that are combining several features in a single complex, while maintaining the specificity and integrity of their information coding fragments.

Our conception is based on the classification scheme and the general model of the hierarchical organization of the mechanisms of inheritance described in the Eva Jablonka and Marion Lamb monograph (Jablonka, Lamb, 2008). We have already mentioned it. From the analysis we excluded epigenetic inheritance, since it is due to genetic inheritance not only

evolutionary, but also functionally, taking part only of biological form of adaptation genesis.

The difference between genetic and cultural adaptive modes of obvious lies in the different ways of adaptive information replication – by biological and / or socio-cultural inheritance. The difference between the cultural and technological (rationalist) adaptive modules due not only and not so much to differences in the ways of replication (symbolic inheritance plays there, and there is quite important), but also in the nature of the relationship with the biological (genetic) component adaptation genesis. The chain of cultural behavioral transformations can be very long, but it always has a point of initiating biologically determined emotional response, and this substantial foundation supports the entire chain of socio-cultural adaptation. The final link in the chain can be virtually autonomous from this basis in the form and in the content, but the destruction of the biological substrate like trigger off the whole chain. Truism, social stress in a person "too easily turns into an animal". This process hampered by secondary connotation between different branches of socio-culture-anthropogenesis, servants to stabilize cultural module as a whole.

Fundamental important conclusion is that the addition of a third (rationalist) element in the original co-evolutionary genome-culture bunch was the latest in turns SESH in a triple helix – autonomous self-sustaining cycle generation of system complexity. This cycle is organized by type of evolutionary fractal. Let`s take a look at the main features of its constituent elements.

The biological (actually genetic) mechanism of inheritance is basedon the Eigen hyper cycle and on mostly unambiguous clear relations of correspondence between the nucleotide and amino acid sequence in the molecules of biopolymers (the genetic code).

The genesis of cultural adaptation is associated to characteristic to hominines (and not only them) capasity of empathy, mimesis (imitation of behavioral of other individuals and other species), and imprinting (fixation in the memory of emotive images that cause the implementation of a specific sequence of behavioral acts).

This neuro-psychological complex may be transform into a sequence of verbal constructs (language) and thereby create new coding system of

adaptively important information, and it is one of the most likely evolutionary trajectories of the genesis of art (Trimble, 2012:96).

In other words, technogenesis as a form of adaptation mechanism implies cognitive (semantic or symbolic) code. Its special feature is the hegemony of an arbitrary system of correlative correspondence between thought-forms (interpretants) that are employee's promoters of adaptive significance of behavioral acts, and appropriate symbols. Therefore, the interpreters unite the mechanisms of the functioning of the sociocultural and rationalistic components of SESH. The difference between them is precisely in the arbitrary coding system of adaptive behavioral acts capable of altering the physical, social and mental reality, increasing or reducing the individual and / or group adaptability of their carriers. This is the process of "co-evolutionary semiosis" as mechanism of evolution and socio-culture-anthropogenesis. This idea is not something entirely new (see Barbieri, 2007 et al.).

Back in 1987, for example, in an article claiming that the basis for the uniqueness of human evolution is the ability to conceptually abstract from the situation of modeling of the actions necessary to achieve the objectives that have been correlated with fitness. The ability to create realities is called a "cognitive" niche in the language of the theory of knowledge (Tooby, DeVore, 1987: 2009).

The above argument of specificity (not to say – unique) of SESH can be equationted as a postulate of the rationalization of adaptation genesis of *Homo sapiens*, as well as other hominines.

The origin of rationalistic forms of adaptation genesis linked the emergence of another theoretical and methodological paradox, the question of the relationship between adaptability and validity of cognitive constructs. The emergence of this problem is connected with the second evolutionary dichotomy.

As a result of the first dichotomy in the evolving reality became possible to allocate a bunch of co-evolution of the two self-organizing systems – ecological niche (environment, decisive phase of space trends of selection) and organisms. The latter is a self-organizing evolving systems using ecological niche as a resource to ensure its own existence (subject to selection). It was assumed that a result of information exchange between the members of this ligament is concordance of the organization evolving

system and the parameters of the evolving environment. This correspondence provides an increase in the number of evolving systems – carriers of information. The appearance of adaptations some way connected with the cognitive processes (psyche) is equivalent to the creation of the new contour of information exchange – between a reality and its ideal image. If this image is adequate to reality, it is regarded as a "true" in the theory of knowledge and "adaptation" in the theory of evolution at the same time. The central postulate of Karl Popper's evolutionary epistemological concept is a thesis that sounds like this: "Every true (weaker - reliable) concept is always adaptive information".

However, the reverse thesis, "all the adaptive information is true" in general, is not always true (McKay, Dennett, 2009: 493). The selection criteria and the criteria of adaptability fit into a multidimensional adaptive (evolutionary) landscape. In this landscape adaptability is the projection onto time-survival of some set of factors including socio-cultural ones. A situation that the selection criteria based on axiological system of priorities will be biologically adaptive for several parameters and, not adaptive for others parameters, may arise.

Meanwhile, for elements of mental life in general and for spiritual culture in particular, there is only one dimension, when the relations between two sets are uniquely defined - the adequacy of reality (truth). However, socio-cultural types and their specific forms of ideology and worldview are numerous, and they are durable. In other words, it is not always the truth of adaptability and self-replicating elements of culture are identical or synonymous. There are special classes of cultural innovations that are adaptive and are not true. They named a "positive illusions" or an "adaptive misbelieves" by McKay and Dennett (McKay, Dennett, 2009). The reason for their fixation during adaptation genesis is the regular adaptive changes observed because of their implementation. The positive effect was observed on the more important parameters of adaptive misbelieves; overlapping maladaptive changes to the elements occupy lower positions in the adaptive priority. In other words, the integral balance of the adaptive error is positive, despite the fall in certain indicators of fitness.

Mathematical modeling confirms this philosophical concept in the framework of game theory. Adaptability and truth cannot be considered

coherent to each other values in a general form (Mark, Marion, Hoffman, 2010).

In fact, in this respect, socio-cultural adaptive misbelieves quite similar to items subsystem biological adaptation. The modular principle of the structural organization of ontogenesis, not excludes, but assumes the appearance of conflicts between the individual functional elements of adaptation genesis – by virtue autonomy of the evolutionary origin. The conclusion applies to relations between elements of the same SESH module as well as module-to-module co-evolutionary functional and semantic relationships.

On one side the conflict between individual self-replicating elements of the genome is a universal attribute of life (Burt, Trivers, 2006: 3). On other side genetic conflicts reflect local differences in male and female SESH (Kappeler et al., 2009) that in hominines are initiating element of social differentiation. Therefore, it reflects conflicts between the pools of biological and socio-cultural adaptations, too.

The basis for fixing individual adaptations is their partial impact on the spread in the population of their carriers. For this reason, the selection of individual items within certain limits of SESH involves multidirectional evolutionary trends in multidimensional adaptive landscape. The same principle applies within each of the three main modules of SESH. Inside each of them, there is a sub-modular organization, which elements occur in parallel in the course of evolution. As applied to the biological type of adaptations, modular organization is justified by a set of experimental data on the simultaneous autonomous genesis of several systemic adaptive complexes of anthropogenesis features presented in the works of J.C.K. Wells, B.Crespi and others modern evolutionary anthropologists (Crespi, 2010; Wells, 2012; Applied Evolutionary, 2014).

Value of “adaptive misbelieves” and the intra-genomic adaptive conflicts should decline, while the value of the system (inter-modular) conflict – increase in parallel to growth of the proportion of Rationalist (Lamarckian) module in the general process of mankind's adaptation genesis. Indeed, different kinds of adaptive technological innovation only with very large distortion can be compared with the “adaptive error”. It is intuitively obvious, however, that the social and biological risks associated with the development and integration of high-tech innovations involve

significant adjustment in the socio-cultural component of the adaptive complex. Consequently, at the level of meta-system adaptations manifestations of "adaptive illusions" will be more important on frequency and scale effects.

If we continue this line of reasoning, the validity of the thesis of adaptability certainly true concepts circulating in cultural tradition must be imposed limitation: it is valid only in the dynamic sense, as in this case, the adaptability largely determined by the system properties of the whole complex of social and cultural innovation. Knowing even true, destroying the already existing system of "adaptive misbelieves" can reduce the adaptability of the carrier – an individual or a social group. This item will also serve as the subject of analysis in the future.

Difference between adaptability and truth of socio-cultural and rationalist concepts must be taken into account when determining the origin of religious belief mechanisms in both the bio-anthropological and philosophical-anthropological aspects. The rationale for this thesis is devoted to our previous publication (Cheshko, 2012:286-543).

So, the mechanisms for the emergence of cultural adaptations and technological adaptive innovations are no longer clear among all three types of adaptations that ensure the survival and evolutionary progress of *Homo sapiens.* In general, it is impossible to say about any form of adaptation genesis (biological, sociocultural, and rationalistic) that there are no fundamental gaps in the theories explaining it.

Even the following assumption looks not so much a scientific hypothesis as a natural philosophy, despite the fact that modern cognitive science, neurophysiology and evolutionary psychology provide us with a large array of experimental data, among which most confirm it, and there is none that is categorically incompatible with it.

According to the hypothesis, there is a continuous series of transformations whose initiating point is the occurrence of a specific configuration of neural networks. They are the reasons for updating certain behavioral stereotypes and, at the same time, hypothetical emotional thought forms (definition, by necessity, rather vague) to ensure the stability of these stereotypes. These thought forms probably include a complex of emotional states in association with certain sensations, adequate to the external and internal environment. In any case, we accept that

• Between the biological, socio-cultural and rationalistic forms of adaptation genesis, there are an evolutionary continuity and a certain transfer mechanism;

• The same mechanism and continuity exist between the biological, socio-cultural and symbolic forms of inheritance that provide them;

• This transmission mechanism has a co-evolutionary nature, i.e. implies the mutual agreement of autonomous in its origin series of adaptively significant features −socio-cultural and biological, for example;

• A necessary condition for the emergence of such mechanism is the existence of processes of epigenetic modification of adaptive information, the flow of which is an object of external regulation by alternative systems of inheritance.

For example, the main differences in the structure of the human genome and other primates are associated primarily with the non-coding sector of nucleotide sequences, which are supposedly mainly regulatory elements (enhancers, etc.) These elements can radically change the pattern of activity of structural genes, which leads to equally radical systemic changes in the phenotype, equivalent in its expression to mutations in the structural sector of the genome.

The non-coding nucleotide sequences evolved during anthropogenesis with the greatest speed. For more details, this model of the molecular genetic processes of anthropogenesis is presented in (Many, 2013). In accordance with our hypothesis, the socio-cultural module of SESH reformats the distribution of the activity of individual elements of the biological module through epigenetic regulators to ensure the expression of its own (socio-cultural) adaptations.

Next, we analyze the empirical and theoretical arguments in favor of this working hypothesis and conclusions in terms of methodology and technique of calculation and prediction of the amount of risk of NBIC-technological complex. (“NBIC-technological complex” we consider how the term identical terms “technology controlled evolution” and “High Hume”.)

Meynard Smith introduced to the academic community the concept of evolutionary stable strategy as species-specific set of modes of solves emerging problems of adaptation. The Maynard Smith concept is a special case of axiomatized game theory in general and the so-called “Nash equilibrium” in particular One of the most difficult problems of the modern

theory of anthropogenesis is the origin and organization of the stable adaptive (evolutionary) strategy of hominids (SESH). The solution to this problem is all the more important that now we are approaching the point of regular global bifurcation of transition to controlled evolution phase, and the cause of latter is global evolutionary and ecological implications of a SESH.

The initial methodological postulates of explanatory model-underlying hypothesis developed below, offered by N. Vavilov, V. Vernadsky J. Huxley at various times. N.I. Vavilov was authored metaphor "human directed evolution" (Vavilov, 1966). The metaphor was the starting point, which semantic connotations gradually filled by verbal-logical constructs available for comparison with an array of empirical data and theoretical constructions of developed evolutionary and philosophical anthropology.

Holistic "ideology" (the original system of theoretical postulates) is the theoretical core of this concept. It is known as the triple helix model. The latter provides that a self-organized and able to progressive evolutionary development system include the structure of the three autonomous but interdependent (co-evolving) and overlapping elements. The generation of new adaptive information is carried out in these hybrid zones, where the interpenetration of autonomous social institutions takes place in parallel with the formation of the hybrid structures themselves. "Hybrid" nature of the generator of new knowledge is reflected in the "hybrid" structure of the theory itself – appears in its composition that we have previously designated as "ethical and epistemological hybrid constructs". Each of the elements capable of autonomous adaptive evolutionary changes in a particular context, but in general, their evolutionary trajectory invariably tends to the point of stable equilibrium. Similarly, binary bundles of these elements oscillate around the equilibrium points described Volterra-Lotka equation.

As a result of the superposition of three separate objects co-evolving as a team, where each part is associated with any other cycle forward and backward linkages generated different dynamic structure. In this case, in the phase space of the parameters of system complexity arises adaptive evolution curve (the "triple helix"), which is applied to the society and is known as the scientific and technological, and social and human progress (in spite of the ideological loading of the term, in which the authors give full aware).

In terms of information theory, the Shannon, this process can be represented by the equation

$$I(ABC) = H(A) + H(B) + H(C) - H(AB) - H(AC) - H(BC)H(ABC) \quad (2.4)$$

where I (ABC) – information generated by the interaction of individual members of the co-evolve triad (ABC – in this case, science and technology, state power and business, respectively), H – entropy of a single element and their interactions. Thus, there may be situations where the total entropy decreases (correspondingly increasing the amount of information). However, the reverse is also possible – additional feedback loop causes the destruction of at least one of the members of the triad, which ultimately becomes the general crisis – degradation socio-institutional organizations. Such information interpretation nonlinear model of co-evolution (triple helix), developed in articles L.Ledersdorf and others since 2008 (Leydesdorff, Franse, 2009) and is valid to self-organized evolutionary complex system in general.

The presence of a third element complicates the interaction of a binary co-evolving systems ligament and leads to an additional feedback loop, bearing either positive or negative. Accordingly, there are either the generation of the organized complexity of each element of the ternary system and itself as a kind of integrity, or their degradation (increase in total entropy).

Therefore, stable adaptive strategy *Homo sapiens* includes original superposition of three main types of adaptations – biological, cultural and rationalistic.

Functionally three components of SESH form a hierarchical system of information cycles. Each loop provides a consistent generation, replication, selection and fixation or elimination of adaptively significant information. However, in parallel there is a stochastic process of loss of information because of random replication errors. The tendency to reduce the amount of information is overcome because of further acts of generation. As stated by one of the founders of modern ecological paradigm Howard Odum from the point of view of thermodynamics, the above information cycle is more "profitable" in terms of energy (Odum, 2007: 224-237). In other words, adaptive data replication is associated with high-energy consumption, compared with its generation and selection at a time. Thus, SESH in this

aspect can be seen as a hierarchy of three-member information cycles composed of biological, cultural and rationalist adaptation. The overlying loop acts as an "ecological niche" for the previous loop, filtering and transforming signals from the actual ecological environment and, thereby, stabilizing the evolutionarily more ancient information loop. Thus, the evolutionary cost of maintaining each component of SESH reduced, that appears in reduce the rate of evolution of the relevant components. (The rate of biological evolution of *Homo sapiens*, for example, is markedly reduced in comparison to the development of socio-cultural and rational technological components of anthropogenesis). The slowest evolving biological module defines the boundaries of the repertoire set of evolutionary transformations of the socio-cultural module, and the techno-rational module reformats the configuration of possible scenarios of socio-cultural anthropogenesis towards expanding these boundaries. The thought is not new; see, for example, the recent publications-bestsellers of Yuval Noah Harari (Harari, 2015, 2016).

The idea of a hierarchical organization of SESH borrowed from some publications of Thomas Abel (Abel, 2014:44). He apply it to the organization of culture exclusively. In accordance with his concept of culture (cultural adaptation to our terminology) is a hierarchy of information cycles described above. The author does not regard the problems of organization of biological adaptation, because of a multi-level process of realization of genetic information. However, judging by the currently available concepts of post-transcriptional and post-translational transform genetic information (epigenetic inheritance), it can be assumed that a similar hierarchical scheme of the adaptation genesis applies to biological components of SESH. Therefore, even without a detailed analysis of specific mechanisms technogenesis there are good arguments to suppose that SESH is a three-tier system of information adaptive cycles (bio-, culture-, technological). At the same time within each level sub-passages, ending a phase transition to the next elementary found. The border between the levels determined by the appearance of an alternative stand-alone module of generation – replication – selection – fixation of adaptive information.

Thus, each of these subsystems is autonomous from the rest of the origin and way of implementation, but dependent on their functional significance

and direction of the subsequent evolution. This feature can be stated as follows: for major evolutionary transformation trends, each subsystem (module) of the adaptive strategy depends on both the other two elements of the evolutionary landscape and, in turn, acts against them as part of the landscape. Therefore,

• First, the landscape of evolution of hominines becomes significantly more multidimensional in comparison with the evolution of other biological taxa;

• Secondly, the share of environmental factors in the evolution of human and including human (socio-) ecological systems generally declining;

• Third, there is an imbalance in conjunction adaptive strategy – ecological environment periodically reaches a critical value and allowed environmental crisis.

Since the outcome of such a crisis in each case is uncertain and includes changes in individual elements of the adaptive strategy, habitat, or a combination of them, such a point should be called an evolutionary singularity.

As a result, the general vector and the specific trajectory of socio-cultural anthropogenesis during the inter-singularity period of its development is less and less determined by ecological dynamics and becomes more and more spontaneous (intentional). In other words, the trajectory of anthropogenesis is increasingly determined by the nature and parameters of the internal organization of a stable evolutionary strategy, and not by stochastic or directed changes in the external environment.

The Russian anthropologist A.A.Zubovcalls this phenomenon by term "adaptive inversion" (Zubov, 2011: 7), in our opinion successfully. In our own publications, without using this term, we wrote about the fact that man, unlike all other creatures, does not adapt to the environment, but adapts it to himself, more precisely, to the organization of his own biosocial substratum − the body and psychic organization.

Adaptive inversion is necessary to be considered as a powerful system adaptation, the point of coincidence of the trajectories of biological, socio-cultural and techno-rational evolution, ensuring the survival of *Homo sapiens* in the conditions of the evolutionary-ecological crisis.

However, this premise of the subsequent evolutionary history has its opposite side. Mark Coeckelbergh, in one of his publications, asks,

> “Why, in fact, mass consciousness (“public opinion”), has quite extensive knowledge about the manifestations and potential risks of the global environmental crisis, but is limited in its practical activities to purely conservative and protective measures” (Coeckelbergh, 2015)?

Without going into the analysis of the content of his research and the main provisions of the "non-romantic" (i.e., non-emotional-rationalistic) version of environmental ethics, developed by him as an alternative to this inconsistency, we note the following. Adaptive inversion has established itself, in our opinion, as a supporting structure of human evolutionary strategy, embodied and maintained as an irresistible cultural and psychological intention to transform reality. This intention, albeit in different ideological and cultural forms, is present in different types of civilization, but the most pronounced is in the transatlantic (”Western”) variant of technological civilization. The latter circumstance is connected with the individualism inherent in this civilizational type. Therefore, the rejection from this intention and the replacement of the desire to slow down and introduce into the framework of an acceptable risk the transformation of our environment by something less radical, seems incompatible with “human nature”.

In principle, these arguments have become trivial for the neo-Darwinian (“synthetic”) theory of evolution. However, in recent decades, they have been revised within the framework of the new epigenetic disciplinary matrix.

Hypothetically, it may be offered an evolutionary algorithm that can lead and probably led to the genesis of adaptive inversion. *A priori* possible to postulate the existence of three different mechanisms of generation and fixation of adaptive information:

1. Random statistical information frequency drift of population fragments;
2. Stochastic process of the emergence of new fragments (mutation) in combination with selective reproduction (selection);
3. Purposeful design based on rationalist outlook of the future.

During most of the biological and socio-cultural evolutionary phases of human history dominated by the first and second mechanisms (Chudek, Henrich, 2011: 221). A radical change occurred as the internal law of cultural genesis.

First, we note that behavioral (proto-cultural) adaptations can ensure strict compliance of behavioral stereotypes with a specific set of environmental factors, and in this case, a narrow range of response rate characterizes this kind of adaptive innovation. The relative constancy of the parameters of a new ecological niche is the condition for the effectiveness of such adaptation.

An alternative is the generation of a complex, highly plastic behavioral stereotype with a broadband plastic response rate. Such a stereotype may have the potential to change over time in accordance with changes in the external environment. This type of adaptation is effective in the regularly changing cyclically or directionally ecological niche. Consequently, this property can be interpreted as the ability to predict the future environmental situation.

However, if there are largely stochastic or too fast changes in the ecological niche, proto-cultural adaptations of the second type can acquire a property that should be called "creativity". This property of the human psyche is evolutionarily associated with the social way of life of hominines and non-biological ways of maintaining functional differentiation within the group, if the biological individuality of its members is preserved.

It is clear that within the framework of the social community of hominines, each individual knows (is able to know) all that other members of the group know. This postulate is called the "theory of mind" (Dubyaga, Meshcheryakov, 2010). The presence of a common pool of knowledge implies the ability of the individual to be included in the overall communicative structure of the group and the ability to modify actively it. As far as can be judged, it was the emergence of social intelligence in primates that served as the starting point for the development of Reason, if

by the latter we understand the ability to predict and purposefully manage our own ecological niche. The first segment of the ecological niche that was accessible to individual control and manipulation was the structure of inter-individual and inter-group communications, which then expanded to the process of "communication" with other species and with reality in general.

Therefore, the evolutionary strategy of hominines can be defined as a strategy for the acceleration and proliferation of co-evolutionary links with elements of the habitat. The latter, thus, is transformed into reality in the philosophical meaning of this term.

The category reality implies, in particular, the emergence of methods of cognition as ways of creating ideal models of what happens outside the human psyche.

It follows from the above that the original method of knowledge should have been hermeneutics, i.e. the ability to understand and predict the behavior of individuals based on empathy. This way of creating explanatory models is obviously the oldest, closely related to the social intelligence proper. The main element of the hermeneutic method is the binary bundle of cultural communication and innate emotional mimic stereotypes. The information about it is encoded in the so-called "mirror neurons" of the associative zone of the parietal and temporal lobe of the cerebral hemispheres (Rizzolatti, Sinigallia, 2012), and acts as a supporting element in hermeneutic method. Their activity is induced both because of the performance of certain behavioral acts, and because of the observation of analogous acts committed by other individuals. In other words, the cognitive correspondence of the behavioral act and its ideal image is established. This gave rise to the discovery of these neurons by Italian neurophysiologists to consider these neurons as a material substratum of empathy and social intelligence (and, consequently, hermeneutics).

For all the speculative nature of this hypothesis, it does not contradict the totality of the data of evolutionary anthropology and agrees with the last of them in time (Waal de, 2016; Sodian, 2016; Martin, Santos, 2016 et al.).

Anticipating future changes in the environment and behavioral acts aimed at survival in new, yet unsuccessful conditions, merge into a single cognitive-activity link.

The result of this association is a phase transition to the teleological formation of an ecological niche − at first spontaneous, then rational. To

implement this (prognostic) adaptive function in the human psyche, there are several standard cognitive models − the algorithms for interpreting sensitive-empirical information (McKay, Dennett, 2009, with additions Cheshko, 2012). The reason for this phenomenon is the autonomy of the systems of genetic and socio-cultural inheritance and the different speed of their functioning. Therefore, the same biological element of this association corresponds to a certain set of cognitive elements (in this case, "cognitive algorithms") that are socially and culturally determined.

As its integral attribute, the mechanism of generation of cognitive algorithms and adaptive conflicts is used. This is the formation of inter-module associations between its elements as a product of combining the cognitive mechanisms of neural modules designed to solve adaptively significant cognitive problems of various types. Among them, there are social intelligence as optimization of the communicative structure and physical intelligence as optimization of the ecological environment, biological reproduction, etc. The term "cognitive module" in accordance with the theory of modular organization of Reason, most fully developed by Peter Carruthers (Carruthers et al., 2005, 2007, 2008, 2015), denotes a set of cognitive mechanisms for solving certain types of adaptation problems. Each module is associated with certain loci of neural networks. It is clear that in the course of cognitive activity, algorithms for solving adaptive problems in one area, created within the framework of the functioning of one module, are transferred to another module. (This transfer is called the cognitive association). As a result, a set of cognitive algorithms for solving such problems is formed. Later, within the framework of the SESH techno-rationalistic module, these modules correspond to the cognitive modules as logical "explanatory models" of the theory of knowledge. A set of such algorithms includes the following types.

Intentional algorithm based on the decoding of behavior of the object in accordance to the analogy of own behavior in the same specific situation. The behavior of an object (person, animal, artifact, etc.), is interpreted as a behavior of rational agent, i.e. its "choice" of "action" is guided by their "beliefs" and "desires". In simplified form, this algorithm provides for compliance with a few simple criteria of reliability of the forecast:

- Evaluation of reliability of the forecast corresponds to the following list of actual or potential underlying causes of behavioral acts or

events (each successive member is less likely compared to the previous ones) artifact → volitional action → objective reason of a certain phenomenon, event or situation (1);

- It is assumed that inanimate objects have goals and intentions similar to the actions of the members of a social group (2);
- External factors (for example, the force of gravity) are regarded as the internal characteristics of the object, i.e., its attributes (3);
- The cause of motion or change is always some kind of action needs serving motive beginning of change. If such a motivator cannot be found, it is assumed that it is rooted in the internal needs of the object (4) (*Homo* Novus, 2010:233).

Constructive (functional) algorithm considers a fragment of reality as an artifact created in order to implement certain specific functions in the implementation of the project or program.

Magic algorithm is a combination of intentional and mechanical algorithms. On the one hand, the reality is the result of purposeful activity of transcendental rational agents, on the other – the agents themselves open to rationalist control and manipulation by rational action agent.

The mechanistic component (scientific and technological innovation) of the algorithm provides psychological "substrate" for meaningful interpretations in the mass consciousness (Davis, 2008). In other words, the image of the discoverer of objective connection of fragments of reality merges and / or transformed in the image of the creator of this reality. In this case, a statement of the possibility or impossibility of achieving the desired state transforms to the willingness or unwillingness of the same state in conscious. In retrospect, the science is evolutionary homologous (derived from) to magic, as "effective" its variant. As he wrote in 20th century E. Garin (1986),

> "Magic is a practical activity that transforms nature, including the game of its laws".

In the long term "Science" as social institution evolutionary increasingly uses its own cognitive codes of other social institutions. Science and technology in the structure of mentality increasingly overlap with magic (Jaspers, 1994: 370-371; Berdyaev, 1992:116). The objects of scientific research, including human-dimensional (genome, the psyche, and so on)

ones, originally considered as an aim of technologized transformation; and the boundary between the "true" science and "false" magic again becoming illusory as in the Renaissance (Cheshko, 2012:384).

Theistic (religious) algorithm (synthesis intentional and constructive ones) is considering all of reality as a whole as the embodiment of a certain initially selected program, its predictive component is so absolute and temporal and spatial aspects of what is empirically improvable but irrefutable (trivial), no was subject to immediate selection.

An *evolutionary algorithm* is the result of combining constructive and physical algorithms and leader in this bundle is the last. In this way, the generated predictions are made available to direct selection for adaptability.

Among all the anthropological hypotheses that have as their goal the explanation of the mechanisms of the emergence of spiritual culture and consciousness, at present, the most reasoned seems to be the concept that connects these phenomena with the development of social (macavelian) intelligence. This term refers to the ability to establish semantic communication with other individuals within their own social group, population, species and beyond (Smith, 2011). Its purpose is the anticipating behavioral acts of individuals that will be implemented in the future or to reconstruct actions committed by these individuals in the past in certain circumstances and, therefore, manage or manipulate them for own purposes (safety and reproductive success).

The point of an evolutionary jump, i.e. the genesis of out biological - cultural inheritance and, accordingly, of socio-cultural module of SESH, might formed by the gender selection in social groups. By assumption of S.Saveliev (2012: 35-40) the fiercest competition could arise in the area of the opportunity to enter into sexual-reproductive contact with the opposite sex under the conditions of a developed social organization of hominines i.e. a favorable ecological resource-rich ecological niche.

In this case, communicative abilities become a means of achievement, and the morphological basis of adaptive advantage is the development of the forebrain, which in amphibians and reptiles had provided the hormonally emotional basis for sexual behavior, and then had served as the morphological foundation for the hominid neocortex (new cortex). The function of the latter are complex forms of social behavior and thinking, as is well known. Despite a certain share of shocking, this hypothesis is logical

explains general trend of early stages of socio-culture-anthropogenesis −environmental degradation (replacement of tropical African forests to savanna due to climate aridity) established socio-cultural adaptation, based on a new diet and a new distribution of social roles between the sexes. It was starting the process of formation of a complex socio-cultural adaptation, leading eventually to the Neolithic revolution.

It is obvious that the evolutionary association between social intelligence and the intentional algorithm is most easily formeed, if the intentional algorithm is interpreted in the framework of the theory of adaptation genesis. It can be seen as a progressive adaptation of the original, while the physical algorithm for forecast the future served as added, safety ones only.

Machiavellian intelligence consists of two parallel proceedings cores – emotional and cognitive, according to the latest neuropsychological views (Shamay-Tsoory, 2011: 18). Apparently, it was an adaptation of the system, to initiate or support trail secondary adaptations that originally served as an enhancer of its predictive function, and subsequently more autonomized from his biosocial substrate. The empirical argument in favor of this hypothesis is the recent psychological research data. In accordance with them, a reading of fictional works improves test scores on the cognitive ability to adequately interpret individual emotional state and interpersonal social relations (Kidd, Castano, 2011).

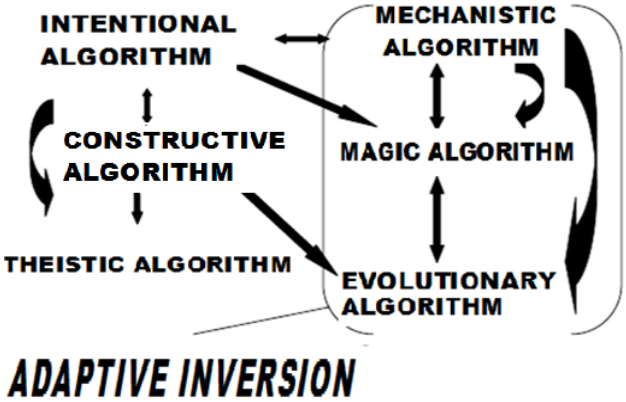


Fig. 1.2 – Hypothetical pattern of the evolutionary origin of adaptive inversion because of the evolution of adaptively prognostic cognitive algorithms.

This conclusion seems trivial only for humanitarian knowledge and everyday consciousness. In philosophical studies, it serves as an initial premise, which is implemented implicitly or explicitly. However, this premise is a prerequisite for the reliability of logical constructions. It is a test of the reliability of logical constructions of the analysis of the phenomenon of consciousness and cognition.

> "We think of mental states, that is, desires, beliefs, images, etc., in other people, as well as in other physical objects; they are not given directly. This speculation is universal in nature for a certain type of situation",

the Russian philosopher V.Vasiliev (2009:15) writes. The paradox is that such "speculation" is initially able to rely solely on an introspective comparison with one's own mental-emotional (actual or potential) states. In other words, a person projects own spiritualistic (in humanitarian knowledge) or mental (in natural sciences) experience on the world around him. To adapt to this world, we must first become like him.

For the natural sciences, this same premise is one of the first technologies that allow one to approach the objectification of the reflection of the evolutionary role of art (at least some of its aspects) in the theory of hominines adaptation. If this logical-empirical construction is not questioned by subsequent studies, there are extremely vague prospects for finding a bifurcation point in anthropogenesis that delineates the isolation of the complex of introverted social (religion and art) and extrovert environmental (science and technology) adaptations and SESH innovation.

The general scheme for the evolution of the predictive cognitive function as a socio-cultural adaptation can be represented in the following form (fig. 1.2).

As it can be assumed, the initial algorithm was an intentional algorithm for creating comprehensible models of behavior of other individuals within the social group and beyond it as the basis of makiavellist (social) intelligence in conjunction with the tool activity that creates the foundation for the formation of a constructive algorithm. Thus, the constructive algorithm was originally used as an auxiliary tool for understanding the behavior of other individuals.

The need for survival stimulated the formation of the integration of the initial social groups of hominenes into the overgroup social formations and the differentiation of social roles within the group, initially on a gender basis.

Finally, the increasing importance of the constructive algorithm in conjunction with the lability of nervous activity (psychotics) of our ancestors led to its spread to the completely objective world, which began to be viewed as a product of some super-natural agents. There was a theistic algorithm and, accordingly, the need for explanatory models of the behavior of these agents (Gods) for their own purposes. The traces of such a transition from theistic to magical and mechanistic algorithms were preserved in the sustainable intentions of the proto-technological civilization to understand and decipher the “divine project” of the creation of the world, which through medievalism and the deistic philosophy of the early stages of the Modern Age came to modern science.

In this interpretation, religion as an element of the socio-cultural adaptive module acted simultaneously as a stabilizer and controller of social

communities of various levels (Cheshko, 2012) and as a bridge for the emergence of a techno-rationalistic module (Henrich, 2016).

Thus, a new, synthetic algorithm was merged into a single system of constructive, intentional and mechanistic cognitive components of the psyche. This event can be regarded as phenomenon identical to "adaptive inversion"– socio-cultural adaptation that the genesis culminated in the phenomenon of technological civilization.

In the first stage of this process, constructive algorithm associated with the intentional and functional ones and tool use in the "substrate" relationship incorporated or replaced mechanical algorithm as a cognitive mechanism for forecasting changes in reality. Then this role back to the original mechanistic algorithm, but the adaptive transformation of modes of behavior has been developing for a constructive pattern. In other words, a change of behavior in accordance with the predictable changes in the environment are replaced by changes in the environment respectively the new behavior patterns.

The scheme as a whole brings us back to the triad of conjugate evolving elements that provide a progressive increase in the complexity of the "triple helix" system model. Thus, the general scheme of the conjugate evolution of biological (G) and socio-cultural 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 inter-module ($G_i \rightarrow C_i$) communication junctions of co-evolutionary process (fig.1.3).

Fig. 1.3 The block diagram of gene-culture co-evolution and techno-humanitarian balance.

We now clarify in the proposed scheme. Certain conditions of each module SESH (G_i, C_i, T_i) is not a single adaptation, innovation, but a set of adaptive evolutionary solutions (ΣG_{ni}, ΣC_{ni}, ΣT_{ni}). Feature of adaptive

evolution (evolutionary-adaptive window) of each such set is determined by its composition and structure of relations between its members and the patterns of inter-module connections.

There are relations between pools of elements that make up each of the three modules SESH, and they consist in a restrictions placed upon each of them by the two remaining. There are relationships between a dynamic evolving techno-rationalist and socio-cultural modules and more conservative biological ones, and they have the substrate-substantial character. In other words, a set of genetically determinates and suported traits serves as material for the formation of socio-cultural adaptation.

Reverse impact of socio-cultural and techno-rationalist biological adaptations is functional in nature. Adaptability or maladaptive appropriate biological trait is determined by its use as an element in the socio-cultural and techno-rationalist complexes. Possible areas for further evolution of each module can be represented as a certain set of potentially admissible trends of varying magnitude and direction. The value of the individual elementary evolution vectors is determined by interaction with other modules. It can be ranked in descending order to the supported, neutral, radical (repressive) and blockable (not allowed) ones.

Thus, the potential implementation of a set of possible rational-technological innovation (techno-rational adaptive window) is limited to a subset of admissible ones under the current socio-cultural composition of the module. In other words, there are currently many social and cultural value priorities sets of limits on the development and implementation of new technological solutions, regardless of their adaptive value. In a metaphorical sense, the current moral predisposition determines not only the results of the implementation of new technologies, but also the possibility of their occurrence.

However, new elements and enrichment pool of technological innovation, in turn, modifies the composition of the socio-cultural module so that those scientific and technological developments that were previously considered moral (cultural) unacceptable, go to the category of radical, but acceptable ones. The fate of traditional technologies, which in this case are close to the borders of socio-cultural determinate norms, can develop in two ways:

- They are stored in the form of a kind of rudimentary within a narrow "technological and adaptive niche" or saved as a "basis" because of its reliability in providing vital life-support functions (equivalent to an increase of volume technological module of SESH); or
- They are no longer supported by the existing socio-cultural configuration of the module and are no longer in use. It is equivalent to the evolutionary "drift" – changing the composition of the pool of technological module of SESH.

The first scenarios correspond to an increase of technological pool of SESH in the volume or complexity. Intuitively, it appears that the first possibility is realized more frequently and, therefore, the composition and structure of socio-cultural module expands and becomes more complicated as well.

If all of the above translate into the language of ontology, "environment" is split into "the world objectively existential (the World of Entity)" and "projective ideal world (the world of proper)" and thus becomes a "reality", as a result of adaptive inversion. Therefore, the binary opposition of the subject (the World of Proper) and the object (the World of Entity) is a distinctive feature of "reality" from the "environment". Traces of intentional-design algorithms ligament in the "evolutionary history" of technological civilization are clearly seen in the philosophical and ideological traditions of deism 17-18 centuries.

In principle, the same construction (fig. 1.3) is practically unchanged applicable to the second co-evolutionary combination of SESH – the techno-humanitarian balance. Under this model, the adaptive evolution of humanity is represented as oscillation of size and orientation relative to each other of three adaptive windows, while maintaining the integrity of the entire structure. Quantitatively, the evolutionary process is described as a projection of the areas of all three windows on three-dimensional coordinate system: BIOLOGICAL SURVIVAL – SOCIO-CULTURAL – COMPLEXITY – TECHNOLOGICAL POWER. Evolutionary risk is an equivalent to the progressive narrowing of the absolute and relative magnitude of at least one of the windows.

At the same time, technological innovations have external contextual independence as the most important difference from their biological-genetic and socio-cultural counterparts. In other words, the adaptive effect of

technological innovation does not depend on the ecological component of the socio-environment niche. However, the internal contextual dependence on the composition of the socio-cultural and biological module remains and in a number of cases increases. The reason is that the adaptive effect depends to a great extent on the capabilities of the biological substrate of their carrier and the sociocultural conditions for their realization. With the formation of the three-modular structure of SESH, the level of evolutionary risk substantially increases and the technogenic component takes on increasing importance in it.

It, of course, is a purely speculative scheme, that, however, does not contradict the data of paleoanthropology and allows us to explain how the cognitive and transformative components of behavior gradually acquired such importance in anthropogenesis. Note that this process, which arose in the evolutionary history of humankind once, could not stop at the first stage. The first adaptive inversion spawned inversion of the second and third level.

Adaptive inversion radically changes the criteria for selection of evolutionary innovations. The evolutionary success or failure of social and cultural, and then rationalist innovations determined by the dynamics of transformation of individual elements of the environment in the resource life support of an individuals and social groups. Adaptability of these innovations stem from the ability to transform the components of the environment into a source of life support and expand the number of carriers of the same innovations.

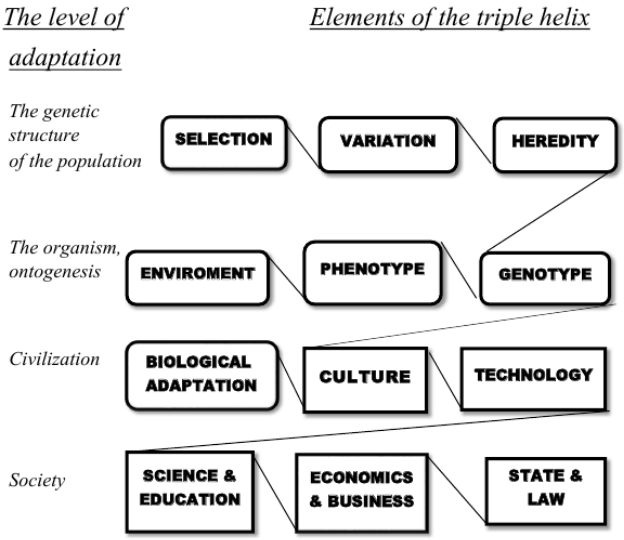


Fig. 1.4 – The hierarchical pattern of g generation adaptive information in accordance with the model of the "triple helix".

From the point of view of evolutionary theory, there is a progressive multiplication of ecological niches accessible by *Homo sapiens*. Thus, biological nature of adaptive innovation carriers remains unchanged, at least – in the latter stages anthropogenesis. In other words, evolutionary divergence changes own nature, from genetic (biological speciation) it becomes socioeconomic ones; ecology gives way to economics.

The dynamics of the process of fixing the socio-cultural and technological innovations (as the conversion of the latter into adaptation) clearly describes by the S-shaped curve. The initial linear increase in the number of carriers of arisen innovations in time gives way to an asymptotic approximation to the constant level, after that it becomes possible to progressive decline in innovations numbers. This form of the evolutionary curve is determined by two factors (O'Brien, Bentley, 2011).

The first of them is entirely similar to population-genetic factor in the case of biological evolution: speed ratio of innovations generation and their distribution in the "population" (society). The damping growth in the number of carriers in this case, there is a simple saturation effect (Bentley, O'Brien, 2012: 5).

The second factor corresponds to environmental parameters is the capacity of newly established "ecological" niches potentially available for using volume of resources. In this case, the phase of the linear or exponential growth occurs when the amount of resources used by the potential well below the affordable volume. The transition to the phase of the logistic growth occurs when these values are comparable.

Next, SESH included in hierarchically structured evolutionary fractal. Each fractal level is a system capable to generating adaptive complexity (fig.1.4).

In this scheme, each level acts as a superstructure to the previous and provides the genesis of the most dynamic element overlying the triad. In the triad of civilizational level, rationalist adaptation is such element that ensures the functioning of the social level of the triad (more precisely, the level of social institutions).

In the course of anthropogenesis, there are a permanent acceleration and an increase in the efficiency of the process of adaptation genesis because of an increase in the proportion of socio-cultural and technological adaptations. In other words, there is a gradual replacement of the Mode of Darwin-Weismann with the Mode of Lamarck, as being able to actualize the higher rates of evolution and / or adaptation genesis.

From the point of view of the external observer, this process looks like the inhibition and stopping of the components of the adaptation evolutionary, determined by slower SESH modules, as a result of the action of more rapidly developing modules. In parallel to advent socio-cultural and then techno-rationalist form of adaptation genesis, there is a "virtual" braking and stopping of evolutionary transformations of the structure and composition of the genome, and subsequently, the unification of culture. Latter transform to mass culture. (As is known, unification of social organization and culture is the essence of the phenomenon of globalization.) In our model, the evolution of SESH, this impression is an illusion that does

not correspond to the internal mechanisms of integral human evolution (socio-culture-anthropogenesis).

Intra-modular conflicts between elementary adaptations previously overcome in the course of subsequent evolution. Now, with the emergence of three-modal SESH, they do not just "preserved", but also supplemented by conflicts between modules. There are gaps and expand the network of functional connections between the individual adaptations within a given adaptive windows, which are perceived as growth of evolution load. "Filling" of these gaps is sudden acceleration of internally module evolution: spontaneous, induced by socio-cultural module and then externally managed and determinated by techno-rationalistic module. External determination in this context means that adaptation genesis proceeds in accordance to characteristics of more rapidly evolving module. With reference to the biological evolution, "external determination" means that it is carried out by technological innovation, not selection or genetic drift.

Here the leading role in co-evolutionary bundle plays an element with a higher speed of (adaptation) evolution (1); separation autonomous system complexes of encoding-replication-generation-broadcasting of new adaptive information is precondition of existing of co-evolutionary triad (2) (Jantsch, 1985; Karpinskaya et al., 1995; Ogurtzov, 2011:154).

In general, these two thesis adequately describe the basic characteristics of evolutionary systems of objects (or sequence of processes) that is HUMAN (biogenesis) – CULTURE AND SOCIETY (socio-cultural genesis) – TECHNOLOGY (technogenesis).

The emergence of this system presumably happened at that stage of our evolutionary history, the essence of which comes down to the evolutionary divergence of phylogenetic lineages primates and hominines – direct human ancestors.

There is a modern hypothetical explanation (cited in Markov, 2011) of driving forces and mechanisms of the passage of this stage. I tsynthesizes postulates explanatory models put forward in the 19th century by Friedrich Engels and Charles Darwin. Engels as a main sapientation factor (the emergence of modern human species) offers a collective labor activity (production and use of tools); and Darwin offers sex selection.

A modern researcher O.Lavjoy believes that the change in the ecological situation has forced the ancient hominids living in the lower forest tier to switch to a new adaptive strategy. The latter was based on a clear distribution of social roles between the male sex (getting food) and the female sex (childbearing and nursing of children), and the behavioral mechanism of its implementation ("sex in exchange for food" subject to the stability of the parents). Indeed, as shown by current research, male sex shows a greater propensity for risk behavior and fosters this feature serves as an attractor for the female sexual activity. In other words, the tendency of males to risk behavioral acts have quite a strong positive incentive for women sexual choice; men, at least in the Western cultural type are more risk-oriented than women, and the latter focused on the more positive perception of the risk behavior of male (Greitemeyer, 2013:36).

All these facts and conclusions are still within own biological evolution. Individual elements of the SESH were found among living organisms belonging to species that are very distant in a systematic respect. There were a relatively long period of childhood and lifestyle, which was based on garbage collection and / or hunting; and they were features of the adaptive landscape that contributed to the emergence of a new strategy. This contributed to the liberation of the forelimbs (to transporting food) and to manufacturing tools (initially – to break up prey, as well as hunting, defense and attack on the competitors).

Another concomitant adaptation was the development of the language as a means of communication, ensuring overall success in obtaining food, and its neurophysiological basis. (Cephalization is increase in the relative size of the evolutionarily younger parts of the brain.) A number of other trends of hominines evolution changed too. There are reducing aggression within the social group, the weakening of the external manifestations of the reproductive cycle and the seasonality in the female, etc.among them.

Thus, the initial behavioral adaptations over time more and more were based on not biological, but socio-cultural inheritance; and they led to a complex biological (morphological and physiological) adaptive traits. It is the so-called hominines triad:

- A bipedalism – 6 million years ago;
- A hand tools capable of manufacturing – 1.8 million years ago;

• A highly developed brain (neocortex and frontal lobes) – 2.5-1.8 million years ago.

On the other hand, the same behavioral adaptations initiated the development of tool use, which was later transformed into phenomenon that we now call technology and technological progress. The whole process of constituting the new adaptive strategy completed 25 thousand years ago. Since then, the further evolution of SESH becomes self-sustaining process of co-evolution of the genome, culture and technology, accompanied by a continuous and spontaneous increase in system complexity. Another, very important postulate of the disciplinary matrix of modern genetics and evolutionary theory flows because of the presence of several (at least two – genetic and socio-cultural) autonomous systems of generation, replication, and implementation of adaptive information. Along with natural selection of individual genetic determinants (genes) and organisms, essential role in the evolutionary process has the selection of social groups. The selection itself, in this case, has a multi-level hierarchical organization.

There is a periodically growing and periodically calming debate between supporters of gene-centric and organism-centric methodological approaches to the interpretation of the concept of natural selection that began with the advent of Charles Darwin's "Origin of Species" in 1859 and the emergence of population genetics (S.Chetverikoff, S.Wright, Th.Dobrzhansky etc.). The essence of the disagreement comes down to whether you can be considered a single point of application of the selection of the genetic determinants (gene) or a single individual (organism). Accordingly, can the equation of the evolutionary process to reduce a change in gene frequency (gene-centrism, the most famous representative of this methodology is Richard Dawkins) or frequencies of the individual phenotypes (organism-centric, that brightest advocates at various times have been I.F.Shmalgauzen, M.Lerner, R.Levontin).

Since the beginning of the 1960s, this dispute arouses additional caveat – group selection. In accordance with the hypothesis of group selection, expression of adaptability of definite social groups (Hamilton equation) has the form $rb + b_e > c$. Here r is the degree of relation between the subject of altruistic act and object of altruistic act; b is an evolutionary advantage of individual objects of altruistic behavior; b_e is total adaptive gain of the entire group, independent of the degree of relationship; c is individual damage of

altruistic subject incurred by altruistic act. In accordance with the equation altruistic, aimed at the benefit of group behavior is genetically determined and consists of two components that aims at the immediate families and promotes altruism genes in the population (rb), and that does not depend from the genotype (b_e). The author, William Hamilton believes that the second term of the equation $b_e = 0$. In other words, any act of altruism can be reduced to the action of a single "predisposition to altruism" gene and the existence of human social behavior can easily be explained by a change in the relevant gene frequencies (Laland, 2002; Odling-Smee, 2003, 2009).

As the term that designates this process, the "construction of niches" is a modification of an evolving system (the organism, in this case) through metabolic products, behavioral acts − innate or acquired parameters of an ecological niche − not necessarily its own. Over time, this "epigenetic drift" and / or "epigenetic optimization" of the original genotype changes the vector of natural selection and initiates the transition of the population to a new ecological niche. The evolution of organisms under the influence of natural selection contributes to an increase in their adaptation to the conditions of the external environment, and the evolution of the environment itself under the influence of organisms adapting to it, too.

So, the evolution of environment and evolution of organisms become conjugately evolving bundle. Introducing the mechanism of adaptation genesis for this bundle, we thereby change the general conceptual model of the evolutionary process, complicating the scheme of cause-effect relations between its individual components. Determination of changes in the external environment and natural selection of the process of biological and behavioral adaptation is counterbalanced by the determination of new behavioral stereotypes (within the existing norm of the reaction of available genotypes), directions of selective pressure and environmental conditions.

The described mechanism has recently been increasingly called environmental inheritance. It should, however, be taken into account that the construction of niches in this case is not connected with specific elements of replicating fragments of adaptive information. In the evolution of hominines, the significance and power of epigenetic transformations as a factor of evolution has passed a certain threshold value. The reason was the autonomy of the behavioral epigenetic transformation of the phenotype from the actual genetic (DNA-RNA-protein) mode of generation,

replication, and fixation of adaptive information to the new, socio-cultural mode of implementation of the same set of functions of adaptation genesis. Unlike environmental inheritance, cultural heredity can be correlated with specific replicators − carriers of the corresponding adaptive / maladaptive information.

The appearance of the new system of inheritance is associated with the occurrence of cumulative mechanism of behavioral adaptations in anthropogenesis by phenomenological way. Their numbers began to increase rapidly. As result the total amount of cultural and technological innovations that have adaptive significance, became more than can provide individual physiological capabilities of the human brain. Evolution of biological components of SESH lags behind rates of generation and fixing the socio-cultural innovation. In other words, the process of socio-cultural adaptation genesis is becoming so quick and successful, that becomes problem for next adaptive evolution.

The solution to this evolutionary task is achieved through the separation of social and cultural components of adaptation genesis on an individual and group levels. In other words, the efficiency of exist pool of socio-cultural, and then rationalistic adaptations provided by social differentiation within the group and the transformation of communication structure to the economic structure. A single function of communication system to ensure the cooperative interaction between group members split into cooperation and exchange. The first function provides large-scale adaptations requiring the participation of the whole group, the second one brings together the results of highly specialized adaptations implemented by intragroup clusters of individuals.

The scheme of fixing a consistent series of sociocultural adaptations no longer required conversion (replacement) of the previous socio-cultural adaptation to its genetic and biological analogue, as well as corresponding form of compulsory “genetic context” (contrary to the requirements of the Baldwin effect) as a mandatory link. The role of such context, providing adaptability appropriate (cultural or technological) innovation, in some cases can take on elements of the same (cultural and rationalist) subsystems of SESH. In other words, a dynamic equilibrium mode of Darwin and Lamarck modus radically shifted towards Lamarck one.

The existence of sociocultural inheritance creates the possibility of differentiating the functions of individuals within a social group. It opens the possibility of a significant intensification of the formation of supra-individual adaptations and competition between groups. A necessary condition for it is a system of information communication between group members. By the same logic, the existence of epigenetic inheritance – post-translational modification, chromosomal and gene imprinting, and so on – leads to a higher adaptability of cells and multicellular organisms with relatively isolated genes or gene complexes.

These two assumptions form the core of multilevel selection hypothesis, created as a result of cooperation of two American evolutionists with the same name – the founder of sociobiology, Edward Wilson and interested in the problems of evolutionary psychology of religion David Sloan Wilson. Because of this thesis, adaptability is an integral derivative of a few potentially divergent (genetic, organismic and group) acts of selection in parallel. Therefore, the frequency of individuals within a social group or cells within the body, providing a higher level of adaptability, can grow significantly faster than allowed Hamilton. As D.S. Wilson wrote several years earlier, selection of cultural types changes the parameters of the evolutionary process by increasing the potential of intergroup selection and reducing the potential of selection within a social group, compared to what one would expect if the mechanisms of evolution on the basis of proper genetic patterns (Wilson, 2002:34-35).

In their joint article, David and Edward Wilson cited the famous rule of ethics (Wilson, 2007: 345), present as an initial, fundamental postulate in any culture and in one form or another, in any common religion. The Judaic interpretation (I century BC Rabbi Hillel) it reads:

> "Do unto others as you want to be done unto you. In this is the entire Torah, the rest is just a comment".

This dogma, in their view, could not become a species-specific characteristic of *Homo sapiens* exclusively due to biological mechanisms of generation and fixation of adaptive information, which are based on genetic and / or individual forms of natural selection (Wilson, 2007: 345:

> "Selfish beats altruism within the (social) groups. Altruistic groups supersede selfish groups. All the rest is commentary").

There are a number of phenotypes that are within the structural complexity of the adaptive value of the higher brain regions and the corresponding set of genotypes that control this complexity, and both sets together formed during sapientation. Gradually multiple phenotypes in the evolutionary landscape shifted toward the maximum values of fitness. The accumulation of average values of complexity and lability of nervous and mental organization close to the maximum possible level of adaptive led to excision during sexual reproduction of genotypic variants beyond the adaptive norm. These limits are set adaptive balance between creativity and resistance to psycho-physiological stress.

The duality of the cognitive mechanisms of the formation of behavioral stereotypes of man is no longer questioned not only in the natural sciences, but also in the socioeconomic and sociological methodological paradigms (Aronson, Pratkanis, 2003). Moreover, in the most radically oriented exploratory theoretical constructions of the market theory (neuroeconomics), this thesis is one of the fundamental initial postulates. The possibilities of effective progressive genetic adaptation as further complications of organization − the "social brain" and the growth of the number of social groups were exhausted, and the role of the leader shifted to the socio-cultural component of the adaptive strategy of *Homo sapiens*. In this case, the material of the new phase of the evolutionary process is socio-cultural types that were formed precisely based on extreme variants of genotypes and phenotypes near the fore mentioned border of adaptation and maladaptation. In this way, a mechanism for changing functions arises, and psychophysiological maladaptation / pathology is transformed into socio-cultural adaptations that increase the chances of survival of social groups by this way. As the Russian evolutionist and neuroscientist S. Saveliev wrote (2012: 29-30),

> "all the additional properties of the brain that are artificially overestimated in imitation-social associations of hominines are accidental consequences of biological adaptations".

The next bifurcation point is the "change of the dominant goal" of socio-cultural adaptation from the transformation of individual and group behavior in a changing habitat to a change in the environment itself, in accordance with the already existing system of behavioral stereotypes

(genetically and socio-culturally generated and reproduced). The data of no longer physical, but actually cultural anthropology (in conjunction with evolutionary psychology and civilization theory) allows us to identify this second point of the fracture as the birth of technological civilization, i.e. approximately 17-18 century.

Like the previous transformation − the transition of the role of the leader of the adaptation of hominines from the genetic (biological) to the socio-cultural heredity, it required the achievement of a certain threshold value of the specific weight of the corresponding adaptation component in its integral meaning. The transition of this threshold in the process of bio-socio-culture-genesis meant the replacement of spontaneous "construction of an environmental niche" by "ecological engineering" inherent only in *Homo sapiens* (Laland, 2006: 306). The latter term denotes the already rational (purposeful) transformation of reality on the basis of the initial knowledge and the forecast of the future. Such a methodological intention is closer to the traditional paradigm of socio-humanitarian than natural sciences. This is the essence of the first adaptive inversion that occurred during the genesis of SESH. Outside the opposition, spontaneous / rational (Odling-Smee et al., 2010: 306), or, if you like, the antinomy "natural process *versus* intelligent design", the difference between these classes of evolutionary phenomena has no content.

Overlay multiple processes of generation, replication and fixing of adaptive information and three systems of adaptations leads to the genesis of hierarchically organized structure of multi-level selection. Each adaptation genesis level functions as a modulator for underlying level and generator of substrate blocks for higher level. Integral adaptability is derived from the number of potentially divergent acts of selection in genetic, organismic and group its forms.

Animated structure of generation-replication-fixing information is both a cause and a consequence of adaptation genesis, i.e. it forms a loop with positive feedback. A new level of adaptation genesis is built like epiboly over existing repertoire by extending the modulation of individual members of a set of adaptations / maladaptations. This set is used as a substrate for a set of emerging adaptive elements on upstream level. Therefore, the variation of elements of the underlying level fixing and expanding as a result of the formation of a new level of adaptation genesis system. "Attribution"

of adaptations / maladaptations of the elements of the source level is controlling by next level of selection. Phenomenologically, it manifested in increasing the scale and speed of evolution "pseudo-drift" of the previous level and these changes are not adequate to meet the structural transformation of adaptive data underlying level.

The "pseudo-drift" term used here because actually one level of adaptive selection projects on downstream levels own adaptive-evolutionary trends. Selectively neutral or even harmful elements of the biological module may be prerequisites for social and cultural adaptations, for example. The greater the functional distance between the levels, the more autonomous they are from each other, and it is to diagnose the connection between them more difficult.

An observer inside the system perceives the situation of bifurcation in this case as an act of free choice (free will); and the outcome of the choice depends solely on formed his system of values. This perception can`t be destroyed as a result of uniquely identifying the mechanisms and causal relationships that have led to this situation and influencing its outcome, so far as may be possible to integrate new knowledge to the original system of values.

Thus, epigenetic modulation of genetic information serves as a transfer mechanism for co-evolution of Darwin-Weismann modus and Lamarck modus, remaining themselves within the boundaries of the sphere of influence of the genetic code itself. The culture played until recently similar role of transfer mechanism from (techno)rationalist adaptations (innovation) to the biological (genetic in the biological sense of the term) adaptations.

As can be assumed, a key role in the transfer mechanism between socio-cultural and biological adaptations is played by positive and negative emotions and the so-called general adaptation syndrome (stress). Emotions are a trigger that is activated or inhibited by the magnitude of cognitive dissonance − the discrepancy between the real situation and the ideal pattern of the optimal situation that has formed in culture; and the result is a progressive intervention in reality by humans and under the influence of permanent transformations of ideal meanings given by culture. In this case, there is a clear shift towards a negative perception of the current reality. The manifestation of these discrepancies and perception of reality is the thought

form of “progress”. It combines emotional-figurative and verbal-rational elements, and the stable state of living conditions, in contrast to the evolutionary strategies of other kinds of living beings that are not related to the genus *Homo*, serves as a source of negative emotions. Positive emotions are caused only by dynamics, constant movement to a certain ideal of what in this work is called a socio-(culture)-ecological niche.

For techno-rationalistic adaptations (innovations), the analogous function of the transfer mechanism with respect to biological (genetic in the biological sense of the term) adaptations has been, until recently, the dominant system of value priorities.

Specific examples and features of the functioning of both branches of the co-evolutionary transmission mechanism will be considered below.

The autonomy of each of the three elements of a SESH led to different speed of operation cycle generation-replication-fixing adaptive information in each of them. Integrity of the system provides two co-evolutionary ligaments of its elements – gene-cultural co-evolution and techno-cultural balance.

The general scheme in relation to adaptation genesis of hominines provides regular change of phases of adaptive plasticity and stability in the transition from the individual to the population-ontogenetic and phylogenetic levels of fixation of adaptive changes. As say in a recent paper (Kuzawa, Bragg, 2012), the original adaptive response to environmental challenges affecting primarily the structure, that call biological component of SESH, i.e. phenotypic modification homeostatic processes within the existing rules of the genetic response. By virtue of the latter, such adaptive changes are highly labile and easily reversed to its original state. (According to the authors, an increase in heart rate and blood volume observed in contact with a person in a high-altitude oxygen deficiency can serve as example.) If you have a long, beyond the lifetime of one generation ecological time-trend, the initial adaptive response, reducing the capacity of homeostatic systems of the organisms to further changes in living conditions, is replaced by more resilient adaptive transformations (in the above example – the increase in lung volume, etc.). While maintaining the trend of adapting the level become irreversible.

In general, in the evolution of hominines (Shinobu Kitayama, Park, 2010), phenotypic plasticity “paves the way” and contributes to the genetic

(add – rationalist and socio-cultural) evolution in accordance with the following algorithm:

(1) Population is introduced into new environment spatially or temporally;

(2) Adaptive phenotypic plasticity provides a "fit" phenotype and the environment;

(3) Changes in the genotype replace phenotypic modification, opening the way for the subsequent phylogenetic development.

It should be noted that the described presentation actually repeated I.I.Shmalgauzen, M.Lerner et al. ideas expressed in 1940-1950 on a new empirical data and new theoretical context.

If we extend this idea to other types of biological adaptations (metabolic, primarily), it takes the following form. Initial adaptive phenotypic and epigenetic transformation moving to the level of the socio-cultural component of SESH, and then initiate the technological innovations that are already causing secondary changes of ecological and cultural environment. Thus, the phenotypic plasticity of biological component of SESH unlike traditional neo-Darwinian point of view plays a role not brake, but the trigger mechanism and enhancer of macro- and global evolutionary process. It also confirms the above conjecture that the biological components of the substrate serves as a basis for socio-, culture- and technogenesis.

However, from our point of view, it is true the converse too. There is a back-and-recursive branch from the technological and socio-cultural innovations to biological ones. It is carried out by the same epigenetic gear.

At this point, we are forced to move from the sphere of natural science in the field of humanistics (axiology). We need to find a correspondence between the phenomenological theory of the stable evolutionary strategy and the theory of values, because it is from the latter depends on the possibility of an evolutionary transition from the potential risk to the actual form and move it across the threshold of existential risk level.

First, the system by definition relates to the field of culture, which actually detects and evaluates the difference between reality and ideal reflection. In philosophy, this discrepancy constituted in two ways – as a compliance / noncompliance between the ideal cognitive model (knowledge) and reality (the object of knowledge), and between reality (existence) and its conversion project (world proper). The first binary

opposition is the content of a theory of truth, the second ones is the theory of values. Both are members of the projective-activity binary bundles, because knowledge is regarded as a tool for updating values.

It is necessary, however, to determine the nature and composition of the "values" within the concept developed. In modern axiology it is accepted to allocate two alternative concepts that reflect some evolutionary dichotomy. In accordance with the naturalistic concept, activities intention determined by multidimensional space of the interests of individualized mental subjective reflections of objective parameters of the most favorable environmental objective reality. In terms of ontology, the World of Entity and the World of Proper associates by network of causal although not necessarily uniquely relations.

Projective-activity system of intentions is determined by objective values in dating back to the writings of Immanuel Kant and David Hume transcendental concept. Thus, there is discrepancy between reality as it is and the world as it should be, and the last image (world as it should be) can`t be derived logically from the existence. As result, the values are inherent in the culture as a counterweight and antithesis of biological and economic factors of life.

Suppose that the concept "interests" (needs) and "value" reflect the real alternative aspects of evolution of SESH, in general, and its cultural components, in particular. Then, with respect to the interests culture act as externalities caused genetic; and rationalist components and values act as internalities, cultural factors caused the definition of the optimal evolutionary scenarios. Interests and values are equally equivalent to term "selective factors" in evolutionary theory, but correspond to different (ecological and cultural-spiritual) aspects of socio-ecological niches of *Homo sapiens*.

In this concept, the system of value priorities and norms act as specific for each socio-cultural type, but overlapping in its content in all types of socio-cultural predispositions that affect the final evolutionary trajectory of socio-cultural-technological anthropogenesis.

The interests and needs are reflected in the genesis and differentiation of social institutions, while the value providing internal integration mentality and continuity of cultural types. The continuity of cultural types implies that each subsequent member of the series can be inferred from the

previous member by converting its elements. Value priorities, are, rather evolutionary settings that are specificated a particular socio-ecological niche of *Homo sapiens*. They define the period of existence of the taxon. Consequently, the continuity of cultural evolution or the survival of *Homo sapiens* is not inevitable.

The problem, however, lies in the fact that the determination of the direction of evolutionary adaptive variability (interests → value or values → interests, culture → gene or gene → culture, etc.) are too ambivalent for unambiguous interpretation in theoretical and / or empirical verification. As recently wrote a well-known researcher of gene-cultural co-evolution A. Norenzayan, the first question that arises here is the following (Norenzayan, 2011: 1041):

> "What are the causal relationships between different variables (environmental, historical and psychological) and how do they interact? Determine whether the institutional structures of certain values and preferences of the individual? Or values and preferences lead to certain types of social institutions? Or is it both?"

The only thing that cannot be doubted: there is a phenomenological correlation between the phenomena of social heredity, biological heredity and socio-ecological environment, of course. At the same time, within the framework of this correlation, its adaptive nature is relatively unambiguous, partial or general. Rigidity or plasticity of socio-cultural standards and rigid or weak penalties for their violations, as recent extensive studies (33 ethno cultural types) have shown, clearly vary depending on ecological and socio-historical history. Societies that have undergone or are currently exposed to stress factors of different nature (territorial or interethnic conflicts, resource shortages, epidemics, etc.), more strictly regulate the norms of social behavior and are more severely punished for their non-compliance. It is curious that both types of socio-cultural adaptations to ensure social stability are mobilized in this case simultaneously and in parallel:

• A higher status and scale of influence of social institutions regulating these norms (determined by interests and needs) and

• A higher level of self-control and greater intolerance towards dissidents.

Thus, in the evolution of the socio-cultural component of SESH, selective factors have both an external and an internal nature that is actually reflected in the concepts of genetic-cultural co-evolution and the techno-humanitarian balance.

Even more interesting is that the importance of interval culturological factors is ambivalent in the formation of the techno-humanitarian balance as well as genetic-cultural co-evolution. It can catalyze and inhibit both the growth / decrease in overall adaptivity, and the growth / decrease in evolutionary risk.

The general methodological conceptual analysis cannot have been completed in anything other than antinomic conclusions, precisely because of its abstract nature. Let us try, however, to consider this problem in an alternative positivistic aspect, so to speak. According to the ecological niche theory, this means that culture should be a powerful selective factor influencing the organization of biological adaptations.

If this thesis is taken as the initial premise of a theoretical analysis, then the existence of a transmission mechanism by which culture influences the morpho-physiological constitution of a person and adapts the latter to itself. If so, a correlation between socio-cultural types and a variety of physiological, primarily neuropsychiatric patterns must exist.

The Russian neuro-morphologist N. Saveliev goes even further. He suggests that these differences should be structurally morphological (inter-neuronal patterns of synaptic contacts), not functional-physiological ones, since the latters provides predisposition to absorption of certain social stereotypes. While such predispositions polymorphism in his opinion serves as material for very intense selective pressure, displacing the “classical” Darwin's selection as the primary mechanism for the further evolution of human. This judgment can already serve as a verifiable judgment, making our arguments available to empirical verification. In this area in recent years, there are works that show that such correlation can indeed be detected.

An interesting observation by the author of this study: the most direct empirical data on their interrelationship of cultural and biological differentiation, including those published in European and North American scientific journals, made by researchers of "eastern" origin (China, Japan) origin (see: Shinobu Kitayama, 2010: 111;Culture, 2010, etc).

We can assume that we are dealing with the peculiarities of the particular techno-humanitarian balance. This refers to the effect of the programming of concept of the scientific research field by basic system of values and socio-cultural type of ideology and the mechanisms that will be described later. For Western researchers, belonging to the individualist-humanist cultural tradition, the judgment on the correlation between cultural diversity and neurophysiologic ones and (even more so) the genetic polymorphism is associated with significant disturbances in the system of value priorities; and such hypothesis is displaced to the borders of theoretically and empirically valid and the "politically correct" scientific research therefore.

So, let us remember that, first, it will continue on hypothetical reasoning, based on a rather poor experimental base now, and secondly, the theoretical basis of this hypothesis is quite vulnerable in terms of the external (extra-scientific) view criticism and ideological and political speculations.

Nevertheless, the very existence of technologies for the manipulation and management of genetic, socio-cultural and cognitive codes (High Hume) makes prospects for such research inevitable epistemologically and in demand socially (Cheshko, 2009).

Obviously, the initial phase of the transfer of the original socio-cultural adaptive pattern to the phenotypic modification of the adaptive response and then to the coding part of the genome presupposes the epigenetic transformations of the functional organization of mental processes and the structural organization of the brain. The influence of culture on brain activity is mediated by regular long-term participation of certain clusters of neural networks in the implementation of a specific set of cultural tasks that are behavioral scenarios intended to achieve "primary cultural value". Primary cultural values in this context determine the position of the individual in the system of intra-group social communication. in other words, serve for personal self-determination, consistent in the system of coordinating individual and group interests adopted in a given culture.

Such a coordination system, firstly, provides a stable adaptive configuration of individual and group selection forms, and, secondly, is specific for different cultural types. So, in the Western socio-cultural type, the autonomy (independence) of the individual, and in the eastern (Chinese) cultural type − the integration (interdependence) of the individual into the system of social relations are the dominant elements. Activated of neural

clusters (specific for the culture) provide cultural adaptations, allowing a person to organically fit into the performance of "cultural tasks" (Shinobu Kitayama, Park, 2010: 111; Chudek, Henrich, 2011: 221).

This term refers to individual elements of the cultural tradition that perform discrete functions within a given socio-cultural type and, thereby, ensure the implementation of this system of value priorities. In a weaker form this judgment comes down to the determination of a system of value priorities together elements of cultural tradition, considered as a means of updating them.

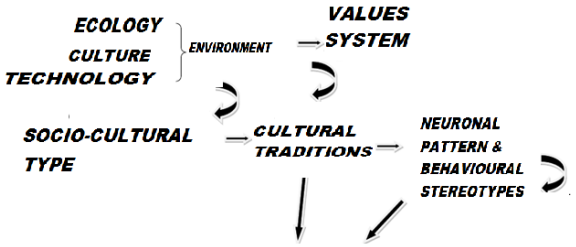
As such, this judgment seems more uncertain in a logical and more are realistic in the historical and empirical aspects. For carriers of Western culture activation of the medial prefrontal cortex areas of the brain and for the representatives of the Eastern, culture ventral area are diagnosed. Researchers associated with this functional divergence cross-cultural psychological characteristics: the intention of representatives of individualistic Western culture on positioning in the zone of personal psychological communication of individuals and the intention of oriental culture to the definition of communication space by socially determined personal limitations. This psychological difference defines behavioral and perceptions stereotypes that shape the relationship of the individual and society.

Clustered differences of neural networks relate to communication structures linking neural domains, of course. Genetic reaction norm of transport and reception of neurotransmitters (serotonin, oxytocin, dopamine) separate neural networks, ensuring the development of emotional reactions changes are also. As is known, these neurotransmitters are involved, in particular, in the formation of social communication (Kuzawa, Bragg, 2012: The Evolution and, 2015; Culture, 2010). This anatomical structure of the brain remains constant.

There are results of a study specific expression of individual structural units of the human genome in the brain during development of alcohol dependence that serve as indirect proof of the principal possibility of the existence of epigenetic transmission mechanism of socio-cultural influences on expressiveness of individual gene clusters. (Unless, of course, the postulate of a significant proportion of socio-cultural environment factors in incidence of alcoholism in the population is correct.) It is shown a

decrease the activity of DNA methylation and, therefore, significant changes in the expression of functional gene clusters in the human brain because of regular intake of alcohol. These changes correlated with progressive alcohol dependence. Thus, per sonal behavioral traits do reflect on the specific patterns of gene expression and functional status of the local regions of neural networks. (The question of a possible deterministic nature of the relationship remains open.)

In parallel, this hypothesis is reinforced by a line of arguments in cultural anthropology proper. One of the classics of evolutionary culturology, Leslie White defined culture as the ability to generate symbols that matter to their bearers (White, 2004: 22). In this conceptual and terminological space, symbols can also be defined as sensory complexes or their collections that activate differentiated genetically determined patterns of dynamic behavioral stereotypes. The latter must have adaptive significance, and the adaptive meaning of each behavioral pattern determines the fixation or elimination of the corresponding symbols in socio-cultural evolution. In other words, individual symbols or their complexes represent generated adaptively significant fragments of information that play the role of a transfer mechanism between genetic and socio-cultural inheritance. As we can see, the structure of explanatory models in biological and cultural anthropology surprisingly organically coincide, and able to fit into the performance of "cultural tasks" (Shinobu Kitayama, Park, 2010: 111; Chudek, Henrich, 2011: 221).



GENE AND CULTURAL COADAPTATION

Fig. 1.5. A block diagram of the transmission mechanism of the descending branch of genetic and cultural co-evolution.

Culturally specific social norms serve, or can serve as an important selective factor in relation to the functional elements, and, possibly, structural organization of the genome.

> ”Socio-ecological processes regulate the expression of human genes by activation of the central nervous system, which subsequently affect the activity of hormones and neurotransmitters in the periphery”, –

this hypothetical thesis expressed in publication on 2009 (Cole, 2009:133), over time is consistent with the increasingly numerous empirical data. Thus, a vicious co-evolutionary loop, and it is far from (biological or sociological) reductionist linear approximations.

The authors of the cited studies (Shinobu Kitayama, Park, 2010: 111) it consider the following assumption to be quite reasonable. Members of polymorphic genetic series that are unevenly distributed in populations and are belonging to different socio-cultural types. They interact with a specific ecological and cultural environment. The result of this interaction is a single set of relevant cultural and psychological practices and psychological processes patterns and clusters of neural networks adequate to them. The organization of mental processes in the brain and the associated with them neural pathways are hidden behind cultural changes and form, possibly, a basic set of mechanisms for mutually influence of culture, ecology and genetics each other. This conclusion follows from the cited research (Shinobu Kitayama, Park, 2010: 125-126).

Thus, the organization of each link of the transmission mechanism between socio-cultural and biological adaptations can be represented in the form of a parallel-sequential three-stage scheme that described here (fig. 1.5).

Another variant of the transmission mechanism between culture and adaptability draws the Czech-Canadian research group (Chudek, Henrich, 2011). However, in terms of its basic system of organization, this scheme is similar to the above. There is also the same three-cascade co-evolutionary bundle; at this time it is the psychophysiological (individual), intra- and intergroup communication components. The output of this co-evolutionary cascade of three parallel processes of adaptation genesis is, according to the

authors' terminology, positive or negative "psychological standards". Positive norms are benchmarks that guide the activity of the group towards a common goal (functional analogue of directional selection). Negative-restrictive regulations, taboos and rituals of their support are implement the function of stabilizing selection in biological evolution.

Under the scheme, the initial stage of gene-cultural co-evolution was presence of socio-cultural and environmental preconditions of the process. Rapid changes in the environment and group life and their means of software (biological pre-adaptation or exaptation) are among them.

A process of accumulation and integration of specific cultural means of survival and inter-group competition is initiated because of the embryonic forms of social heredity. Latters can be considered as the beginnings of modern techniques and technologies – tools, construction of dwellings, and use of fire, livestock and crop production. All of this requires the formation of a specific environment to operate and maintain – a means of communication, psychological norms and mythological explanatory model. In his book "Bonobo and atheism: in search of the origins of humanity among primates" famous evolutionary ethologist, F. de Waal defends the hypothesis that the mythology, religion, morality is a socio-cultural amplifiers of "pre-created" by biological evolution behavioral patterns, whose impact on cumulative adaptability proved to be insufficient in the new circumstances. As a sequence of evolutionary phases of the functioning of the transmission mechanism between bio- and culture evolution should be interpreted "morality precedes religion", de Waal statement (Waal, 2013:5).

This position shared by other proponents of evolutionary adaptability of religion (Norenzayan A., 2013) and is close to the authors (Glazko, 2013). But in our view, it is more correct to speak about the autonomy of social and cultural components of the original coadaptive ligament. This algorithm of the relationships between genome, culture and rationality can`t called reductionist ones. Rather, we are talking about the ascending branch of building a hierarchical, self-complicating system, which subsequently closes as a result of the downward flow of adaptive transformations from technology to genome. We see classic Hegelian (more precisely – a triple) helix rather than a linear inductive or deductive syllogistic structure.

So, in the general system of complex cultural adaptations, new, verbal-logical elements are emerging and rapidly expanding. It constituted over time as mythology and religion.

This element requires the development of relevant departments and structures of the brain and patterns of neural networks and their components as its substrate material. Functional differentiation of the cerebral hemispheres on the left, verbal and logical and right, emotionally-image hemispheres stimulating the development of socio-cultural component of human adaptation genesis (see: Cheshko, 2012). As we note, the "psychological norm" remarkably correspond to "cultural problems" of the previous model. Probably the difference between them is explained by different angles, under which all these phenomena are projected on abstract theoretical constructs of evolutionary theory – social and neurological in one case and socio-psychological in the second ones.

Surprisingly, the socio-cultural adaptation and socio-cultural inheritance provides both:

• High rate of generation and dissemination of cultural innovation as vertically (between generations), and horizontally (between the members of the social groups and between social groups);

• Conservative and high resistance to destructive factors of socio-cultural types over time, often regardless of the area and preserve the integrity of the communication structure. Examples of conservation of cultural self-identity in the diaspora are sufficiently numerous and for all diversity "actors" very striking (Jews, Chinese, Gypsies, etc.).

At the same time, socio-cultural and rationalist adaptation do not fully fit into preexisting systems of biological adaptation. An emerging differences between them varies in magnitude, but in general are permanently expanding, as noticed already on the 19 century by Friedrich Nietzsche. As a result, a problem of harmonization and integration into complete system components of SESH arises.

On the one hand, epigenetic processes provide the substrate basis for sociocultural adaptations, serving them as building material suitable for transformation into cultural innovations. However, they also allow to culture to play the role of trigger reformatted genetic response from one mode of another in accordance to exist cultural and environmental context. Thus, between biological and socio-cultural level of adaptation genesis, a

cycle positive and negative feedbacks (gene-culture co-evolution) arises. A similar system (the techno-humanitarian balance) arises between culture and technological innovation.

In this case, the cultural inheritance, first, forms repertoire modules of socially demanded scientific and technological developments; second, changes the probability of spontaneous actualization of specific epigenetic module; and, thirdly, actually performs the individual selection of biological adaptation. The process is induced by culture selection of genetic information; and it is equivalent to the replacement of cultural adaptation by their biological counterparts.

The autonomy of each of the three system-forming elements of the SESH entails different speed operations in different cycles of generation − replication −fixing of adaptive information. In particular, the socio-cultural component of the evolutionary process takes place at a much higher rate compared with the biological component. As a result, there are such elements of culture that do not correspond to the condition of an increase in the frequency of genes providing the greatest possible biological fitness; and they can be spread.

The above argument is also valid for the other binary bundles of culture-technology. In the context of significant reserves of resources that could be used as a means of survival, dominance of rationalist adaptation provides better survival of society appropriate types. However, technological innovations entail a mismatch between the behavioral patterns that have developed in the type of culture, and the terms of technologized environment. This imbalance is potentially more and more intensified and is transmitted further, to the peculiarities of the biological constitution, the genome clusters controlling them, etc. The peculiarities of this imbalance were analyzed at the beginning of the last century by famous Russian-Ukrainian-French biologist Ilya Mechnikov in his famous dilogy "Etudes of human nature" – "Etudes of optimism":

> "The human descended from some ape inherited an organization adapted to the conditions of life very different than those in which he has to live. Gifted with a much more developed brain than its ancestors of animals, people discovered a new way to the evolution of higher creatures. Such a rapid change in the nature has led to a variety of organic disharmonies which gave the more feel that people have become smarter and more sensitive. Hence –

> a whole string of misfortunes that poor humanity is trying to eliminate all the means available to him (Mechnikoff, 1988: 233).

However, the source and mechanism of this imbalance had be presented as unambiguous and linear, and in linear model its individual manifestations are not interdependent and relatively easy to solve by technology:

> ”Morality, therefore, should not be based on a perverted human nature what it is now, but on an ideal, i.e. such what it should be in the future. First of all, you should try to restore the proper evolution of human life, i.e., disharmony turn into harmony (orthobiosis)” (Mechnikoff, 1988: 236).

Since that time, it becomes clear that the mechanism of adaptation genesis of *Homo sapiens* is constant, and that the occurrence and elimination of local imbalances is “internally integrated” into a stable adaptive strategy of our species. Consequently, the possibility of developing progressive loss of adaptability is imminent ones.

The integrity of the organization of SESH should be considered in two time dimensions – evolutionarry (populational, social) and ontogenetic (individual).

Let's start with the second (ontogenetic) aspect. Any information system must include an operator – a specific structure that implements and regulates the decoding process of stored and newly generated information. In relation to the genome, this system is represented by a set of processes for the implementation and epigenetic modification of the expression of genetic information. The system of direct and feedback interaction of cultures and genome comprises some elements.

- Firstly, there is the influence of ecological and cultural environment on the epigenetic processes and selection of genetic information. If the mechanism of cultural selection is obvious, the cultural effects of epigenetic information began to accumulate only in the last decades. For example, it is known that epigenetic modifications of parental behavior, diet, etc. can be transmitted to future generations (Shatalkin, 2009).
- Secondly, there are the mental processes and phenomena that contributes to the formation and spread of certain images, which can be converted to a different extent in the verbal and logical form. These images

are in the form of intentions and predisposition to guide the development and channelizing of techno-rationalistic adaptations

Let us turn to the evolutionary aspect of the integrity of SESH. It is saving from disintegration by embedded in her generalized mechanism of co-evolutionary interactions – gene-cultural co-evolution (E.Wilson, R.Doucins) and techno-cultural balance (John Naisbitt, A.Nazaretyan).

The finished paradigmatic concept of techno-cultural (techno-humanitarian) balance established at the turn of 20-21th centuries by Russian sociologists A.P.Nazaretyan (2013). However, prototypes of this idea have been expressed for many years as an alternative to the paradigm of technological determinism. (The author of this term is Thorstein Veblen (1857–1929), an American sociologist.)

The concept of technological determinism was particularly popular in the early twentieth century and had a marked effect on a certain part of the researchers belonging to the Marxist philosophical tradition. One of the most prominent Marxists who tried to introduce the concept in the conceptual framework of the Marxist version of sociological theory was Karl Kautsky (1910).

Among other megatrends of the emerging information civilization, J.Naisbit pointed out the following.

> "The world moves towards dualism technical progress - spiritual comfort, when each new technology is accompanied by a compensatory humanitarian reaction" (Naisbitt, 1984, 2013:8).

The technical progress provides the coordination and harmonization of the binary bundles of biological and socio-cultural components of the integrated adaptation of *Homo sapiens*, the peace of mind provides the same role with respect to the culture and technology.

The concept of co-evolution as a conjugate evolutionary development of biological (and not only) objects of varying degrees of complexity turned out to be applicable to phenomena of several levels of life organization,

from molecular genetic structures[2] to population and eco-systems[3] and socio-genesis (Rodin, 1991).

However, the genesis of the phenomenon of co-evolution associated with the formation of interdependent evolved systems. Direct exchange of information is impossible or at least difficult and rare between them. In this case, there is a mechanism for mutual adaptation of these systems and their integration into a new holistic unit. Such a mechanism is realized in the form of biological evolutionary process of natural selection. This co-evolution is a necessary condition of origin of holistic systems of various levels of complexity and of different nature, with their own specific forms of homeostasis. Such systems include genomes, eco-system biosphere, societies and so on.

Recently, some researchers prefer a clarification to the theory of gene-culture co-evolution to emphasize the leading role of cultural evolution in the binary sequence of "biological adaptation" – "socio-cultural adaptation". To this end, they propose to use the concept of "culture-driven gene-cultural co-evolution" (Richerson, 2010).

The authors of the modern version of the theory of "evolutionary niche construction" K.Laland and J. Odling-Smee reformulated this thesis in a stronger form (et al., 2010:137) –

> "cultural practices shaped the human genome".

In their opinion, in perspective, gene-cultural co-evolution:

1. Provides opportunities for synthesizing the results obtained by human genetics and evolutionary theory, with data from anthropology and archeology;
2. Require the creation of new hypotheses;
3. Lead to a broader understanding of the human evolution ultimately.

Thus, a bio-reductionist interpretation of the concept of gene-cultural co-evolution is removed. The latter initially replaced "genetic-cultural co-evolution" with genetic reductionism in the understanding of both its

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[2] Evolution of coding and regulatory molecular genetic structures, during which the genome is formed as a concertedly acting set functionally differentiated genetic determinants

[3] Interaction of a species that are members of the same the same eco-system

supporters and almost all opponents. In fact, everything is much more complicated.

Equally, and as incorrectly, we could say on cultural, cultural and ecological, social reductionisms with respect to epigenetic paradigm. In an extreme variant, it degenerates into vulgar Marxist economic reductionism, which reduces all the features of the cultural and ecological environment to its economic component.

If there exists a "cultural-directed gene-culture co-evolution", then there must be a "genome-directed gene-culture co-evolution, i.e. the influence of the genetic context on the formation of a cultural type and the diversity of its elements. In this case, the culture, so far as it contributes to survival, is forced to "take into account" the effects of the genotypic environment in which it is formed. Obviously, the same can be said for the other components of the co-evolutionary ligament – techno-humanitarian balance. As one can assume, the connection of generation and selection of technological innovations is mediated by the cultural environment, therefore the transformation of the genome into an object of technological manipulation is uncompensated by feedback biological adaptation → technological innovation.

Let us give a popular and an impressive example of "directed by genome gene-culture co-evolution"that is use features of our visual analyzer in painting (Livingstone, 2000). *A priori* it seems obvious that the prevalence and success of an artist is determined by a combination of three components, namely,

- The correspondence of the design of the images he creates to the socio-cultural context,
- The use of the peculiarities of the organization of perception of new visual information for achieving the maximum aesthetic and emotional response and
- The technological innovations in the technique of painting with for the same purpose.

Relative autonomy of each of the elements of this triad excludes the possibility of an adequate reduction of the artistic significance of the work of art exclusively to the action of cultural-aesthetic, technological and biological factors. However, within the framework of the concept we are

developing, the “evolutionary success” of the artistic direction can be described by the cumulative effect of two integral parameters:

1) A combinations of physiology of perception and technology of painting and

2) A possibilities of integration into the common system of value priorities and cultural meanings.

As Margaret Livingstone, in particular, claims, “La Giaconda” of Leonardo creates an emotional association with a deeply rooted in culture a mysterious female soul's image. Leonardo uses the colors of the part of the spectrum that is perceived primarily by the peripheral receptors of the eye. Therefore, it seems to the viewer that the expression of a woman's face disappears under close observation.

Similarly, for a long time, the tendency to depict a human face at a certain angle dominated in portrait painting, as a result of which the image of one of two eyes appeared in the center of the canvas, while the image of the second eye was slightly shifted to the side (bimodal display). It is supposed to achieve several simultaneous effects at the same time: fixing the viewer's attention on the facial triangle most relevant to the individual's identification (binocular vision serves as a sign of biological species in which hunting and attack play an important role in behavior); activation of non-stereoscopic vision systems for assessing spatial depth (muscle accommodation); the selection of the most contrasting areas of the human face. It is even possible that the propagation and integration of painting into culture gave adaptive “meaning” to the anomalies of the development of the visual analyzer. According to Livingstone, there is the violation of the parallelism of the optical axes of both eyes that should facilitate the artist's ability to transfer the depth of the image on a flat surface of the canvas using muscle accommodation (muscle memory).

The investigator assumes that this particular feature was characteristic of Rembrandt van Rein and is found on most of his self-portraits. If this is the case (the hypothesis is rather controversial), then this anomaly (strabismus) could make a definite contribution to the formation of the skill of the painter and his technique of painting; had to be even more common among prominent artists than in the average population (Conway, 2007). In case of confirmation, this guess will serve as one of the falsifiers of the

concept of the bio-semantic component of anthropogenesis, i.e. coevolutionary semiosis.

Finally, the estimation of spatial depth by the magnitude of muscular accommodation is associated with the constant movement of the eyeball and could serve as a physiological stimulus for the development of the technology of impressionism painting with a characteristic shift of perspective for different areas of artistic image.

According to some experts, for the course of anthropogenesis, the key adaptively significant behavioral stereotypes and models are (Laland et al., 2010:140):

1) A training as the transfer and dissemination of socially significant experiences and elements of culture and learning abilities and ways of its implementation (strategies);

2) A mode of nutrition, in particular, the consumption of milk during the whole life cycle;

3) An evolution of language and symbolic systems of coding and communication;

4) A ability to intellectual activity, personality features;

5) Culture-supported preferred use of the right or left hand and associated functional asymmetry of the nervous system;

6) Development of cooperation and altruism as behavioral modus and forms of activity;

7) A formation of markers of social and ethnic identification and self-identification, and system of formation of emotions, which promote maintenance and observance of norms of social life;

8) A repertoire of admissible and inadmissible norms and stereotypes of sexual and reproductive behavior, in particular the relation to incest, bisexual asexual, homosexual and heterosexual methods of its (behavior) realization; and

9) A system of sexual preferences that direct or limit the boundaries of the formation of sex couples and the prevailing vector of sexual selection (see for more details Butovskaya, 2013);

10) Behavioral norms that determine the frequency and expression of signs of infanticide and / or parental care.

The evolutionary history of all these behavioral modes originates in cultural innovations that are distributed in the population through sociocultural inheritance.

In all of these spheres, genetic (biological) signs and determinants act as prerequisites for the genesis and the result of the evolution of the corresponding cultural or behavioral elements simultaneously.

At present, the induction by the cultural and techno-genesis of fixation in the human gene pool of human genetic, monogenic or oligogenic determinants seems to be quite reasonable and reasoned for some phenotypes. It has demonstrated for the constant lactase and amylase activity in human ontogenesis (The evolution, 2012), sickle cell anemia and other hematopathies, absence alcohol dependence (Dudley, 2014),

homosexual male behavioral activity (Barthes, 2013), intention to reduce emotional tension in interpersonal relationships conflict, development center of speech and so on.

Evidence of such cultural induction of genetic determinants selection in human populations has been obtained in the last two decades and their number is multiplied with each passing day. *A priori* one can assume only two evolutionary mechanisms by which the socio-cultural module implies the propagation of genetic adaptations in human populations:

- The acquisition of pathological signs of group adaptive value due to the culture-induced changes in lifestyle (sickle cell anemia and other hematopathies in areas of tropical irrigated agriculture - as a consequence of an increase in incidence malaria), and
- The transformation of highly adaptive biological signs into pathological ones for the same reasons. As examples, Crohn's disease, psoriasis, are the result of hyperactivity of the immune system (The Evolution, 2015).

Let's take a look at some examples of the "co-evolution of a culture-driven gene culture" in more detail. The development of molecular genomic technologies made it possible to revise the thesis on the termination or inhibition of biological selection as a result of the genesis of sociocultural and technorationalistic components of anthropogenesis, starting from the Pleistocene. With the help of these techniques, traces of selective pressure show human biological signs. Since 2009 (Cochran, Harpending, 2009) the alternative thesis of a sharp acceleration of the evolutionary biological process is becoming increasingly popular and justified (Fieder, Huber.2016). There is a need for the logical compatibility of this statement and the unconditional lag in the rates of evolution of the biological module from the speed of transformations of socio-cultural and techno-rationalist modules. This fact made the very existence of the process of genetic-cultural co-evolution extremely elusive. In the future, we are able to find a satisfactory explanation by the evolutionary dichotomy of evolution into selective and semantic components.

According to paleogenetic data, there are the gene-determinate changes induced by culture and they have become tangible during the so-called Neolithic revolution − the transition to agriculture and cattle breeding (O'Brien, 2012). As a result of the Neolithic revolution, two new

fundamental attributes prevailed in the evolutionary mechanisms of anthropogenesis. These new evolutionary trends are the "conscious" (techno-rationalist) components of adaptation genesis and the adaptively significant increase in the size of social communities due to not only demographic growth but to intergroup integration processes also (Grinin, 2007:65-67).

Creation of agro-eco-systems as a new ecological niche of *Homo sapiens* initiated changes in the course of socio-cultural development, creating prerequisites for the formation of early forms of the state. It was a systemic adaptation, the significance of which was to ensure the coordination of individual forms of activity in a technologically determined, more pronounced correlation between the size of the social group and the group's adaptability.

The cumulative effect of technological and socio-cultural evolutionary factors triggered a cycle of triple helix. The initial change in the behavioral complex created a new structure and a new vector of evolution of interspecies contacts, and a new physical environment of human habitation. In turn, it changed the vectors of selective pressure with respect to individual genes. The resulting biological adaptations required the inclusion of new elements in the technological scheme of agriculture. The formation of the new techno-cultural and environmental niche of *Homo sapiens* has become a self-sustaining process.

The same scheme can be interpreted in a different aspect as a mechanism of the trigger switching of adaptive evolution vectors from the sphere of culture-genesis to the sphere of biogenesis or technogenesis. Cultural innovation creates a new ecological niche, which forms a provocative background for generating and fixing secondary cultural transformations. If the latter prove to be ineffective, the cycle of searching for technological solutions that modify the habitat is included. (In the subsequent stages of the evolution of SESH, the sequence is reversed, and attempts to find a technological solution precede a change in culture.) If this also turns out to be inadequate, the turn of the reorganization of the genetic constitution comes, bringing it into conformity with the new environment in the expanded metaphorical meaning of this term .

Paleoanthropological data allow us to isolate several core load-bearing elements of the biological component of this process. There are adaptation

to a diet with a predominance of carbohydrates, milk as the main source of protein components in the diet, formation of immunity to new parasites and pests, weakening the complex of means of protection from species that, on the contrary, came out of areas of frequent human contact.

However, these transformations involved not only changes in the frequency of genetic determinants of lactose metabolism and its regulation in ontogenesis in parallel to the development of dairy cattle breeding, on the one hand, and carbohydrate metabolism in parallel to the development of agriculture, in general, and hematopathies in parallel to the development of irrigated agriculture and, as a consequence, the expansion of the range the spread of malaria, on the other hand. Equally important was the increase in the frequency of the FOXP2 gene associated with the development of speech abilities.

Let's recall that a Russian mathematician and philosopher N.N. Moiseeff (2000) proposed a hypothesis that during the Neolithic revolution the direction of the genetic component of anthropogenesis split up. Pastoral tribes needed constant movement in space, the search for new pastures, and the conquest of new territories. Adaptive strategy of similar tribes was unlimited expansion.

Agricultural civilizations accumulated in the valleys of the rivers, while the existence of society presupposed tight restrictions of aggressiveness and the ability to unconditionally submit to those who occupy a higher position in the social hierarchy of individuals in conditions of high population density. An adaptive strategy in this case meant harmonizing relations with the natural and socio-cultural environment. The socio-cultural transformation of biological aggression will be conservative in this case, i.e. there is conservation of the created agricultural infrastructure from the external threat. In any case, "military force" as a component of an adaptive strategy should arise at relatively late stages of the formation of SESH.

According to archaeological data, mass graves appear with traces of violent death from various types of weapons in the era of the Neolithic technological revolution (Waal, 2012:874).

Thus, "risk genes (genes of adventurism)" and "passionate" genotypes should have accumulated in cattle-breeders, and alternative alleles should have accumulated in agricultural ethnos. For example, the features of the Japanese national character − emotional restraint and the desire to weaken

emotional tension in interpersonal contacts − are due, probably, to the high incidence of one of the alleles of the gene controlling the reception of serotonin. This particular feature of the Japanese gene pool has a socio-cultural explanation − the rigid pressure of selection for the integration of an individual into a rigid system of social connections (Chiao Joan, 2010). a Prerequisite and an element of adaptation of the ancestors of modern man to socialization were changes in the structure of the genome, which contributed to the reduction of conflict within the group. It occurred approximately 40 million years ago.)

However, genomic studies of behavioral moduses in modern human populations have made significant updates to the scheme of N.N.Moiseyeff. One of the most likely contenders for the role of the gene of adventurism or risk gene is DRD-4 (Schinka, 2012), which is related to the dopamine receptor in the brain cells. It turned out that this genetic element at one and the same time carriers in one of its variants is able to ensure the aspiration for obtaining new sensory information, while others are the cause of the development of the syndrome of diffused attention in children. This gene is fairly widespread in populations of primates (Bailey et al, 2007: 23-27). The initial, provided by biological heredity signs (hazardous stereotypes) were subsequently "redistributed" to new, already socio-cultural adaptive elements, which also played the role of "romantic" stimuli of female reproductive choice.

Evolution with the change of functions could continue further into a sphere further remote from the initial biological units of adaptive transformations. An analysis of the individual variability of market strategies is evidenced by the researchers (Cesarini D. et al., 2009; Benjamin et al., 2012) that the predominance of risk aversion or reliability in modern society obviously correlates with the presence in the genome of numerous genetic elements with a weak effect. The ratio of behavioral modes is determined by the additive mechanism, in this case.

How powerful and ambiguous is the epigenetic transformation of the expression of genetic adaptation under the influence of the socio-cultural component of SESH is evidenced by relatively recent attempts to find the correlation between the presence of the DRD-4 element and the "predisposition" to liberal political ideology (Settle et al., 2010). In fact, such a straightforward reductionist interpretation is unlikely to be substantiated.

Rather, we can talk about the relationship of ease of social adaptation to a specific social context and the presence in the genome of certain elements. In other words, the given data speaks about the dynamics of the realization of free choice, and do not determine the results, but only the probability of political self-identification. In the framework of our proposed concept, such interpretation indicates the mutual conjugation of various components of SESH.

Cultural traditions of collectivism, hierarchy, obedience and cultural secrecy for external influences in the social group are potentially related to the prevalence of the "short" 5-HTT allele that provides transport of the neurotransmitter serotonin through the synaptic gap. In all likelihood, the selective advantage of this allele is the biological adaptation induced by the culture, which in turn ensures the social stability of society, which is in conditions of social or environmental stress a long historical time. The reason for this is the increase in the development of manifestations of depression in individuals "dropped out" from the system of social communication, as a result of violations of accepted social norms, migration, etc. It can be said metaphorically (and this is confirmed by direct observations) that within the framework of an individualist-oriented cultural tradition, the frequency of such alleles that impede personal initiative should be lower than in socio-cultural types, oriented to the prevalence of collectivist interests over individual (Mrazek et al., 2013; Norenzayan, 2011).

An alternative hypothesis does not contradict the data described above. It generally relates the socio-cultural balance of egocentric (individualist) and cooperative (collectivist) cognitive intentions with the "binding" of each of them to the neurophysiologic complex of testosterone- and oxytocin-ergic processes. In accordance with this concept, the cascade of psychophysiological reactions determines alternative types of social behavior of an individual (Crespi, 2015). Manifestations and strength, as well as adaptive meaning, each of these cascades depends on the socio-cultural context. The obvious conclusion from the above is, that socio-cultural adaptations "uses" the biological features which are present in the population, as a substrate and the mechanism of its own implementation. This thesis is fully fits into the concept of a three-module SESH.

Thus, N. Moiseyeff's hypothesis fits into the general scheme of anthropogenesis, as well as the existing database of molecular genomics.

The hypothetical constructions, starting with the idea of N. Moiseev, do not contradict, but rather complement and deepen data on the connection of the peculiarities of the mentality of Eastern and Western cultures with systemic technological innovations. One of the most important socio-psychological differences between Western and Eastern civilizationi is the dominance of analytic rationalism and individualism in the Western mentality, and holism and communitarianism (collectivism) in the Eastern (Chinese, Japanese) mentality.

At phenomenological aspects, Oriental thinking focuses on the study of relationships and communications between objects of reality, which more closely corresponds to the module of social intelligence. In Western thinking, a substantive approach as the search for specific "entities" of the same objects dominates. These features are clearly diagnosed during psychological tests. In particular, the composition of a certain set of objects (for example, a rabbit, a dog, carrots) into separate groups by carriers of Western culture by the criterion of similarity between them (rabbit, dog), and the eastern one by the presence of links between them (rabbit, carrot) is made predominatly.

According to the data of the international group of researchers, the same patterns are observed within each type of culture. The "holistic" type of responses predominates in areas where rice is the main crop, which seems quite understandable, given the above. The "analytic" type of response is dominated by immigrants from those areas of China where, wheat was used as basic crop culture, with the proximity of the ethnic composition of the population. In this case, the minimum necessary degree of social coordination of efforts and, accordingly, the minimum size of an effectively functioning (competitive) "production team" was significantly smaller (Talhelmet et al., 2014; Henrich, 2014). Probably less attention and effort could be spent on maintaining the agro-ecological system of growing wheat in comparison with rice.

So, there is a mutual conjugation between the social structure and the cognitive processes occurring in the psyche of its members, and this idea receives a rather broad empirical confirmation. The consequence is the emergence of socio-cognitive homeostatic systems (Nisbett et al, 2001). The

basic parameter and, at the same time, the adaptive-evolutionary function of them we will denote the term techno-humanitarian balance in the present study.

The subsequent techno-cultural innovations were layered on the initial impulse of the gene-cultural and techno-cultural co-evolution, initiated, in turn, by the Neolithic revolution, which was a systematic cultural-technological innovation. One of the adaptive divergence lines of socio-cultural and rationalist adaptations led to the emergence of technological civilization. This systemic adaptation within the evolutionary-psychological paradigm is characterized by several basic value priorities (Henrich J., 2010: 61):

1. *Western* (analytical-holistic) type of mentality;
2. High social status of theoretical and vocational *Education*;
3. *Industrialism*;
4. High level of individual *Riches* in population;
5. *Democratic* political system.

Thus, all the listed socio-psychological intentions (WEIRD as the first letters of the English names of these attributes) dominate in the West civilization, which is an insignificant part of the original pool of cultural types and, indeed, "weird", rare. But with the growth of its influence, it becomes the owner of a sufficiently high contagious part of the socio-cultural inheritance. In other words, this cultural type can spread to other cultures as a result of "contagion when in contact" with other types of societies.

However, in the high "infectiousness" of technological civilization, there is also economic, political and military coercion, since it by the fact of its supremacy compels competing socio-cultural types "to accept the rules of the game", which are inherent to WEIRD-sociocultural (civilizational) type. These considerations, however, do not exclude alternative scenarios of sociocultural or civilizational evolution, and the result of competition between them is not inevitable from the very beginning. The formation of a multicultural system and the adaptive radiation of its constituent sociocultural types can be such alternative outcome in the presence of complex "ecological" relations among civilizations.

An example of this is the current configuration of the macroeconomic relations of the East-West. Technological innovations as ideas and their

material incarnations are produced, mainly by the West, assimilated by the East and returned to the West in the form of end products of consumption. This configuration itself is subject to global evolutionary changes as a result of the exhaustion of the possibilities of extensive economic growth that is being devised by the resources of the biosphere.

In addition, the contagious modification and, as a consequence, evolutionary convergence and parallelism in socio-cultural adaptation genesis does not mean, however, the necessity of the emergence of twin cultures. There are new socio-cultural types, characterized by incomplete analogy with the type while maintaining systemic originality. Quite often, this occurs as a result of the combination of individual elements of Western and autochronic cultural heredity (for example, Confucianism and Marxism) with an additional modification adapted to the local conditions.

We have reason to suppose that culture is based on already existing genotypes in the population, forming in the simplest case a binary adaptive bundle, and, in the future, they become a substrate basis that provides replication and distribution of adaptive elements of culture.

An example is the depletion of the genome by genes that provide the ability to cleave potentially dangerous physiologically active substances of plant origin. This phenomenon arose as a by-product of the Neolithic revolution. The transition to agriculture brought many plant species from among the foods consumed and significantly reduced the adaptability of the detoxification genes, and, as result, number of their copies in the genome. Thus, the sensitivity to the effects of these substances on the human body became more pronounced and productive. Later, these very similar genotypes "opened the way" to the means of folk phytotherapy and scientific pharmacology. Otherwise, these complex sociocultural and technological adaptations would be less effective, their fixation in social groups would either be impossible, or it would be mainly due to the exclusively biological module of SESH much slower (Wade, 2016:337-340).

The same can be said about the binary bundle of a genetically determined decline in the sensitivity of olfactory receptors, which took place at the same time, and subsequent development of perfumery. The latter turned out to be an adaptive response of culture to social evolution. There is regulation of the emotional state of an individual through the

persistence of psychophysiological reactions to smells, and it lies at the heart of this co-evolutionary bond. Without a combination of these two features (the low sensitivity of the olfactory analyzer and the differential psychophysiological response to its irritation with specific odors) perfumery would hardly have received wide development without having a physiological foundation.

Thus, the developments of culture is based on the already existing features of the biological module of SESH and, so to speak, "use" them for own "survival". For example, in the cultural development concept of Oliver Morin (Morin, 2015), cultural traditions are supported and disseminated not because of their adaptive superiority, which is rational perceived and transmitted through mimesis in the course of communication, but due to a connection with congenital cognitive predispositions. In evolutionary psychology, the formation of co-evolutionary links between the socio-cultural and biological modules is exploited through a model of the motivational mechanism (Schaller et al.. 2017). From this thesis several conclusions follow, namely,

- The genes that define contemporary human populations are the product of a long history of evolution by natural selection;
- The human nervous system typically develops according to a recipe encoded in those genes, and
- "Human nature" can be characterized as comprising psychological mechanisms that exist because they facilitated genetic reproduction.

In our opinion, it is a simplified explanatory model.

First, the evolution of the structure of SESH obviously plays the role of both mechanisms –

- The spontaneous emergence of further propagating by imitation of the elements of culture, that "appealing" to pre-existing in the population of cognitive preferences (socio-cultural module), and
- The construction of new elements of reality based on rationalistic cognition of reality (techno-industrialist module).

Secondly, there is a link between genetic (and epigenetic) controlled traits and cultural innovations in the set of "cognitive preferences", which is more important for the evolutionary process at the stage of generating these innovations; and then, its co-evolutionary function is transformed in the direction from initiation to stabilization of cultural elements that have

acquired adaptive significance. If the spread of cultural innovations is determined not by their adaptive value, but only by the biological component of human nature, then we have the phenomenon of sociocultural drift, similar to genetic drift.

Finally, socio-cultural innovations can form complex adaptive associations around the elements of the biological module. (We call them "co-evolution nodes".) An example is the system of "social hormones" (oxytocin, vasopressin, prolactin, etc.), acting as regulators of various physiological and biochemical functions in the body, but directly or indirectly "tied" to the provision of a whole range of behavioral responses that regulate communication at various (from individual to interspecies) levels of social organization (Shalev, Ebstein, 2013; Zhukov, 2014, Vol. 2:60-88). Each of the social hormones is associated with providing the most diverse elements of the socio-cultural module of SESH, and, currently, the most well-known of them is oxytocin. Characteristically, most of them evolutionarily were associated with the regulation of the sexual-reproductive sphere of mental processes.

Thus, the motivational model is adequate only for the first phase of the formation of a human evolutionary strategy. As the network of elements of the socio-cultural and techno-rationalistic modules becomes more complex and the inter-modular communications become more complicated, the role of the system-forming element has shifted to the socio-cultural module, and now it moves on to the techno-rationalist one.

Adaptive nodes, because of their complexity, are sources of co-evolutionary conflicts and evolutionary risk caused by the diversity of the elements of the socio-cultural module associated with them. Because of this, adaptation genesis can impose constantly tightening demands to the biological adaptive element located in the center of such a node. Indirectly, this is evidenced by numerous pathologies and dysfunctional disorders, and its main causes are associated with social hormones. Throughout this research, we have repeatedly touched this topic as illustrations of our explanatory model.

As recent computer simulations show (Stern, 2010), the accumulation of risk genes is unlikely exclusively as genetically controlled adaptation through biological selection. The situation is changing in the case of a parallel system of socio-cultural inheritance and socio-cultural (group)

adaptations. The reason is the inclusion of this mechanism of generation of adaptive information to the Lamarck modus. In this case the adaptive effect cumulatively accumulates in a number of generations, "pulling" the genes that support it. A necessary condition is the existence of a socio-cultural mechanism that redistributes the positive effect of a vulgar risk behavior on the whole group.

Sociocultural in origin population dimorphism by genes and phenotypes of risk superimposed on older sexual dimorphism on the same signs. Above all, the risk genes were supposed to have adaptive significance for the male. It is due to the functional differentiation that the hominines had created within the social group. The transfer mechanism, which provides for the growth of group adaptation, can consist, for example, in the structure of family and marital relations. It is possible that such genetic-cultural bonds act as factors of ethnic differentiation and social mobility.

The "Genghis Khan haplotype" (Zerjal et al., 2003:5) is one of the most impressive, though not undisputed in terms of the reliability of the above interpretation. An international team of researchers (Britain, Italy, China, and others) published in 2003 data of analysis of mononucleotide replacements in the Y-chromosome of people living in the vast area of Asia, once part of the Mongol Empire of Genghis. According to the results of at least 8% (approx. 16 million people) of the population of these areas has a haplotype, which goes back to a very small group of founders of male sex. The study authors have identified this group as the namely Genghis Khan and his immediate family, although this attribution is conditional one, of course.

From the point of view of classical Neo-Darwinism, this phenomenon can be attempted to be explained by the action of genetic drift, i.e. stochastic oscillations of gene frequencies in populations. In accordance with this explanatory model, the personal characteristics of Chingiz Khan and the peculiarities of society can`t be the reasons for such significant contribution to the gene pool of subsequent generations.

The most adequate analogue in such an interpretation would be a "founder effect" ("bottleneck"). It is defined as a pronounced drop in the level of genetic variability or its shift (asymmetry of the distribution of gene frequencies) as a result of a marked reduction in the population size. Then the gene pool of the new population is formed by a very small group of

individuals and the probability of accidental fixation increases dramatically of someone specific genotype in the population.

With such an explanation, two circumstances do not coincide and do not allow to accept it unconditionally reliable or at least "in the first approximation" as a working hypothesis.

Firstly, we are not dealing with pure population wave numbers, but with the geopolitical and socio-ecological determinate long process of growing and proliferation the initial population in the other ones to form a new mega-population (miksodem), which occupies a huge area and has a very complex genetic structure. In particular, such mega-population consisted of a system of local populations strongly expressed asortative mating. "The descendants of Genghis Khan" had in the mega-population reproductive advantage, determined by more and longer as not so much genetically but socially, or culturally. Therefore, to talk about the effect of the founder, as well as an over-the adaptability of the genome of Genghis Khan, at least is not correctly.

Secondly, the progenitor (ancestors) of this haplotype was obviously some inherent characteristics or personality traits, consisting in the ability to subordinate their influence masses of other people, the charisma, and the ability to withstand severe physical and emotional stress to achieve this goal (passionarity). These features cannot be considered indifferent to selective pressure.

Within the framework of the SESH concept, the interpretation of the obtained data is reduced to the fact that the totality of the personality traits of the progenitor of this haplotype was associated with the co-evolution inherent in the social organization of the Mongols. These personality features were genetically, epigenetic and socially constructed traits. They were the so-called "social elevator", whereby owners of this haplotype got an incredible in terms of classical evolutionary theory adaptive superiority. Adaptive advantage in this case is absolutely does not match the purely biological adaptability of the individual without regard to the gene-cultural co-evolutional tandem. In fact, because of the SESH structure, we are witnessing a phenomenon that looks similar to the founder effect or genetic revolution, but it is an example of genetic evolution guided by culture. That is how we must understand the conclusion reached in a recent article that

Genghis Khan Haplotype is a prime example of social selection, moreover, it is no longer unique (Chuan-Chao Wang, 2013:7; Balaresque P. et al., 2015).

Evidence of a sharp imbalance in the level of genetic variability of the female and male in the period 4-8 thousand years ago was obtained in another study (Karmin et al, 2015) by the analysis of samples of nucleotide sequences of mitochondrial DNA and Y chromosome. During this period, the effective number of the male population is sharply reduced, which indicates a significant decrease in the number of men actively participating in the breeding process. "Failure" in the level of variation and effective size of the male population was synchronous to Neolithic revolution. According to the authors of the observation, the most probable cause is the cultural changes in the demographic structure, family-marriage communications, the social status of individuals due to their economic situation, and so on. All of them, according to the authors of the study, led to the spread of reproductive success beyond the limits of one generation, by reconstruction of the main trends of genetic evolution as a result of the mechanisms and laws of socio-cultural inheritance. The haplotype of Genghis Khan is only the most impressive particular manifestation of this general pattern

Thus, the selective space of evolution of the biological module of SESH becomes a derivative of the evolution of the socio-cultural module. The meaning of this thesis is that socio-cultural heredity acts as an "amplifier and signal modulator", enormously increasing the magnitude of the initial variations of selective differences of a particular genotype and extending the time of the adaptive advantage far beyond the physical existence of this genotype.

A "calmer" example of the socio-cultural enhancer of the evolution of the SESH biological module can be gleaned from the works of the American anthropologist Napoleon Chignon. He found that the great "sociability" of the men of one of the Amazonian Indian tribes, cultivating a high degree of male aggression towards the tribal neighbors in the formation of killer coalitions, increases their reproductive success and promotes the spread of the corresponding genes (Chagnon, 1988, 2000). In this case too, the nature and mechanism of biological selection varies considerably according to the "socio-cultural context".

It leads to a remarkable conclusion. There are sociocultural module of SESH and sociocultural inheritance as a means of ensuring it, which change

the meaning of the biological interpretations of the concepts of "adaptability" and "selection". Both concepts become derivatives of the sociocultural context not only in the humanistic, but also in the objectively-evolutionary meaning. Thus, there is a translation of a complex adaptive significance of information fragments from biological sphere to the sphere of socio-cultural inheritance. Cultural inheritance transforms acts of selection and extends it beyond a time frame of existence of selected genotypes and beyond their biological fitness. Saved in the cultural traditions, the "avatar" of individuals determines the trend of evolution of the population in the biological and genetic sense of the term, or when the biological adaptability or maladaptive of concrete individual genotype are no longer essential.

This thesis has long been considered a true in humanitarian conception of human nature. In recent fundamental research on history of human corporeality claimed that "fake" phenomena of consciousness, representation, beliefs, psychosomatic effects, change the meaning and direction of the historical process. Designed culture model becomes the internal laws subordinating himself corporeality and its evolution (Korbin et al.,2012:5-6). But it is not always easy to transmit these humanitarian influences on the language of the biological component of anthropogenesis. However, it does not mean that there are no such influences. Ultimately, they become a reality. This becomes evident as paid to the subject of technological progress.

Let's return to the theme of our investigation. Obviously, Western civilization appeared as a result of the collision and integration into a single bio-social system of agrarian and pastoral cultures.

As a result of this evolutionary transformation, a qualitatively new adaptive strategy could emerge. It can be called "strategy of sustainable expansion". The combination of the conservative protective elements of agricultural civilization with aggressively assimilatory "mems" of pastoral tribes formed a socio-cultural homeostasis system, based on harmonization of opposite effects.

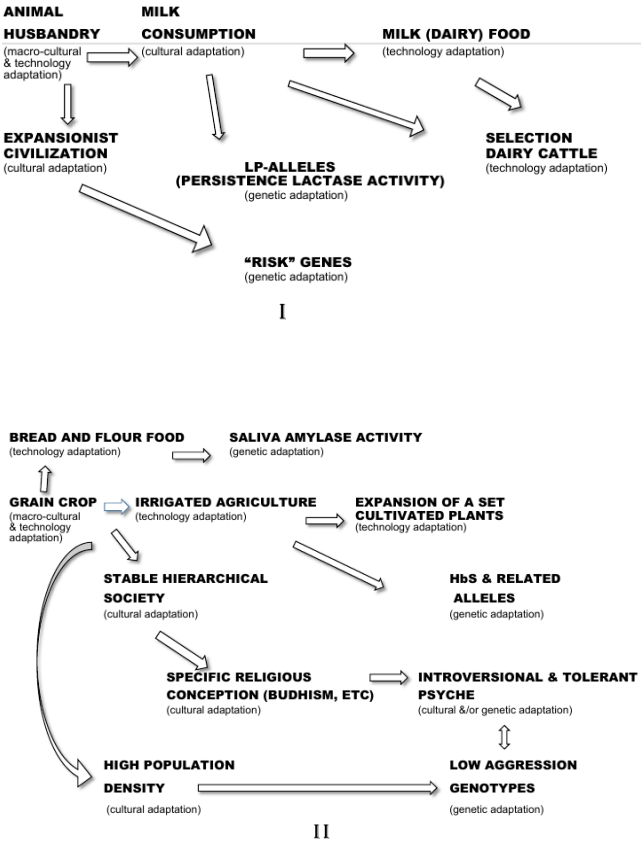

Fig. 1.6 – Formation of gene-culture-technology complex adaptive process of livestock (I) and agricultural (II) types as a result of the Neolithic (cultural) technology revolution.

This was the germ of the modern technological civilization. The logic of relations with other tribes and habitats in general became an invariant ensuring the survival of Western man in an environment where natural resources and opportunities for self-healing biosphere far surpass human

needs. Under these conditions, natural hazards and social risks overcome because of the further expansion and deepening of cognitive-reform human activities in time and space.

There is new version of the adaptive system dichotomy, which combines ideas N.Moiseeff and modern adherents of theories of niche construction and gene-cultural co-evolution (fig. 1.6). We note that this scheme is diachronic in nature and some of its elements formed and fixed at different times and in different regions. However, a common feature of the mechanism of formation of an integral complex adaptive marked rather clearly. Namely, macro-evolution transformation as combination of cultural, behavioral and rationalist elements stand the source of initiation of the impetus for the formation of this complex.

Then a cascade of gene, cultural, and techno-cultural innovations-adaptations of lower rank develops. (Strictly speaking, we are talking about several cascades that are parallel in time, but not in the multidimensional space of the adaptive landscape.) Thus a number of functional modules is formed. The system of interconnected modules in their organization and structure is holistic nonlinear complex of specific "programmed" by original macro-evolutionary transformation of adaptations The conclusion follows from the mathematical model of the process (O'Brien, Bentley, 2011: 9).

The evolutionary trend is strictly deterministic and predictable in the period between such macro-evolutionary innovations. At the same time, the initial macro-evolutionary innovation is a quantum leap between adjacent vertices of the adaptive landscape (accordingly to the concept of punctuated equilibrium of S. Gould). In other words, the mechanism of functioning of SESH corresponds to more emergent model of evolution (Lamarck Modus) than the additive accumulation of various micro-evolutionary adaptations (Darwin-Weismann modus).

The following output appears unavoidable. Relatively long evolutionary trends are forming to reduce the adaptability of one such module due to the growth of adaptability of another, as result of the parallel and hierarchical modular organization of SESH in combination with several autonomous systems for the generation and replication of adaptive information. Such trend in the present study will be called the "evolutionary risk". The

conclusion is supported by the arguments of the theory of programming and computer science (Banzhaf, 2014; Leier, 2014).

Presented here scheme (fig. 1.6) is broadly consistent with the concept (Lucock et al., 2014:78) of "Darwinian evolutionary medicine" of Australian group of researchers. In their scheme, the parallel development of several cultural and technological innovations (cattle, farming, traditional and modern way of life) led to conflict between individual genetic clusters of biological module of SESH and, as a consequence, to the evolutionary risk formation.

We note in passing that these schemes provide for the possibility of alternative adaptive anthropogenesis trends at the expense of the elements of the various modules of SESH.

For example, the genesis of dairy farming (by the complex of socio-cultural and technological adaptations) creates a potential dichotomy in the subsequent course of adaptation genesis. The first possibility was connected with the fixation in the population of lactase enzyme variants with a constant level of activity in ontogenesis (genetic adaptation). Alternative adaptive trend consisted in the implementation of technological innovations, involving, in one form or another, the use of lactose fermentation products, especially cheese-making (technological innovation). Both evolutionary trend turned milk into a food resource and both were realized in the evolutionary history of *Homo sapiens* – with a time lag in the 4.000 years (cheese-making appeared earlier), and 5.000 years after the "livestock variant" of Neolithic revolution (Gamba et al., 2014).

Long-term effects of genetic conflicts within the biological module of SESH and between biological module on one hand, and the technological and socio-cultural module on the other hand stretched out on the millenniums.

For example, change the usual way of eating (diet), typical for the man to Neolithic revolution, caused modifications in the metabolism of lipids, proteins, carbohydrates. These modifications manifest in late and postproductive age. Therefore, they are closed to the biological form of natural selection. As it is considered now, an increase in the frequency of cardiovascular (strokes, heart attacks, atherosclerosis), oncological pathologies, diabetes II, etc., are linked to it. In addition, there is also an imbalance of sexual sphere, reflected in the divergence of the timing of the

menstrual cycle and other components of puberty women. All of that is the apparent magnitude of the evolutionary trends of inherent in the type of Western industrial civilization risks.

Details of these issues are set out in a recent book by the Swedish nutritionist, adept evolutionary medicine S.Lindeberg (2010); the genesis of "diseases of civilization" as general result of co-evolution of the human genome and culture investigate in the book of Daniel Lieberman (2013) too.

Both researchers consider the transition to a non-fruit diet determined by sociocultural heredity as a systemic factor reformatting the structure and meaning of the relationship between biological, behavioral, and, consequently, extragenetic adaptations. As involves the last of these authors (D.Liberman), most common in human populations currently pathologies is the consequence of "evolutionary errors", i.e. discrepancy between posed by socio-cultural and technological adaptations to habitats and pool of biological adaptations to not by culture has formed ecological environment.

Added to this, in our opinion, culture-ecological ethnic differentiation is obvious, too. The importance of this differentiation repeatedly increases with respect to the consistency of co-evolution links between biological, socio-cultural and techno-rationalist modules of SESH as result of the emergence of "hybrid" socio-ethnic formations, the integration of immigrants in the new socio-cultural adaptive complex, etc. The adaptive value of biological, socio-cultural and technological elements in their complex determines by the "communicative code" that changes significantly, as a result. Positive adaptive correlation within specific constellations of elements of culture, technology and genetics are replaced by negative and vice versa.

With certain reservations, we can talk about the evolution of "semantics", and "sense" of gene-cultural co-evolution and techno-humanitarian balance. In the future, we will try using argumentation of these researchers to justify semantic concept co-evolution as an explanatory model of gear mechanism between modules of SESH.

There are a rating of reduction in adaptability of some elements of SESH upon reaching a certain threshold zone of values or a passing a similar threshold of changes in the ecological-cultural environment. These parameters are capable of spasmodic growth requiring an immediate adaptive response as the solution to the problems of survival. Such jump, in

fact, is the actualization of evolutionary risk. One symptom of this actualization becomes systemic effect, i.e. spread beyond the initial module to the other components of SESH. So, the above-mentioned diseases of Western civilization transformed from a purely medical (i.e., related directly to biological module) problem to the sphere to guide the evolution of the socio-cultural module including the area of the economy.

So, sociocultural transformations are reflected in the frequency of the corresponding genes; and the numerical predominance of certain genetic determinants is an additional condition for the stabilization or instability of the general direction of historical development.

Initially, social and cultural heredity provide ecological and biological balance of the genus Homo. The separation of technological innovations as independent forms of adaptation has seriously transformed this function beyond the initial level of adaptive response. Actually, technological innovation creates many potential and actually existing socio-cultural adaptive complexes.

First, the impact of technological innovation reflected in the progressive "filiations" of social structure. The Neolithic technological revolution violated the "normal" sexual dimorphism, in addition to the biological effects, leading, above all, to a change in the daily diet (the appearance of milk, carbohydrates, etc.). The male sex provided greater access to resources (Foley, Gamble, 2009).Thus, the dominant trend of social and cultural evolution of the relations between the sexes was permanently predefined.

More complex, but especially prominent examples of the functioning of this evolutionary mechanism are the evolutionary origins of symbolic speech and religion. The conditions and mechanisms of its genesis have become apparent in recent decades thanks to the synthesis of achievements of science and the humanities. Thus, the researches of D. Bickerton of (2012), M.Tomacello (2011) and S.Bourlak (2011) were devoted to the origin of language and speech in 2011-2012 only. The trigger mechanism for initialization of the development of modern symbolic speech became proto-cultural (behavioral) adaptation to reducing the area of tropical forests and, as a result, the food supply base, according to a widespread hypothesis. The adaptive response of our ancestors had be the change nutrition sources, and more specifically, the transition to eating the remains of hunting of large

carnivores and, then, the transition to a new ecological niche. The evolution of repertoires of morphological signs and behavioral stereotypes that were pre-existing in populations of hominines given a new direction associated with the activation of inter-individual and social communication progress.

Hominins have double potential and, in particular, a projective competitive advantage in a new ecological niche as the realization of a long evolutionary trend. First, it consisted of the ability to feed itself freshly killed prey of predators, bypassing the stage of "ripening" (a softening of the skin of the bodies of dead animals). Secondly, hominines were able to use as a source of nutrition bone marrow, poorly available to most scavengers. Both possibilities opened thanks to the tool activities.

Update of the potential of adaptability has been caused by the social organization and the ability to communicate effectively within the social group, i.e. the ability to "mobilize" and coordinate the actions of the members of the group for the safeguard and "utilization" of prey.

So, a symbolic communication played the role of socio-cultural adaptation along with science and technology afterwards. All of it started branching cascade of adaptations within the same component of SESH, one branch of which led to the replacement of the initially dominant, facial and gestural communication system by initially marginal, sound communication. Features of the latest communication system contributed to the acquisition of the properties, which N. Chomsky, known American linguist called the movable reference. This term means the absence of a rigid binding of the objective situation to the emotional state of the individual reporting this information (Barulin, 2012). N. Chomsky idea of binary structural and functional organization of the human voice becomes dominant in the modern theory of anthropogenesis.

As suggested in one of the hypotheses (Jablonka, 2008: 2153), language is a communicator, which generates a code, the plan, outline the basic coordinates of sensual image used by the interlocutor as an armature for the construction of a parallel mental image in their own psyche.

If you follow this assumption, the initial stage of cultural development was initiating or "provoking" imagery that correlated with certain behavioral acts or their complexes in the psyche of the hominines. The source of such images (thought forms) could be genetically and epigenetically programmed psychophysiological processes (Pinker,

2004:3). For example, it may be imprinting, impressing (Efroimson, 1995:79-81); communication with other individuals (Christiansen, 2008:489) and their combinations.

The other hypothesis (Dor, 2011; 149: 2153), and, more precisely, its original postulate, is the third explanatory opportunity. A language is arbitrary conventionalist innovation as an example of the systemic rationalist adaptations itself in the same line with tools of labor, the use of fire, plant growing and animal husbandry. In this case, the adaptive value of the symbolic-syntactic organization of human languages, with its inherent ability to recursion, is manifested in conjunction with the effectiveness of gun activity, the social organization of socio-cultural inheritance (the role of grandparents as custodians and translators of cultural tradition), inter-individual intra- and inter-species communication, etc.

Obviously, hominines are characterized by a rather "soft" ability self-identification as members of the social group or biological species. This contributed to the expansion of communication links to individuals beyond their own social groups and own species. The semantic component of adaptation genesis thus created a specific adaptive landscape or socially organized species occupying similar ecological niches. In such a landscape, with the similarity of intra-group communication, a trend arose for the formation of stable co-evolutionary relationships with representatives of the genus *Homo* (self-domestication). In this case, the semantic component was transformed into a classical selection form with the passage of time. The proof of the co-evolutionary-semantic nature of this trend is a sharp increase in genetic variability. This phenomenon the Russian researcher D.K. Belyaev called a "destabilizing selection" at one time (Markel, Trut, 2011).

The reason for destabilizing selection is the acquisition of a high status of a "friendly" attitude by individuals of the domesticated species in the system of human value priorities. This attribute receives phenotypic expression only in the case of destruction of a genetically determined complex of adaptations oriented to its own, rather than co-evolutionary survival. Their basis is "self-stranger" recognition (Hare, Woods, 2013). When contacting representatives of a foreign group, and even more so, individuals of other biological species, a complex of stereotypical reactions of avoidance or aggression develops. The destruction of this system of "social immunity" is results in the absence of a protective reaction in contact

with such individuals. Hyper social behavior is the main symptom of the so-called domicile syndrome, or Williams-Beuren syndrome (Shuldiner et al., 2017). This created the basis for the domestication of animals (the Neolithic revolution). In principle, the same co-evolutionary communicative mechanism acted also for relations between the sexes within the group, since the latter inherited rather different reproductive strategies. Thus, *Homo sapiens* can also be considered a result of self-domestication (Theofanopoulou et al., 2017)[4].

In general, this idea is surprisingly consonant with the general conceptualistic scheme of the investigation. Of course, it's just a suggestion, its possible rebuttal will not affect the verification of our own theoretical constructs at the moment, although in the case of the confirmation may be seen as a beautiful argument in their favor. Thus, the subsequent evolution of the described causes the formation of thought forms of cultural inheritance, rationalist thought and language.

In the process of anthropogenesis, conditions could arise for transcoding of initial outside-verbal emotional complex in verbal-logical form. As a result of rationalization of the adaptive significance of thought-forms, the latter becomes a proper interpretant which is both a means of transferring adaptively significant information and mental (ideal) model of reality, an instrument for forecasting and transformation of not behavioral acts only but reality itself too. This model doubles the contour of co-evolutionary interactions body-environment, generating adaptive innovation. Thus, it becomes part of our concept of a key prerequisite for the genesis of SESH rationalist component.

In the development of this concept, it is postulates the existence of two, expressive and linguistic systems of coding voice information, in one of the last works of Japanese-American research team (Shigeru Miyagawa, 2013: 1-6).

Like the singing of birds, expressive system creating a holistic image of the emotional state of the individual and can`t be divided into separate fragments of information.

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[4] On the role of inter-species communication in the process of domestication of animals as a system-forming factor of sapientation, see: (Shipman, 2010).

Linguistic system is complex of relating to the type of subject − predicate combinable elements. Their combination creates human language, which is based on such a way is a binary bunch / opposition of two ways of encoding and perception. In accordance with the quite plausible hypothesis, two-system module in the neurological organization of mental processes should exist too. They may manifest themselves in the organization of cognitive and structural-adaptive stereotypes.

The opposition of linguistic and expressive co-evolutionary subsystems is related to the process of SESH becoming. As already mentioned, the sociocultural component plays a leading role in the mechanism of adaptation genesis, which is associated with the appearance of the prediction of the future by individuals and social groups. The latter involves the generation of new knowledge about the world. In principle, the source of such knowledge can have a threefold evolutionary origin:

1. The instinct, i.e. genetically programmed behavioral response to an external stimulus;
2. Reflex, i.e., the occurrence of acquired behavioral response, formed on the basis of recurring situational associations in accordance with the "*post hoc*, ergo propter hoc" simplest cognitive algorithm;
3. Explanation, i.e. cognitive model acquired by a verbal and logical abstract thinking.

This scheme reveals the fundamental, rather even substantial dichotomy, which led to the final separation of the genetic-biological and sociocultural component of SESH and the corresponding mechanisms of the adaptation process of *Homo sapiens*, very clearly. This dichotomy has biological roots, preserved within the socio-cultural component, and served as a necessary and sufficient condition for the emergence of technological innovation as a fundamentally new in the latest mode of adaptation genesis. The essence of this dichotomy is the division of the original generation of adaptive type information into two, spontaneous (attribute of Darwin-Weismann module) and teleological (attribute of Lamarck module) ones. The reason for the dichotomy in this aspect is rationalization (implementation of verbal and logical form) of adaptation genesis of hominines.

In neurology, the dissociation of psycho-physiological mechanisms between the loss of musical abilities (amusia) and the loss of already formed (aphasia) or congenital (alalia) speech abilities has been diagnosed. The

differences between them reach the level of anatomical structures that are responsible for their occurrence. As result, it quite reasonable assumption that the perception and reproduction of speech and music is associated with the existence of two alternative ways of perceiving and processing information (Peretz, 2006; Dediu, 2013:7).

The idea on the inheritance by *Homo sapiens* speech and language from Neanderthals (Chuan-Chao Wang, Hui Li, 2013:7) seem as extreme controversial one. As the authors themselves note, most researchers are inclined to believe that the mutation that served as the genetic basis for the formation of modern linguistic diversity took place 50-100 thousand years ago. Having moved this date back to ½ million years ago, we thereby add speech to the list of sociocultural adaptations that have crossed the species reproductive barrier.

However, the very appearance and subsequent discussion such hypotheses are symptomatic phenomenon in the scientific discourse. The ancient concept of innate ideas of Plato and Descartes was not so much contradicted to experimental data and theoretical constructions on our time. Anyway, in modern theoretical cognitive science, as in the modern technological training scheme, there are enough successful concepts emanating from the recognition of the existence of two forms of knowledge of objective reality, make possible the survival of the media in this reality (Sweller, 2011: 3) –

- the primary, ideas biologically inherited by an individuals as a result of earlier evolution, and
- secondary, knowledge acquired because of rational organized and controlled cognitive activity of a person.

Obviously, it is the latter form of the organization of knowledge, so to speak, in its pure form, that determines the way to implement technological innovations, as the third component of SESH.

However, the adaptive value of knowledge *a priori* involves the elimination of all possible behavioral acts, except one in each standard problem of survival. The existence of a greater number of potentially behavioral acts with equal opportunity for realization creates a situation known in the logic under the name “Buridan's Ass”.

Additionally, the behavioral adaptive stereotypes fixed as a result of such selection should not contradict to already accumulated stereotypes that

form a pool of adaptive reactions within the SESH framework. Thus, there is a need for a neuropsychic mechanism for the for removing of such conflicts by eliminating of the elements if they are not compatible with existing ones. In cognitive psychology, such a mechanism is called "cognitive dissonance" (Festinger, 1999:3). It means the feeling of emotional discomfort in the event of a conflict between two parts of knowledge that simultaneously present in consciousness. *A priori*, new elements of explanation and prediction may relate either to the "innate ideas" of Plato and Rene Descartes, which are a genetic in origin, or to "empirical and spiritualistic experience" that is socio-cultural in origin. In any case, if these elements of mentality contradict a certain set fragments of adaptively significant knowledge, arising cognitive discomfort is enough psychological stimulus for their elimination or suppression. Elimination of such elements of culture and psyche occurs up to the possibility of their selection for adaptability (Perlovsky, 2013).

On the other hand, the very fact of socio-techno-anthropogenesis, (scientific and technological progress, growth in volume of scientific knowledge, quality of life, human longevity, etc.), testifies that the progressive evolution of culture and science is still possible. Moreover, consequently, there is a mechanism of "surviving" of cultural and cognitive innovations. It make possible a fixation them as new elements of the adaptive complex.

A possible explanation is that such mental innovations are preserved as elements of an expressive speech subsystem based on the emotional brain that is evolutionarily older structures of the central nervous system. Information complexes of this system are not capable of linguistic division and reconstruction, which allows them to act as an information repository of potential socio-cultural adaptations. Recessively, cohesion and similar genetic phenomena play such a role in the biological module of SESH.

Similarly, religiosity is a consequence of the structural and functional organization of the human psyche and, in parallel, the basis of sociocultural adaptation, which ensured along with speech progressive sapientation of human ancestors.

In the human mind, there are a number of concepts (ideas of God, including) whose genesis is associated with the interaction of two information systems. In the humanities and in philosophy, these systems are

called spiritualism (spiritual culture) and rationalism. They act for each other as complementary, figurative-emotional and verbal-logical (discursive) substrata. The evolution of mentality forms trajectory having two nodal points corresponding to the domination of religion or rationalism in spiritual culture (Cheshko, 2012: 439).

The problem of the rationalistic justification of religion in modern science is represented by two alternative, evolutionary-epistemological and metaphysical-ontological methodologies. Both methodologies are inconsistent in a logical aspect.

In the evolutionary-epistemological aspect, religion and science turn out to be equal and alternative supporting structures of the stable evolutionary strategy of humankind. Their balance provides stability and adaptive plasticity of the evolutionary anthropogenesis vector.

To both socio-cultural adaptations (speech and religiosity) equally belong to the comments of D. Bickerton (Bickerton, 2012:117):

> "Initially being a behavior[5], which led to changes in genes, it turned into a series of genetic changes triggering new behavioral changes."

Ultimately, these behavioral transformations are freed from direct dependence on the evolution of the genome and acquire their own replicators and their own evolutionary modes.

[5]We add genetically determined and evolutionarily conditioned behavior − Auth.

CHAPTER 2.

GENESIS of STABLE ADAPTIVE STRATEGY of *HOMO SAPIENS*

Valentin T.Cheshko, Valery I.Glazko

"The history of our species is a stream of discoveries – major
and minor – which have allowed us to progress and direct, to some extent, the course of our evolution".
Sarah Chan (Grimm et al., 2013: 49)

The general scheme of the genesis and development of structural organization fits well with SESH, in "Tektology" o A.A. Bogdanov (Malinovsky) and the "triple helix" as two variants of general systems theory, separated in time ¾ century.

In accordance with the tectological concept (Bogdanov, 1989, vol. 2:208) evolution of self-organizing systems is a regular alternation of two phases – conjugation (C) and demarcation (D). First, conjugation phase is a cycle of disintegration – integrating external to the system or its component connections and relationships. The result is the expansion of the evolving system, and this system is expanding the scope of its influence on the new elements and the complexity of the structure of the newly formed meta-system.

Demarcation phase is a process of internal structuring of the evolving system, accompanied by the differentiation of the functions of its constituent elements and the complexity of the connections between them.

In fact, as already noted, we are dealing with the description of macro-evolutionary process involving complex systems, regardless of the substantial nature. So, here it is well within the Thomas Kuhn scheme of

theoretical scientific knowledge, where there are two successive phases in the development of science:

- evolution phase that is the actual expansion of the pool of objects that serve as the application of this paradigm (disciplinary matrix);
- revolution phase that is potential expansion of the application pool object of scientific theory as a result of the change of scientific paradigm.

The result of this process will be pulsating expansion of the applicability of successive scientific theories, that is to say, the expansion of "environment niche" of theoretical discipline.

Actually, in anthropology, the same patterns we observe in the genesis of SESH. The chain of successive ecological and evolutionary crises has resulted in pulsating expanding the limits of ecological niches and areal of *Homo sapiens*. The transition from one expansion cycle of ecological niche to another was associated with the transformation of the internal structure of SESH that is transfer of a leading member of the adaptive strategy in the direction of biological adaptation to socio-cultural adaptation and after to rationalist innovation. The amplitude of the expansion of the boundaries of the human ecological niche is determined by the efficiency (i.e. speed of adaptation genesis) corresponding component of SESH. The separation of each from the existing members of the triad of SESH began with the expansion of controlled contact to the environment of hominines (complication of ecological niche (S-phase) and ends with a change in the internal structure (D-phase).

Most modern scholars, anthropologists and evolutionary psychologists believe that individuals belonging to the biological species *Homo sapiens* are born with a built-in system of gene modules that provide the ability to assimilate the reproduction of social and cultural components of the adaptive information. In other words, every human being has an innate ability to learning to tools and ways of inter-individual and intergroup communication.

Within the framework of SESH theory, social and cultural heredity uses as elements of the maintenance and reproduction of their own organization "building blocks", that are biological components of SESH. An alternative view, there is postulates that the genesis of social and cultural inheritance is

provided by exclusively own internal mechanisms[6]. In this case, the absorption of the encoding system and "instrumental support" (language, reading, writing) of a communication are accompanied and, at least – in part, provided by biological component of epigenetic transformations of SESH.

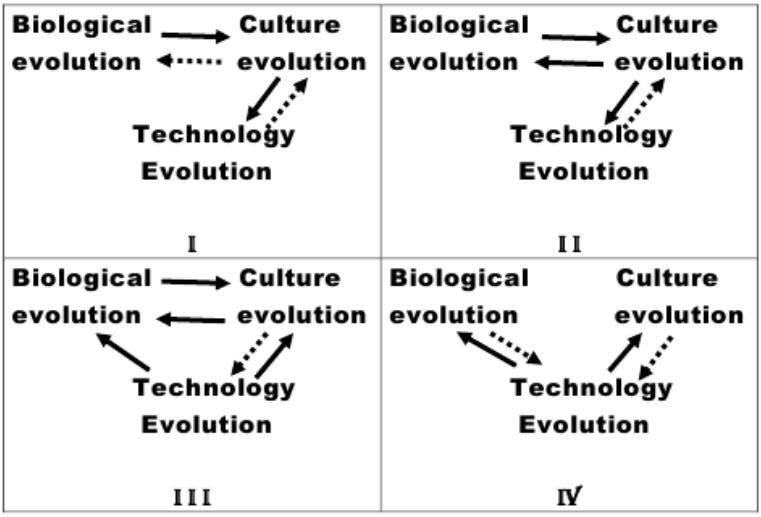

Fig.2.1 Four phase structure evolution of hominines stable adaptive strategy and mechanism of the genesis of the phenomenon of evolutionary risk

There is a second (socio-cultural) in parallel to biological (genetic itself) system of the generation-replication-implementation of adaptive information; and time of occurrence of it is a complex problem for theory of anthropogenesis now. In scientific publications, circulate the three most commonly used hypothesis about the place and time of this event (Powell, 2009: 1298; D'Errico, 2011: 1060).

First, attention is drawn to the synchronicity appearance of anatomically modern human constitution and the explosive spread of the techno-cultural

[6] More two hypotheses set out in article of Cecilia Heyes (Heyes, 2012)

artifacts, suggesting major changes in the cognitive mechanisms. This refers to the clear and recurring symptoms of symbolic thinking – works of art, musical instruments, various decorations (beads and necklaces), means for applying the paint on the skin and tattoos; stone tools, including committing ritual acts, etc. etc.

In accordance with the first hypothesis, which focuses on the biological component of SESH, the reason for this phenomenon is a certain macro-mutation of the genome, essentially on the functional organization of the nervous system and the human psyche of an anatomically modern type. This event dates back to 50 thousand years ago and "tied" to the African region of modern areal of *Homo sapiens*.

The second hypothesis is based on the socio-cultural determination of cognitive processes, tying them with cultural innovations occurred 60-80 thousand years ago.

Finally, the third hypothesis suggests that in fact the process is stochastic and cumulative in nature. The emergence and spread of the same cultural innovation happened many times, and repeatedly interrupted. As expected, the proto-cultural and technological innovations were distributed within their social group at this stage. The fixation of these innovations is carried out through intergroup competition and selection, which leads to an increase in the number and range of the most adapted social groups. "Transfer" of innovation and intergroup communication has little effect on the course of adaptation genesis.

The initiating factor, to change this situation, was the demographic (Mellars, 2006). As modeling shown, on reaching the population size at 10^5 individuals intergroup exchange and cross-group communication begins to take shape. A process of adaptation is still further moving away from the mechanism inherent in the Darwin-Weismann module. Under these conditions, efficiency as a sociocultural inheritance proper that ensures the transmission of sociocultural adaptive innovations "vertically" from ancestors to descendants is complemented by the diffusion of the same adaptations along the "horizontal" during inter-individual and intergroup communication.

In any case, the ability to perceive and ability to active disseminate of relevant information through adaptive communication (learning and pedagogy) are an initial comprehensive adaptations during human evolution

(Csibra, 2011). It led to the transition to the exponential growth in the number of socio-cultural adaptation and, accordingly, the adaptive capacity of hominines. "Germs" forms of over-group social communities become the unit of evolution. Increase in the share of horizontal intergroup diffusion of social and cultural adaptation may have become the main reason for the differentiation of intra-system communication (speaking and writing language) too.

It initiated the genesis of intergroup exchange of products means rationalistic adaptations (proto-commerce, proto-market). Both factors in this interpretation acted as system group adaptations of "2-nd queues", initiated a total restructuring of the bio-, and techno-rational and culture sets of their adaptations in the integral anthropogenesis of hominines toward *Homo neandertalicus* and *H. sapiens*.

The first of these adaptations (conventionalist linguistic diversity intergroup) in accordance with this hypothesis (Pagel, 2013) served as the immune system, i.e., safeguard of cultural and technological adaptations pool from "leakage" outside the group. Thus, the adaptive advantage of each group is relatively protected from erosion and leveling relative to other groups.

The second adaptation (ancestral form of the modern market) provides the appearance over-group adaptive communications and formation of over-group social structures. Thereby, while maintaining inter-group differences in the specific adaptations of the value of adaptability of each of them increased in the framework of inter-group associations.

Based on the Peter Jordan conception, we can assume the following sequence of events. If the socio-cultural SESH component is the result of a meta-system evolutionary transition within the biological module, the techno-rationalistic module originated within its predecessor (socio-cultural module) and was based also initially on the mechanism of a socio-cultural transmission (inheritance) of its "ancestor".

Technological traditions are interpreted as a complex system of cultural inheritance, with information passed between individuals through the sophisticated human capacity for mimesis and social learning. This transmission system enables particular combinations of cultural information to persist from one generation to the next and from the social group to another group. The separation and autonomization of the techno-

rationalistic module resulted from the emergence of a conventionalist language in a similar mechanism (Jordan, 2014: 341-344)

The key and irreversible point of the genesis of SESH was the Neolithic revolution, when, strictly speaking, the prerequisites arose for the idea of man's assuming the role of the Creator and the threat emanating from the knowledge acquired by man. ("One of Us" (Genesis, 3:22) – God says about Adam, eat fruit from the tree of knowledge). Likewise, the first global technological revolution doomed man to tireless efforts to transform this world:

> "... Cursed is the ground because of you in sorrow shalt thou eat of it all the days of thy life; thorns and thistles forth it to you; and you shall eat the herb of the field. In the sweat of thy face shalt thou eat bread, till you return to the ground from which you were taken; for dust you are and dust you shall return" (Genesis, 3:17 – 21).

Since the inception of SESH, the main principle of its functioning and, therefore, the survival of its carriers (hominines) is the construction of an evolutionary-ecological niche, i.e. its transformation into a cultural and ecological niche. The main global-ecological attribute of anthropogenesis is the radical reformatting of ecological systems as a result of socio-culture-anthropogenesis. Four main trends of the reformatting of eco-systems of various levels of complexity are highlighted as a result of the SESH implementation (Boivin et al., 2017). There are global expansion of man in the Late Pleistocene (1); the spread of agro-eco-systems in the Neolithic (2); island colonization (3); and the emergence of early urban societies and the network trade routes (4). A common distinguishing feature of these trends is the establishment of a close co-evolutionary association between biological evolution, the structure of eco-systems on the one hand, and social evolution, the historical process, on the other.

As a result, SESH has become a systemic factor in the global evolution of the biosphere, the value of which continuously increases with time, parallel to the increase in the proportion of the technocratic module in an adaptation of *Homo sapiens*. The role of SESH as an evolutionary factor reached its maximum with the emergence of technological civilization (17-18th centuries AD). During this period, a two-tier homeostatic system of balanced co-evolutionary relations was finally formed. Here, the role of the balancer controller is still played by culture (phase III). SESH at this time is a dynamic homeostat of genetic-cultural co-evolution and the techno-

humanitarian balance, closing on the socio-cultural component of the adaptive complex. Practically identical scheme of this phase (if not to take into account the replacement of the techno-rationalist social module offered W.Runcimen (2009:224).

Now it becomes apparent already prospect in the near future to the last transition (IVth) phase of the cycle. Action of externalities of the evolution of culture (ecological environment, biological and ratio-technological modules of SESH) is equivalent to the displacement of techno-humanitarian balance towards predominance of technological component. Ultimately, it leads to the socio-cultural gap, the transition from Phase III to phase IV configuration of SESH. It determined the technologization of evolution of biological (genetic engineering), and socio-cultural components of SESH.

Adaptive fractal of SESH forms uncompensated loop forward and backward linkages between the individual modules. The loop of direct and inverse links between culture and biological adaptations (genome) disappears, which is fraught with a global socio-cultural rupture, i.e. violation of the continuity of evolutionary transformations of cultural types of *Homo sapiens*. This, in turn, means the destruction of both genetically-cultural co-evolution and the techno-humanitarian balance. Thus, coherent continuum series of conjugate evolutionary transformations of the genome (the system of biological adaptations), cultures and technologies are transformed by a sequence of discrete configurations of the triad of the same elements. The transition from one configuration to another will be determined solely by the laws of technogenesis, outside the co-evolutionary relations with bio- and cultural genesis.

A characteristic of this is the initial reaction of the cultural elements of SESH, which can be reduced

- firstly, to finding objective perspectives for completion of evolutionary history of *Homo sapiens* as the concept of trans- and post humanism of Julian Huxley, 1957 (Huxley, 1957: 13-17) predicts;
- secondly, to the development of conceptual foundations and social institutions of sociocultural management (more precisely, sewage) of the process of implementation of new technological innovations as ("technoself") conception of Ronseller Van Potter postulate (Potter , 2002);

- thirdly, to the statement of the role of modern High Hume as a leading system-determining factor of formation of self-identification and structuring of interpersonal relationships (Lippinchini, 2013: 25).

We have descripted the transformation of the contemporary socio-cultural module of SESH in chronological order to identify the main trends of these changes. The problem of technological predetermination of human identity, its belonging to the subject-object community is the key here.

The sentence "subject-object community" underlines the fact that the identity of a person means to relate to

(1) The set of subjects as persons endowed with reason and system of values, and also

(2) The set of homogeneous objects as individuals of the same biological species.

In the first aspect of this community is allocated based on subjective-ideal uniformity in the second it is allocated based on objectively-substrate uniformity.

Thus, content analysis of philosophical and humanitarian knowledge allows to confirm the conclusion of the transition SESH to IVth phase previously made exclusively within the framework of the theoretical constructs of formalized evolutionary models of SESH.

We have already mentioned that the genesis of SESH include adaptive inversion as a key component. It resulted to the transformation of the habitat from the cause of the evolutionary process to product of the evolutionary process. Representatives of the genus *Homo* emerged from an object to a subject of adaptation genesis. This inversion is only the first link of the transformations that have begun. In accordance with our scheme, it can be further called "direct adaptive inversion" (adaptive inverse 1). The instability of the modern phase of evolution of SESH is associated with the genesis of "recursive adaptive inversion" (adaptive inversion 2). As a result, it initiated a new cycle of adaptive (and not just adaptive) changes of the actual genetic component of SESH.

At this time, the changes have not stochastic and spontaneous, but the teleological, technological – rationally organized and constructive character, and they are determined by culture (or rather by the mentality as a component of culture). It should only take into account that culture itself is also under the direct and indirect influence of technology. That is why the

term recursion in this case will be more accurate than the reverse. It is not a reversal of the evolutionary vector. The acquisition of an evolutionary landscape by a new dimension is implied. In the projection to the original topos, the change looks like a return to the previous trend of global evolution.

The bases of both adaptive inversions are two alternative psychological predispositions that can be called “introversive-projective” and “extroversive-projective” inversions according to their influence on the dominant values in the culture's priorities.

The source of the adaptive inversion 2 can be recurrent cycles of relationships within the contours of gene-culture co-evolution and the techno-humanitarian balance. In cultural module, it manifested in increased reflexive components with respect to environmental and cultural components of adaptation genesis. This refers to the periodic amplification targeting the mentality of the spiritual life, i.e. the process of “spiritual self-improvement”, as compared with the projective-activity intension to transform the material world.

Previous historical development cycle of this trend was observed in the history of Western civilization in the Middle Ages. The factor limiting the sustainability of middle ages predecessor of adaptive inversion 2 was, in our view, the lack of efficiency in translation and replication of group social and cultural adaptations through purely pedagogical tools. For this reason, there was the gradual weakening of the introversive branch that was aimed at transforming the mentality of the techno-humanitarian balance, and then its replacement extroversive that was aimed at transforming the material reality. This led to the creation of the technological prerequisites for the formation of the mature form of adaptive inversion 2.

As a result of recursiveness, number of newly generated evolutionary innovation no longer limited to the original set of most slow, genetic and biological co-evolutionary component of the SESH triad in this cycle of adaptation genesis. Until now, this transition has been realized only within the culture and implied a multiplication of the “World of Proper”, its separation into many potential, but not necessarily technologically feasible, future scenarios that relied on a fixed “World of Existence”, i.e. genetic and biological substrate basis of sociocultural genesis.

This discrepancy occurred due to the peculiarities of the psychophysiological support of the epigenetic plasticity of the cognitive processes of the psyche and the recursiveness of the linguistic organization of human speech, probably. The human language served as a tool for mental description, prediction and transformation of reality. Therefore, the language should have been freed from direct determination of the original emotional image. (As already mentioned, the latter serve to express the subjective state of the individuals, and not to the objective situation of reality.)

Modern evolutionary linguist clearly noted that due to the recursiveness of human speech communication, the psyche acquires the ability to create an infinite number of thoughts, phrases and expressions as models of cognitive reality. This ability is based on fixing and combining a limited set of "Inborn Ideas" as emotionally colored images, due to evolution, one way or another (quoted by Bentley, O'Brien, 2012: 5).

The evolution of culture has gone through three key points, according R.A.Bentley and M.J. O'Brien (Bentley, O'Brien, 2012: 1-14). Each key point radically reduced culture dependence on the genetic mode of generation – replication – realization – fixation of adaptive information.

The new coding system for communication between individuals (language) provides the exchange of information, which has an objective value that is independent of the emotional and physical state of the source and destination information. Additionally, techno-cultural ability to store such information was created, and specific "information drives" (the elderly) was created too. The establishment of such living "information drives" was initiated by forming the first morality as "socio-cultural ensuring their functioning" (care of the elderly and the weak members of the social group).

The emergence of written records and systems, storage and retrieval of cultural and technological information, do not require biological media was the next stage formation of SESH.

Further, creation of computer information systems capable of managing the information flow to generate and implement a lot of information without the biological media happened. As a result, new evolutionary landscape formed. Evolution of culture and reasonable life in general was reassigned

from biological substrate to technological ones accordingly to the already apparent evolutionary trend.

There is a long-standing tradition in Western civilization of self-reflection by the culture of its own substrate basis (genome) as something external, and not forming binary system integrity. It reaches the logical finality with Rene Descartes. The possibility of technological manipulation by genetic and mental processes transforms the human biosocial substantiality into another sphere of the external environment accessible to rational control and management.

There is the active-system-forming function of culture as a factor of coordination and "lapping" of the three components of the adaptive strategy; and its importance entered the mentality of a technological civilization for a long time. However, it happened only indirectly. "Liberation" of socio-cultural organizations from the power of human biological constitution is considered as a measure of social progress. The classic example is the famous saying of Charles Fourier. According to him, a basic principle of social justice is "freedom of women" to go beyond the boundaries of the "natural" division of social roles by genetically determinate sexual dimorphism.

From 19th century, the reason for this specific character of Western mentality lies in the very organization of the adaptive complex known as the technological civilization, whose appearance was identical to the next global evolutionary bifurcation. Its evolutionary potential was determined precisely by setting the "liberation" of culture and habitat from the pressure of the biological substrate, and this liberation was "embedded in mythological thinking and practice" as background and foreground of scientific and technological developments [Grant, Moses, 2017: 25].

Thus, rational "values and interests" and irrational "myths and metaphors" coincide in their content as the determinant and channeling factor of evolution, in general, and the social and biological evolution of the humankind, in particular. At the same time, the intention to objectify S&T stimulates a time drift of socio-cultural prerequisites for development and the implementation of scientific knowledge and technological innovations in the direction of greater rationalization. This trend is constrained by the growing influence of axiological discourse.

The autonomy of the socio-cultural component of SESH from the biological foundation can occur not only as a result of the direct influence of the rationalistic component, but also spontaneously. (At the same time, the culture as a whole retains its adaptive significance.)

In this case, the initiating or catalyzing factor is the ambivalence of the role of biological adaptations with respect to the adaptive effect of specific socio-cultural adaptations. So, for example, the statistical norm of the ratio of the social, emotional predominantly intelligence and rationalistic intelligence is shifted somewhat in the direction of the social and emotional components for the female, and the rational for the male, according to the latest data. The physiological basis of this pattern is a shift in the balance between neural connections within each cerebral hemisphere and between them (Sex differences, 2014:823-828). Inter-hemispheric connections facilitate emotional intuitive-figurative understanding of the behavior of members of numerous social groups, but it makes difficult behavioral acts goal-intention-action that based on clear unambiguous logical modeling.

The initial distribution of the social roles of hominines between male (hunting and protection) and female ("guardians of the hearth") sexes was most probably connected with the equilibrium of these two conflicting trends. However, the adaptive value of social intelligence increased as the social structure and differentiation of relations between individual members of society increased as a result of the growth of social groups. Consequently, the ratio of the relative contribution of the male and female to the performance functions of production, protection and management began to change in the opposite direction. This process was initiated and supported by socio-cultural transmutation, i.e. the above-mentioned release of biologically deterministic dictate of distribution of social roles in conjunction with the process to separate sexual and reproductive functions.

The intention to free man from external coercion by objective reasons was embodied in the search for technological tools for transforming nature. As a result, humanity significantly reduced the magnitude of the danger resulting from the action of natural disasters and the unforeseen effects of natural forces outside the sociocultural sphere of the habitat controlled by humanity.

The modern evolutionary theory calls a human nature and its substratum by term "stable evolutionary (adaptive) strategy", and human nature can no

longer be accepted as a world constant that can be “taken out of the brackets” of the equations of the future evolution of civilization, as result.

On the one hand, directed (controlled) evolution is the natural result of the implementation of a SESH as the factor that determines the main direction of evolution of the universe. On the other hand, the “natural”, not subject to human intervention for the global evolutionary process suddenly finds signs of intelligent design. Similar to the well-known optical illusion “Face or Cup”, the objective facts available to our observation and cognition turn into artifacts that acquire a teleological meaning. Adaptive Inversion 1 and adaptive inversion 2 integrated with each other and form the evolutionary cycle. The latter operating until are not self-destroyed culture as the central element of gene-culture co-evolution and techno-humanitarian balance as functional basis of SESH configuration in phase III. This event will mark the transition from phase III to phase IV of the evolutionary history and *de facto* before the self-destruction of SESH.

Already from the above, it is clear that we are talking about the exit of the evolutionary risk to the existential level. Now, evolutionary risk is an invariant of SESH organization, and SESH is on the verge of irreversible evolutionary teleological transformation. The essence of this transformation is the transition to the directed evolution, and in particular, to managed socio-culture-anthropogenesis. From point of view of SESH development, and in accordance with our scheme, phase IV is characterized by the dominance of technological innovations in the common organization of co-evolutionary interactions.

Thus, at the stage IV, the technical-rational module combines the functions of the coordinator and manager of the two remaining modules with great difficulty, but the transition to the stage of destruction of the SESH organization is already underway. This conclusion follows from the technologization of the biological and socio-cultural components of the evolutionary process. This is equivalent to losing the autonomy of two of the three SESH modules and turning them into derivative elements of the techno-rational module.

This transition through the evolutionary bifurcation point of will mean a radical transformation of the actual economic organization of technological civilization too. In accordance with our concept, which is partly the development of A.V. Chayanov's philosophical and economic

studies, technological civilization is based on the homeostatic interaction of industrial and agricultural sub-civilizations. Each of them is based on the alternative evolutionary-economic mechanisms to searching and production of resources (Glazko, 2010).

A prerequisite for this dichotomy is the dichotomy of civilization process, namely, the specificity of the economic functioning of the subjects of economic activity in the agricultural and industrial sectors,

Both sub-structures performing the necessary and complimentary functions in ensuring the viability of society. The essence of t Neolithic revolution can be reduced to alternative variants of the first high-tech innovation of the production of organic matter by photosynthesis and solar energy. So, there are actually agricultural civilization version as direct innovation or pastoral civilization version as indirect its variant. There are two fundamental characteristics of the agrarian type of civilization, generated by dependence on solar energy and by the nature of the used "bioreactors" (plant organisms): spatial constraints imposed on the specific efficiency of agricultural production in this technological context and the cyclical nature of the production cycle. Both these features are not applicable to the industrial segment of the industrial civilization.

The above dichotomy is also subject to radical and irreversible erosion and deconstruction as result of the biotechnological revolution.

So, in a general way , the result of simultaneous or sequential occurrence of several evolutionary trends is the evolutionary landscape that formed SESH. There are

1. Extraversively projective-activity behavioral intention (adaptive inversion of 1);
2. Group mimesis, marked an opportunity to generation and distribution within the social group of adaptive behavioral and tools innovation (socio-cultural heredity);
3. Social (Machiavellian) intelligence expressed in the ability to predict and manipulate by communicative structure of social groups and the behavior of its members;
4. Expansion of inter-individual communication outside own social group and biological species (Crespi, 2010);
5. Symbolic system of communication through mimetic / gestures and sound code and then written language (symbolic heredity);

6. Spiritualistic transformation of emotionally-imaging components of thinking, leading to the interiolization of social control functions and the development of religiosity;

7. The dominance of rationalist components of thought to catalyze the development of science and technology (enhancer adaptive inversion 1).

During the formation phase IV of SESH evolution them to add some more.

8. Recursive distribution of projective-activity intention to human genome, mentality and culture (Adaptive Inversion 2).

9. Introversive reorientation of the trend of cognitive activity with a scientific explanation of the world in the scientific knowledge. It led to the stratification of the knowledge on the dangerous (classical) and warns science and socio-cultural initiation of internal controls to realization of projective activity-behavioral intentions (adaptive inversion of 3). A manifestations of the mentioned control mechanisms development are initialization and integration in the life of society and political sphere, in particular, of social institutes (bioethics and biopolitics, especially) that carry out humanitarian control for S&T development.

In this list the largest share have four points 1, 8, 9 and 7. The first three points (adaptive inversions) play the role of Driver of macro-mutations and determine the direction of common future evolutionary trends of a *Homo sapiens* (i.e. trend of socio-culture-anthropogenesis). The the rationalization of mentality accelerates dramatically the globally evolutionary transformations, and extremely rapidly expanding the boundaries of the ecological niche of humans, and raising the risk to evolutionary existential level. (This thesis will have to go back.)

CHAPTER 3.

EVOLUTION RISKS: NATURE, ORGANIZATION AND STRUCTURE

Valentin T.Cheshko, Valery I.Glazko

> "If scientific and technological progress will continue and will not happen improvement of human morality, the probability of survival of civilization not only in the modern era, but also the next century will steadily diminish" Ingmar Persson and Julian Savulescu (, 2012: 126).

> "Moral codes, like any other cultural system, depend on the existence of human biological nature. Discrepancies between accepted moral rules and biological survival are, however, necessarily limited in scope or they would otherwise lead to the extinction of the groups accepting such discrepant rules"
> Francisco Ayala (2016: 245).

The term "evolutionary risk" has become one of the key in the disciplinary matrix of the general theory of systems and areas that examine specific types of such systems in medicine, genetics, economics, management, sociology, etc. recently only. However, as history shows, most modern examples of anthropological and technological risks are associated with collisions of biological adaptation, socio-cultural norms and living conditions and technological innovation. This thesis is in accordance with the concept outlined here and according to the life theory as one of its sources and predecessors.

> "Individuals face genetic and physiological trade-offs to optimize investment in reproductive and other priorities at different stages of the life course. Trade-offs can be reflected in variation in nutritional and social status, fertility, disease risk, mortality - and other parameters conventionally thought of as "health variables" (Jasienska et al., 2017: 9).

Theere is a dynamic balance points of participants in these co-evolutionary trade-offs, and its position is shifted as a result of mutual autonomy and partial overlapping of Darwin-Weissmann and Lamark co-evolutionary modes during the life cycle. The process of transition from one configuration of adaptive features trade-offs to the next is risk due to the phenomenon of so-called phenotypic inertia. "Phenotypic inertia" is the preceding state of the phenotype for the subsequent state. An example is the remote influence of the prenatal nutrition on the development and behavior of an adult (Jasienska et al., 2017: 15).

In an extensive, numbering 746 pages, the report of European Environment Agency, 27 specific events are analyzed. They are related to the sharp jumps of magnitude of environment, evolutionary in its phenomenology risk that's just cover almost all aspects of social and anthropological reality. These include, in particular, parameters such as

- bodily health;
- human environment;
- human-made (technological) threats:
- economic and social stability;
- scientific and technological development policy.

t is significant that there were observed long-term effects that suddenly reached a value comparable to the existential risk level with poorly expressed (although observable) early diagnostic "harbingers" of the catastrophe, in all analyzed in this study examples (EEA, 2001; EEA, 2013). This is what allows us to say that in all these cases we are talking about evolutionary risk, which becomes the basic parameter and key element of the mentality of modern civilization, reflected in the structure and composition of modern discourse (Slovic, et al., 2004). The last point made by us as a starting postulate subsequent research of methodology for techno-humanitarian balance of risk-taking technological complex.

The emergence of technological civilization is equivalent to the transformation of SESH, and, more precisely, its socio-cultural component. It is characterized by the dominance of technological innovation in adaptation genesis, and then in socio-anthropogenesis, in general. Such a homines evolution trend implies an escalation of evolutionary risk as a side result .

As a result, an important milestone was reached for 350-400 years of existence of this type of civilization. With the advent of gene and information technologies, the level of evolutionary risk reaches an existential level, since both co-evolutionary bundles are replaced by a system where the status of technological innovation uniquely determines the status of the genome and the culture of the carrier of intelligent life.

The conjugation of the processes of sociocultural evolution and technological development occurs under conditions of partial overlapping of the mechanisms for generating and fixing new information, as well as coding systems of adaptively meaning information. In other words, along with the actual co-evolution cultural and technological innovation, *a priori* may be a direct exchange of information between them. Mainly for this reason, we believe that the concept of techno-humanitarian balance proposed A.P.Nazaretyan, in this case is more correct. So, high enough level of "techno-humanitarian balance" is it necessary to the survival of humankind, in general, and technological civilization, especially. The higher the energy capacity of technology, the more effective use of their socio-cultural adjustments needed (Nazaretyan, 2013:39).

Societies that are characterized by low values of this parameter, can`t exist for a long time "by definition", so to speak. In this sense, the techno-humanitarian balance appears unavoidable logical tautology as the Darwinian "survival of the fittest".

However, the hypothesis of techno-humanitarian balance can still lean on some empirical evidence. For example, the level of uncontrolled violence, defined, on the relative number of violent deaths and (relative) level of military losses remains approximately constant from century to century and even tends to some reduction. These facts are described in the publications of A.P. Nazaretyan (Nazaretyan, 2013: 39) and are supported by independent calculations of the American psycholinguist S. Pinker (Pinker. 2011:1026).

Indeed, there is an amazing contrast between the continuously increasing ability of *Homo sapiens* to kill representatives of its own biological species and the proportional capacity of the SESH socio-cultural module to prevent the scale of individual use of murder technology from going beyond the adaptive norm. It sounds cynical, but social control of tremendously increased intra-specific (inter-individual and intergroup) competition technological tools inspires some evolutionary optimism.

However, the humanistic component of described tendency should not be exaggerated, and the essence of the process will not interpret in terms of ideological bias. (Steven Pinker himself is not free from the pressure of ideology in our opinion.) We are talking about adaptive evolutional (ensures the survival of the society), and not on humanitarian (increasing the value of individual human life as such) progress. This conclusion is confirmed by the increase in the absolute values of casualties in the same period.

Reducing the relative magnitude of violence in society is explained rather by a progressive increase in the size and differentiation of society. Threshold of the obvious adaptive value parameters has gone beyond biologically determinate norms, and maintenance of techno-humanitarian balance, ensuring further improvement of organization of society, took over the socio-cultural module of SESH. It is characteristic that, in S.Pinker analysis, major role is given to socio-cultural and economic transformation in reducing the level of aggressiveness. Those he considers

1. *Appeasement* that is the emergence of agriculture, requiring of numerous, living together and agreed operating people and therefore reduce their mutual aggressiveness (biologically driven norm of groups volume does not exceed a few tens of individuals).
2. *Civilization* that is the formation of large national or supra-national states in place of the previously fragmented collections of ethno-tribal or feudal territories.
3. *Enlightenment and Humanism* that are uphold the principles of individualism and self-worth of individual human life.
4. *Lasting peace* between the great powers (from 1945 to the beginning of the XXI century at least) that is a result of the creation and dissemination of nuclear missile weapons, increase the value of the risk of global military conflicts to the existential level.

Subsequently, these elements serve as a basis for reducing the role of violence. They migrate to the sphere of competence of socio-cultural, rather than biological evolution, in our opinion. These tendencies are its infancy now, and an assessment of their reality is unnecessarily and ineradicably ideologically loaded. The entire list is presented either by factors that ensure greater stability of large societies or serve as a manifestation of this stability. It would be necessary to include not only the ideology of humanism and the Enlightenment, but also most religious systems, including all three world religions, as real macro-cultural mutations of this kind.

There is another observation. Accordance to the hypothesis of Pinker balance of violence and non-violence are based on the behavioral stereotype inherited from the biological stage of evolution of hominines.

The biological evolution support the algorithm of social behavior of hominines that is "Do unto others as they do unto you". Biological algorithm social behavior of hominines is opposed to the ethical rule "Do unto others as you wish them to do unto you" that maintain a culture. According to Pinker, these two imperatives reveal the distinction of individualistic, "demonic" elements of human nature that developed primarily in the course of biological evolution and "angelic", socially oriented elements, supported by culture. S. Pinker uses the metaphor of Abraham Lincoln ("Demons" and "angels" of human nature), but expression "better angel'' in the same context is found in the works of Shakespeare.

The author refers the physical aggressiveness during extraction and safeguard of resources, the intention to hold the highest possible status in the group (dominance), and the ability to remember and to eliminate hostile individuals, the ability to get positive emotions from suffering such individuals, etc. to the "demons" of human nature promoting violence as a manifestation of aggression human attributes.

Accordingly, the "angelic" behavioral stereotypes include empathy and Machiavellian intelligence developed on its basis, as well as consciousness and self-control of behavior depending on circumstances and value priorities, altruism, rationality (Efroimson, 1995:631-639). However, this fact is not clear, and its manifestation depends on group ("angel") and individualistic ("demonic") adaptive components. Once again, all these manifestations have origins in the evolution of hominines and meet at close of systematically of primates (see the review de Waal, 2014).

So, techno-humanitarian balance and reducing violence as its particular manifestation are an integrative system characteristic of SESH, dependent on the interaction of all three of its modules.

Similar to described model of SESH made recently denoted by the term "System of Systems" (SoS) in systems theory and computer structures (Lock, 2012). Such systems consist of relatively independent modules. Its communication provides a mechanism of evolutionary risk management to ensure overall stability of inclusive adaptability. The co-evolutionary interactions of the individual modules are basis of this stability. However, the rate of evolutionary transformations (or rather, generation, replication, and fixation / elimination of adaptive value information) does not match in different modules; and imbalances and inconsistencies are not excluded between them. They, in turn, entail the possibility of a general reduction of adaptability (evolutionary risk). Thus, the risk is an attribute of the evolutionary multi-level self-organizing SoS, arising from escalating into a conflict imbalance between the adaptations of different levels of the organization of such systems.

Let us reformulate this thesis as applied to the theory of stable human adaptive strategy. An evolutionary risk is the system characteristic of SESH and values of risk periodically reaches existential level.

The evolutionary path of the biological and socio-cultural forms of adaptation, as it is commonly believed (El Mouden et al., 2014), described by equation of Price

$$\Delta \acute{z} = \mathrm{cov}(v; z) + E_v(\Delta z) \qquad (3.1),$$

where $\boldsymbol{v}$ is adaptive value of traits, $\boldsymbol{\Delta \acute{z}}$ is the average change in the trait values in population in one generation; the first term of equation $\boldsymbol{cov(v; z)}$ reflects the change in trait due to its influence on the adaptive value of its carrier, the second term $\boldsymbol{E_v(\Delta z)}$ is altered distribution characteristic in the process of communication between individuals. Obviously, the first term describes the process of selecting (removing) individuals with different characteristics. The meaning of magnitude $\boldsymbol{Ev(\Delta z)}$ comes down to the impact of specific variants of trait on the distribution of carriers on the various traits in the population. For example, the genes of altruism, increase reproductive success of individuals related by reducing its own adaptability.

Thus, ***cov(v; z)*** describes the process of selection, $E_v(\Delta z)$ is direct or indirect communication between individuals.

As mentioned above, the effect of communication (socio-cultural inheritance) is growing in parallel with the growth in the density and size of social groups. In other words, socio-cultural and technological evolution is faster in large heterogeneous populations. This acceleration has selectively adaptive nature, since the effect of communication spreads available to the action of natural selection innovations, we emphasize.

In the case of cultural inheritance (Lamarck module) the effect of communication significantly increases its share, and takes the form of direct infection (contagion). The rate adaptive (and also non-adaptive) evolution increases unconditionally with the size and population density. In the case of genetic inheritance of adaptively significant characteristic, the same effect is mediated by kinship participants of communication.

It is another difference between the socio-cultural inheritance (Lamarck modus) from biological Weismann-Darwin modus. For biological inheritance, the evolutionary significance of the effect of communication (i.e. mating system in this case) is due to the genetic drift, especially. In other words, the adaptive evolution of the biological component is defined by adaptability and population size at a fixed value of adaptability / maladaptive of any genetic element. With the population growth a specific weight of adaptive selection grows, but its speed drops. With a decrease in the size of the population increases the proportion of non-adaptive components (genetic drift) and the total rate of evolution can be carried out with greater speed.

Thus, the first conclusion from the above is the growing importance of the Lamarck modus in adaptive evolution as result of different speeds and a close correlation between the value of the coefficient of selection, population size and relative contribution of each mode of adaptation genesis in the process. To the same conclusion reached by the American specialist in evolutionary genomics E.Kunin (2014: 312).

According to him the Lamarck modus (the term he does not using) or quasi-Lamarckian inheritance is possible because of epigenetic canalization / genetic modification programs. However, his approval feature of Lamarckian evolution model is a postulate about the reality of a mechanism of direction of the generation adaptive information process (Derex et al.,

2014:297). “Fortunately”, in the case of socio-cultural and technological modules of SESH, nature of such a mechanisms combination of intentionality (goal-setting) of human consciousness and the ability for objective ideal modeling of reality (epistemology). It allows for a purposeful design of adaptive innovation, and excludes or at least restricts the role of the selection from from which the pool of mutations originated in the process of adaptation genesis. The imbalance of gene-cultural co-evolution is another risk factor for evolution of SESH. Below we look at this issue in more detail.

So, the Price equation, in relation to the socio-cultural component adaptation genesis takes the form (Derex et al., 2014)

$$\Delta \acute{z} = cov(c; z) + E_c(\Delta z)\ , \qquad (3.2)$$

where ***c*** is socio-cultural component of adaptability. The authors of the cited article does not consider the rational (*t*) component SESH, but by analogy it can be represented as

$$\Delta \acute{z} = cov(t; z) + E_t(\Delta z) \qquad (3.3).$$

Note, due to the indivisibility of the system of generation and replication of adaptive information, in the Lamarck module component ***E(Δz)*** plays a much more significant role in adaptation genesis compared with the biological component of SESH. At the individual level ***E(Δz)*** nonselective trends reflect biological, technological and socio-cultural components respectively. However, at level of competition and selection of social groups, they become a factor evolutionary success or failure of the respective groups, i.e. anyhow, have adaptive value. In this interpretation, communication between individuals leads to change of the adaptive significance of the trait as a result of its inclusion in the adaptive landscape of other modules. This is the most correct interpretation of recent data (Derex, 2004: 89) on the high value of the selective propagation velocity of technological and cultural information in terms of intergroup competition from our point of view. So, in the Price equation, ***cov(v; z), cov(c; z),*** and ***cov(t; z)*** corresponds to the amount of adaptive information and ***E(Δz)***

describes semantics adaptive changes as a consequence of integration in holistic SESH system.

As result, some researchers have proposed to divide it into constitutional and induced sub-components (Heywood J.S., 2005). The first sub-component corresponds to the "innate" ability culture to self-replicated by imitation and learning (the phenomenon of cognitive preferences).

As a result, the dominant cultural stereotypes are reproduced with greater efficiency compared to their minor forms in society. Second sub-component is the ability of individual cultural or rationalist innovations serve as attractors for the behavior in a social group due to correlation between social status and the carriage of certain cultural stereotypes. In essence, the same two sub-components, and for the same reasons also is present in rationalist (technological) component of SESH.

A priori seems obvious that a stable evolutionary curve is based on the positive correlation between the components (modules) of SESH. It is this conclusion in relation to socio-cultural co-evolution is done in the publication of a group of European researchers (Derex et al., 2014:236). However, just as intuitively obvious, conclusion is that such a configuration is a relatively rare event caused by an introduction to the third (technological and rationalistic) component.

There are an increase in stochastic fluctuations or a stably high trend of changes in the ecological situation in relation to the source of life support resources, and they acts as an amplifier of rationalistic adaptations, first of all, the use of various tools. This assumption explains the evolutionary dynamics of the development of the instrument activity, and it is referred to in modern anthropology as the "environmental risk hypothesis" (Collard et al., 2013).

The prerequisite for the high efficiency of the rationalistic module of SESH serves high number and density of the population, providing a sufficient intensity and reliability of social inheritance and a relatively high intensity of the process of generation of adaptive significance of culture and technology innovations (Henrich, 2004; Kline, 2010).

Combined with each other, they create a delayed risk effect associated with a risk factor that goes beyond an already existing cultural and environmental niche. Eliminating potential (delayed) forms of evolutionary risks associated with "pulling" more slowly evolving biodiversity module

to a new evolutionary landscape (fig. 1.3, a branch of $T_{n-1} \rightarrow T_n \rightarrow C_{n-1} \rightarrow C_n \rightarrow G_{n-1} \rightarrow G_n$). $G_{n-1} \rightarrow G_n$ stage falls out or is greatly delayed when a certain threshold value is reached by stochastic fluctuations or a steady trend of changes in the environmental conditions and the rate of adaptive evolution of the rational and socio-cultural modules. As a result, the stage is replaced by adaptive changes of the other participants of adaptation,

$$T_{n-1} \rightarrow T_n \rightarrow C_{n-1} \rightarrow C_n \rightarrow T_n \rightarrow T_{n+1} \rightarrow C_n \rightarrow C_{n+1} \rightarrow \ldots \quad (3.4)$$

An example would be later (for four thousand years comparatively with the appearance of cheese-making) fixing a permanent level of enzymes milk sugar digestion in populations of tribes of Central Europe (Gamba et al., 2014).

However, upon further technogenesis speed growth, loss of stage adaptive cultural transformation also occurs. In this case because of the smaller difference between the rate of evolution of technology and culture evolution compared with the biogenesis, general scheme of evolution SESH is dualistic ones:

$$T_{n-1} \rightarrow T_n \rightarrow T_{n+1} \rightarrow C_n \rightarrow C_{n+1} \rightarrow \ldots \quad (3.5)$$

or

$$T_{n-1} \rightarrow T_n \rightarrow C_{n-k} \rightarrow C_{n-k+1} \rightarrow T_n \rightarrow T_{n+1} \rightarrow C_n \rightarrow C_{n+1} \rightarrow \ldots \quad (3.6)$$

The connection between the modules is broken. There is a redistribution of balance deterministic, functional and limiting the composition of exist adaptive repertoire linkages as a result of the “great divide” of triple structure of SESH, i.e. breach of system integrity, supported by closed-loop forward and backward linkages between all modules. Balance of more slowly evolving modules and faster modules changes in favor of the latter ones.

A very difficult problem is the dating of the transition leading role in adaptive evolution from the biogenesis to socio-cultural genesis and loss of communication between them. It is solved only *ad hoc* to each of the adaptive phenomenon. Allow only one assumption. With regard to inter-

individual communication and social organization, this transition occurred at the moment when the formation of the over-group, social structure began, since the origins of intra-group cooperation can be traced within the framework of biological behavioral adaptations of higher primates.

This is evidenced, for example, by data and discourses on the biological sources of morality of F. de Waal. Within the limits of intragroup relations, the evolution of morality goes "from bottom to top," from elementary genetically programmed behavioral stereotypes to culturally reproducible norms of relations between individuals within a group, and even more so, to verbally-logically based moral systems (de Waal, 2014: 317).

If individual members of the group are related by kinship, at the stage of integration of groups of individuals into a single society, the ability to maintain social structures and ensure the viability of the group as a whole is supported by classical sibs-selection and similar models of micro-evolution. This mechanism is no longer effective when combining groups that are not linked by a common gene pool initially.

Sociocultural innovations (religion, ethics, etc.) are formed "from top to bottom", from general rationally coordinated postulates to specific norms of behavior. They "work" as an enhancer in this case. There is a network or cloud emotive images (thought forms) associated with the initial logical-verbal design and with each other. At least some of them can overlap with thought forms that initiate genetically determined behavioral stereotypes, which are not necessarily uniquely defined and single. Then themselves culturally determined images and the original verbal-logical constructs, transformed into significant socio-cultural or rational adaptation. This is the first gear, which may explain the appearance and fixation of the rationalist and socio-cultural adaptations, especially religion and morality.

Alternative transmission between rationalistic, cultural and biological SESH modules can be initiated by the culture and technological innovations, affecting the survival of *Homo sapiens*. These innovations are a network of co-evolutionary connections arises between the adaptive windows of individual modules of SESH in any case. Its structure and composition are variable and not always unambiguous. By this surface three adaptive windows are displaced relative to each other and do not coincide completely.

As a result, the value of the delayed risk is equivalent to evolutionary risk. It tends to be a permanent increase over time, since the above technological development becomes autocatalytic process, stimulated not only culture, but also by the cognition and technogenesis.

Accelerated development of socio-cultural and rationalist modules of SESH leads to increased stress at gene-culture co-evolutionary ligaments and techno-humanitarian balance. (This refers to the growing discrepancy between the techno-cultural environment and the psychophysiological adaptive norm.) The situation of delayed evolutionary risk allowed a sharp increase in all kinds of elements of biological variability of adaptive module, which in turn is accompanied by an increase in the frequency of genetic and epigenetic violations ("diseases of civilization"). Delayed environmental risk becomes relevant, evolutionary form.

In the future, we understand the term "evolutionary risk" as "existential evolutionary risk". Thus, this term will be denoted as a first approximation of following meanings:

- In terms of the disciplinary matrix of biological (physical) anthropology, it is the likelihood of long-term evolutionary trend, ending an extinction, i.e. an irreversible decline in the number of biological carriers of stable adaptive strategy (in this case – SESH);
- In terms of culture (philosophical) anthropology, it is equivalent to a judgment about the loss of cultural self-identity of the bearer of the mind;
- Finally, from the viewpoint of technology (anthropology of technique), this point is recorded as offensive Posthuman future. If the technogenesis process continues, we may to speak an era of post-humanism in the technological or noospheric evolution, depending on the original system of values and attitudes of the researcher.

Explicitly or implicitly, all three aspects appeal to the ineradicable and cumulatively accumulating imbalance of individual and group adaptability, which makes them incompatible upon reaching a certain threshold value. Upon reaching this bifurcation point, there is a sudden catastrophic disintegration as result irreversible decline adaptability of the SoS. Further evolution can develop in accordance with one of the three mutually exclusive scenarios that we present below.

- *The extinction* of *Homo sapiens* is complete elimination of the carriers of SESH – $(SoS) \rightarrow 0$.

- *Posthumanity* is replacement of one strategy by another strategy, with the elimination of one or more components – N_1 (SoS_1) → N_2 (SoS_2). "Elimination" of SESH component in this context refers to the inability of evolutionary transition between the component SESH-predecessor and the newly formed adaptively strategy. In a sense, this feature corresponds to the known model of "irreducible complexity of the system" according to which the object can`t arise through incremental evolution of the original building.
- *Divergence (irradiation)* of intelligent life is the division of the original set of carriers of the SESH into several ones – $SoS_1 \rightarrow \Sigma$ (SoS_i). In terms of design niches and evolutionary ecology theories, this case is equivalent to the fragmentation of the original ecological niche. If at least one of the newly emerging forms of intelligent life carriers remain actual or potential intention to unlimited expansion, evolutionary reduction of the third to the second scenarios inevitable.

Technology makes our genetic constitution and the content of our consciousness by the subject of rational control and management. The result of the development of both types of information technology is the same: technology of mind control (change of socio-cultural code) and technology of controlled the genetic code are both technology of driven evolution (Cheshko, 2009:337).

By reducing the degree of evolutionary risk posed by uncontrolled (stochastic) microevolution, the rationalistic component of SESH raises the level of risk to the next, macroevolutionary level. This is equivalent to the possibility of destroying the organization of an ensemble of SoS homeostasis. Let consider the general mechanism of evolutionary risk in relation to the possibility of disintegration and destruction of co-evolutionary relationships and communication between the components of SESH.

Probably, the most obvious example of an actualization of evolutionary risk is the process of carcinogenesis in accordance to one of the most reasonable hypothesis (Gilles, 2012). The development of all cancers, regardless of hereditary, infectious, or sporadic origin, is subject to the dynamics of Darwinian selection in a heterogeneous cell population. The necessary conditions for a self-sustaining process of carcinogenesis are the instability of the genome of the cell in combination with the heterogeneity

of physiological parameters such as hypoxia, acidosis and presence of active molecular oxygen.

All of them together form a cycle with positive feedback, and provide progressive tumor growth, very quickly adapt to the selective action of the environmental factors that can potentially slow down the multiplication of cells (cytotoxic substances, ionizing radiation, and so on). It is assumed that such a system is the complex of cellular anti-stress adaptation to environmental stress of very ancient origin. The effect of this system becomes a source of risk to the evolution of cell populations in a multicellular organism, because ultimately destroys the conditions for their existence (the death of an individual). By the same scenario developed any evolutionary process of actualization of risk.

3.1. Evolutionary load and evolutionary risk

Thus, the source of evolutionary risk is any inherent contradiction between the elements of a stable adaptive strategy that may lead to its destruction and, consequently, extinction of SESH carriers. The sources of evolutionary risk are the multi-vector nature of the process of adaptation genesis, which simultaneously involves a certain set of elementary adaptations that affect more than one adaptive significant trait simultaneously, and evolving in different directions and at different speeds.

The social adaptive nature of longevity and aging is just as obvious (Mitteldorf, 2017). The initial adaptive value was due to the implementation of two functions of the competitive advantage of social groups with a fairly high number of older people. It are the upbringing of children and the storage of accumulated adaptive information that is compressed by a socio-cultural transmission. Later this feature was included in the general network of the adaptive complex as one of the central bearing elements.

Equally clear are

- The leading role of the socio-cultural module in the mechanism of maintaining a sufficiently long individual life outside the reproductive period, and
- The techno-rationalistic module as the main provision of security in comparison with the actual genetic substrate.

\As a result, the study of socio-psychological and socio-cultural aspects of aging and longevity becomes extremely multi-dimensional in theory and in practice.

Partial empirical manifestations of evolutionary risk are growth of evolutionary load and an increase in the scope and depth of the environmental crisis of civilization. Evolutionary load will be denoted by the accumulation of elements that reduce the general adaptability within each of the three modules and the in entire SESH.

Thus, the components of the evolution load are follows.

1. *Genetic Load* is accumulation of reduce adaptability mutations in population, whose action is compensated by other elements of the genetic module of SESH;
2. *Socio-Cultural Load* is the accumulation of cultural elements, reduces the stability and viability of this type of culture or its competitiveness in relation to other socio-cultural types (anti-humanism). Textbook examples are human sacrifice in Aztec civilization, Khlysts and Skoptsy in Christianity, etc. All of them were either side and / or excessive results of socio-cultural adaptation, or adapting to no longer valid socio-cultural or environmental conditions;
3. *Techno-Rationalistic Load* is the accumulation of elements of theoretical and technological knowledge, if society can`t currently control their possible negative consequences (risk knowledge);
4. *The System Load* is a general accumulation of imbalance between of self-replicating environments and *Homo sapiens* as a result of a spontaneous evolution of SESH. In other words, evolution of SESH increases energy, material and informational cost to artificial maintenance of original ecological niche of hominines (global environmental crisis and post-humanism).

As you can see, the systemic evolutionary risk of SESH means the output of the hominenes evolutionary trajectory beyond the effective functioning zone. Also, SESH may be in conditions inevitably lead to the extinction of their carriers not only as a result of a catastrophic change in living conditions, but also due to internal system restrictions, like any evolutionary strategy of a different taxon.

n both scenarios, the ecological system will become incompatible with the existence of this evolutionary strategy. The ecological niche will

disappear (ecological crisis) or the adaptive strategy will be replaced by a new one (post-humanism).

However, the linear approximation implies acceptance one of alternative risk components (environmental crisis *versus* post-humanism) equal to a constant. It is not possible to adequately assess the evolutionary risk value in these conditions. In addition, integral population adaptability is determined not by one, but by two parameters that are individual (genetic load) and group (ecological crisis) adaptability due to the mechanisms of realization of the biological and sociocultural component of SESH. Finally, genetic load of individual adaptability is result of genetic heredity and socio-cultural transmission that controls the lifestyle too.

Due to these considerations, it is necessary to introduce an adaptive differential (D_a) as new concept to designate the influence of the evolutionary innovation on the adaptability of other ones, already existing and recorded in the innovation population. Adaptive differential of individual adaptations can have different signs and different values in relation to other adaptations, regardless of their nature. So,

$$D_a = \frac{|\sum A_k - A_i|}{N}, \tag{3.7}$$

where $\boldsymbol{A_k}$, $\boldsymbol{A_i}$ is relative adaptability of the inherited (biological, cultural or rationalist) innovations and other innovations from their totality $\boldsymbol{N}$. The value D_a lie from zero to one with the approach of D_a unity, it makes a relatively larger contribution to the final value of adaptability. Taking into account the hierarchy of speeds of individual components of SESH, adaptive differential of rapidly evolving (socio-cultural and technological) innovations increases.

However, the more slowly evolving components deliver the substrates for more rapidly evolving components. Consequently, the tensions in the overall system of SESH grow, and this process continues until a disintegration of the meta-structure of adaptive complex. This complex provides operation and the possibility of further transformation of socio-cultural and technological components.

Obviously, the risk is an evolutionary feature of any self-organizing (evolving) systems. For example, according to the theory of “cognitive load” in cognitive science and to the evolutionary epistemology,

assimilation of new non-hereditary by biological way informational fragments is only possible, if their number does not exceed seven elements.

With all the differences of these situations, we are talking about similar information processes, because the acquisition of new adequate reality knowledge is equivalent to the generation of adaptive information by living organisms. As a consequence, an avalanche-like elimination or replacement of elements of an adaptive strategy takes place. The end result will be either a complete elimination of the carriers of this SESH, or the emergence of a new SESH.

Explanatory model of inclusive inheritance of adaptively relevant information found in the scientific literature are based on the principle of the validity of the linear approximation of this process (see Danchin, Pujol, et al, 2013). Accordingly, the total phenotypic variance can be decomposed into individual components that in this case both are separate systems of heredity (genetic, socio-cultural, and so on), and various forms of *Homo sapiens* adaptations

$$\sigma_p^2 = \sigma_g^2 + \sigma_c^2 + \sigma_m^2 + \sigma_s^2 + \sigma_t^2 + \sigma_e^2 + \sigma_r^2, \qquad (3.8)$$

where σ_p^2 is an "extended" phenotypic variance. Extended phenotype includes all stable transformation of morphological, physiological, biochemical, psychological and other signs caused not only genotypic factors, but also the culture and technological interventions. For example, the technological interventions category includes such diverse phenomena as surgery, pharmaceuticals, prosthetics and technical correction of hearing and vision, the results of pedagogical and psychological adjustments, etc.

Components $\sigma_g^2; \sigma_c^2; \sigma_m^2; \sigma_s^2; \sigma_t^2; \sigma_e^2; \sigma_r^2$ are parts of the general variation, caused by genetic factors, cultural inheritance, the parent effect, social environment, technological interventions and environmental factors, respectively.

Components $\sigma_m^2; \sigma_s^2$ (nfluence of parents and the social environment) can be seen as the result of cultural and genetic factors, and σ_t^2 as mediated by cultural inheritance of technological modification of the phenotype. (It is defined by culture modification of phenotype that initiated and / or supported by the system of value priorities; and latter determinate the status

of dignity and self-esteem of carriers of certain traits in the population.) The latter statement is true, at least in respect of the III[rd] phase of evolution of SESH. Component σ_r^2 is "residual" that determined solely by currently unknown factors. The relative contribution of individual types of inheritance of adaptively significant attributes to the "extended" (inclusive) phenotype corresponds to the equation

$$\frac{\sigma_g^2}{\sigma_p^2}+\frac{\sigma_c^2}{\sigma_p^2}+\frac{\sigma_m^2}{\sigma_p^2}+\frac{\sigma_s^2}{\sigma_p^2}+\frac{\sigma_t^2}{\sigma_p^2}+\frac{\sigma_e^2}{\sigma_p^2}+\frac{\sigma_r^2}{\sigma_p^2}=1 \qquad (3.9)$$

As already mentioned, components $\frac{\sigma_m^2}{\sigma_p^2};\frac{\sigma_s^2}{\sigma_p^2}$ can be distributed between genotypic and socio-cultural variance. Technological component is autonomous by mechanisms of generation, and the way of realization of adaptive information. Therefore, with respect to SESH, the above equation can be simplified by the way

$$\frac{\sigma_g^2}{\sigma_p^2}+\frac{\sigma_c^2}{\sigma_p^2}+\frac{\sigma_m^2}{\sigma_p^2}+\frac{\sigma_t^2}{\sigma_p^2}+\frac{\sigma_e^2}{\sigma_p^2}+\frac{\sigma_r^2}{\sigma_p^2}=1 \qquad (3.10)$$

From our point of view, component σ_r^2 is heterogeneous in its composition, since it involves a fairly significant result of the nonlinear interaction of co-evolutionary elements of different levels of complexity. Then, when it comes to adaptability, the linear approximation is no longer correct, due to the systemic nature of the interaction of components of SESH. For an external observer, this is manifested in the gradual growth of the relative fraction of the "residual" component, $\frac{\sigma_r^2}{\sigma_p^2}\to 1$.

For this reason, the evolutionary risk phenomenon occurs, as well as the need for a transition from micro-parameters (selective advantage, adaptability etc.) of separate fragments of adaptive information (genes, memes, culture-genes, etc.) to the system of macro-parameters. Below you will find the data and arguments that suggest:

1. During socio-culture-anthropogenesis, parameter $\frac{\sigma_r^2}{\sigma_p^2}$ increases with acceleration. Initiation and compensation of this increase carried out to

date, primarily due to further technological innovation of High Hume (NBIC) complex;

2. An evolutionary risk iss the projected growth of the parameter and its relation with the technological innovation process in this equation, and its magnitude becomes a critical factor in assessing system-forming problems both biological and social safety and security in the course of the IVth phase of SESH evolution.

The concept of "risk" is the subject of "warning of science". Therefore, it is key category of concept field of post-academician science in general. In the instrumental aspect, the transformation of the social institution of science into the modern, post-academician phase of its development is due to the cooperative action of qualitative and quantitative factors of evolution. This thesis is based on a systematic assessment of the materials of the previous sections of the study.

1. First, quality system-evolutionary factor of socio-culture-anthropogenesis is evolutionary dominance of risk in the overall structure of the hominines evolutionary landscape.

2. The second, metric or ranked evolutionary factor is the transition of the integral risk value across the existential threshold.

The concept of evolutionary risk in this study suggests the need for synthetic model; and theses (1) and (2) will be present in the equations as a definite two initial parameters of the conceptual model, and subsequently, as the algorithm and the general scheme of risk assessment of NBIC technological innovation.

The concept of "evolutionary risk" originally came into use in the socio-humanitarian disciplines. The first time it has used by Niklas Luhmann.

It is also necessary to mention the name of the Italian philosopher and sociologist Danila Zolo. In his book "Democracy and complexity: a realistic approach" (1992), he argues quite convincingly that the main source of increase in potential instability of modern Western democracies is their excessive complexity of the structural and functional organization. Suddenly turning into the actual form of potential instability diagnosed him as "an evolutionary risk" (Zolo, 2010: 179). There is an inversion of the causal relationships between the subjects of the political process. New political actors no longer are a party but the narrow circle of elite entrepreneurs from election campaigns that come with each other in

advertising competition. They appeal to the masses of citizens-consumers, offering them under the revised strategy of television marketing its symbolic products, he says further (Zolo, 2010: 10-11).

If this tirade is cleared of emotionally-axiological coloring, then the following conclusion remains in the "dry residue" accessible by verification with empirical data. One of the leading causes of the stability of the socio-cultural module of SESH (in his West-technological variety) has been the emergence of political and social engineering technologies (varieties of technology of managed evolution). Inversion of explanatory links and functional dependencies of self-organizing social systems and violation of the integrity and autonomy of its separate elements occur. There are an inversion of the causal relationships and functional dependencies of self-organizing social system and a violation of integrity and autonomy of its individual elements.

The reason for this is imbalance in favor of rational-technological and other modules SESH. In fact, this definition is consistent with Niklas Luhmann concept (see Cheshko, 2012:52-53), and with our interpretation of the phenomenon of evolutionary risk.

We considered a similar example of the inversion of the loop of direct and feedback as a manifestation and mechanism of the mismatch of adaptive processes between the SESH modules. The object of the research was the development of a crisis in relations between the state and the social institute of science (genetics in concrete) in the former USSR in 1920-1965 (Cheshko, 1997; Glazko, Cheshko, 2009). The evolutionary mechanism of these social phenomena genesis demonstrates an amazing analogy, more precisely even homology, with all the differences between them.

Once again, we emphasize that any interpretation of the concepts of "evolutionary risk" and "system complexity" postulated correlative, causal and functional bilateral relationships between adaptively significant elements within the adaptive module and between modules. Between the individual elements within the module can be observed conflicts as their adaptability / maladaptability defined with respect to various environmental complexes or to provide oppositely directed survival functions.

Maladaptation within the module can be used as a substrate for formation of adaptation in another module. With the increasing complexity of internal structural and functional organization and external ecological

niches such conflicts are becoming more and more significant and large-scale; and the magnitude of the risk of evolution is growing as result. After reaching the threshold of existential risk (R = 1), returning to acceptable risk values (R << 1) will mean complete destruction of SESH and the birth of a new structure of the evolutionary strategy, which cannot be obtained by changing the configuration of its previous stage. Paradoxically, the removal of evolutionary risk in this case would be tantamount to its actualization.

Conceptual-terms apparatus to create the concept of evolutionary risk can be virtually unchanged borrowed from studies on the economic theory of innovation processes.

Structure of evolutionary risk can is assessed on the following parameters:

• The probability of success / failure of adaptive evolutionary innovations that amounted to the ability to solve the key problem of survival of *Homo sapiens* and expansion of his ecological niche;

• The probability of generating the evolutionary innovations that can potentially solve / aggravate the imbalance of SESH with the environment and gene-cultural co-evolution and the techno-cultural balance;

• The presence / absence of sufficient environmental and cultural resources that are necessary for the implementation of evolutionary scenario, which is actualized by evolutionary innovation;

• Projected decrease / increase the probability of generating and recording new evolutionary innovation, i.e. plasticity / sustainability of SESH and all its components. As we can assume, there is the controller, capable of ensuring maintenance of the parameter SESH plasticity / stability within adaptive norm; and this role playing member of adaptively inter-modular complex with an intermediate evolution speed. (Its speed of evolutionary transformations lies between the fastest and slowest modules of the SESH triad.) In doing so, the range of possible rates of at least two such modules overlaps with the third module. As is clear from the above, at present the only contender for this role is culture. This implies the following option:

• The compliance / noncompliance of predictable evolutionary scenario `to some basic system options. These options are recognized not subject to review under the system of human values. Once again we will quote the

book by Ilya Mechnikov, which was published on the beginning of the 20th century.

> "To change human nature, first of all, one should be aware of the ideal to which one should strive, and then use all the means presented by science for its existence" (Mechnikoff, 1988:245).

On the one hand, the last criterion looks subjective in comparison with the rest criterions, since it corresponds to the reflection of the "human nature" to the moment in time and to the type of culture. On the other hand, its assessment looks the most labile and prone to extraneous manipulation by social groups that are carriers of marginal value systems. However, with more careful analysis, it turns out that in the post-academician science, it is this indicator that can influence the evaluation of other criteria to the strongest extent. It determines the evolutionary landscape that decides the fate of adaptive / maladaptive innovations. Moreover, it is for calculating the integral macro-parameters of the evolutionary risk assessment − evolutionary correctness and evolutionary efficiency (see below).

There is a stable intention of Western (technogenic) socio-cultural type focuses the individual and the society on a constant search for means of improving the environment and psychological comfort; and it is true for all (Judaic, Christian and Islamic) cultures that belong to the same branch of the evolutionary tree. Achieving this goal it is accompanied with strengthening the adaptive capacity of human nature. Technical artifacts complement and enhance human physiological abilities, and technological artifacts perform the same function in relation to mental and cognitive abilities.

Technical artifacts in this context consider various adaptations that increase physical abilities of the human body, i.e. replace the morphological and physiological biological adaptation.

Verbal expression of this intention can be represented as a technological imperative. In its simplest form, it is as follows: *All that can be changed to a common or individual gain must be changed* (Harris, 2007: 9). This ensures a permanent process of generation of adaptive technology innovations.

There is potential evolutionary risk as reverse side of this intention that is counterbalanced by the opposition intention. Phenomenological consequence of its existence is the well-known in cognitive science "Knobe Effect". In accordance with it, the perception of the positive and negative consequences of new knowledge and technology is asymmetric: the evaluation of the first is underestimated, and the second is overestimated. Or, as the well-known in Russia vaccinologist Mikhail Favorov put it (Favorov, 2013),

"We do not have good news".

This creates a certain socio-cultural effect of inhibiting the growth of evolutionary risk. Latter, as the mathematical analysis shows (Turchin, 2008), tends monotonically to 1 in the region of the existential threshold of its values, as a whole. In general, the binary opposition of the mentioned alternative intentions acts as a homeostat, preventing the disruption of SESH until now.

Let us turn to the results of research on the evolutionary mechanisms of genesis and the adaptive role of psychological prejudices of technological and socio-cultural innovations. The prejudices are tendentiousness of assessing the possible evolutionary risk and adaptive advantages. The hypothesis of J. Johnson and J. Fowler (Johnson, 2011; Johnson et al., 2013; Marshall et al., 2013) is most interesting. Their concept is known as the "Management Error Theory". It asserts that the mechanisms of perception, decision-making and assimilation / elimination of adaptive innovations are fundamentally asymmetric.

This is different from the classical Bayesian scheme of a step-by-step decision-making strategy, in which the overall assessment and the path of innovation are continuously adjusted in accordance with previous results. This scheme, in general, corresponds to the model resulting from the Darwin-Weisman mode: in each generation, natural selection performs an independent act of comparing the adaptive value of competing innovations, as a result, the frequency of evolutionary innovations in the next generation changes to increasing the adaptability of each individual innovation in the general adaptive landscape.

The existence of a hierarchy of autonomous mechanisms for generating and replicating of adaptive information changes this scheme, and bringing

it closer to the Lamarckian mode. In general, these transformations boil down to “memorizing” and generalizing the results of previous acts of selection of adaptive innovations. Thus, the act of selection is the fixation or elimination of innovation that ceases to be entirely autonomous, and turns out to be integrated into the hypercycle of “adapting of adaptations”. A prerequisite is the asymmetric distribution of evolutionary risk as the product of the error probability by the magnitude of the possible damage.

The implementation mechanism of the evolutionary risk management process is embedded in SESH and, obviously, has a sociocultural character, since it includes a quantitative correction of statistical choice in stereotypical problem situations (optimism, pessimism, self-confidence, caution, etc.).

However, it is based on the features of individual and group perception of the dynamics of changes in reality. In other words, the outcome of the innovation process in this case is influenced not only by the system of socio-cultural value priorities, but also by the psychophysiological features of human perception and thinking that were formed in the course of the previous evolution of the biological (genetic) component of SESH. Then. Knobe Effect represents a particular case from the set of decision strategies that arose within the SESH, depending on the macro characteristics of the problem situation (primarily resource availability, benefit-risk relations, etc.).

The reason for its activation is the passage of the upper permissible threshold for the rate of evolutionary transformations, since, in the evolutionary history of hominines, excessively rapid changes in the parameters of the ecological niche were potentially dangerous for the survival of populations and social groups and required the presence of adaptive instruments for excessive stabilization too.

The speed of the innovation process correlates here with the complementarily of the morphological and physiological organization, spiritual culture and *Homo sapiens* socio-ecological habitat of this set of excessive adaptive means. Obviously, there is bottom barrier too: in resources ensuring individual and group survival, the fall is below the threshold, followed by a sharp activation of social (hardly technological) innovation processes (“there is nothing to lose”).

All these arguments introduce a subjective component into the theory of evolution, but, simultaneously, objectify some parameters of the spontaneous evolutionary process. However, oddly enough, both aspects suggest evolutionary risk as their common consequence.

The categories “evolutionary load” and “evolutionary risk” associates by deterministic attitude in the case of the linear reduction: evolutionary risk represents the potential (projected) form of evolutionary load; evolutionary load is the actualization of evolutionary risk. The asymmetry of the relationship between them is determined implicitly, by presence of a rational subject in the definition of “evolutionary risk”. In fact, the very existence of the phenomenon of evolutionary risk already needs in accordance with any version of the theory of evolution, if the latter is based solely on genetic mechanisms of adaption genesis. The category of “evolutionary risk” means rationalization of the evolutionary process and, therefore, the existence of technological control over it (technology-driven evolution).

Generalizational evolutionary risk corresponds to a predictable drop of SESH effectiveness as an integrated system of survival of *Homo sapiens*.

Specific evolutionary risk corresponds to a predictable drop in adaptability of the individual components of SESH, if the drop normally is compensated and / or assimilated by other components. (The term “assimilation of risk” in this context means the transformation of maladaptation generated by one of the SESH components, to a substrate base of adaptive innovation of SESH. During this study, we look at a few genetic on nature examples of this kind). By far namely, biological component of SESH was the most risk-taking ones.

Let us to compare the evolutionary risk and two fundamental postulates of Neo-Darwinism – Fisher's fundamental theorem (Fisher, 1930:22) on one hand, and the principle of minimal genetic load **(**Kimura Moto, 1985:171) –on other.

In accordance with the Fisher theorem, adaptability of non-equilibrium population will continue to grow with a speed proportional to the variance of the individual adaptability. In the absence of complicating circumstances, this process should result in a stable equilibrium genetic structure of the population with the maximum adaptability. The principle of minimum

genetic load can be derived from this thesis: The end result of evolution is always the structure, which is characterized by the minimal value of the genetic load, i.e. minimal discrepancy between the average value of population adaptability and the maximum adaptability under given environmental conditions.

When the value of the evolutionary load and evolutionary risk are determined by biological components of SESH only, evolutionary risk is defined as the number of acts of genetic elimination that are needed to achieve the highest possible level of population adaptability ("pay for the selection"). In this case, exclusively the speed and regularity of environmental changes on the one hand, and efficiency of selective transformation on the other determine the existential magnitude of evolutionary risk.

The latter factor is determined by the complex of such parameters as adaaptional genetic variation, the reserve of genetic variability, speed selection, wide norm of reaction and so on. It is intuitively obvious that the existential risk (extinction) occurs after reaching by a speed of environmental change threshold that equal to the rate of selection in a given population. This threshold in the case of Darwin-Weismann module is relatively small. According to the long-standing calculations of Moto Kimura, selection is effective if the number of alleles under its action does not exceed 10-12. Although a variety of amendments, strictly speaking, this conclusion has not refuted in the classical theory of evolution.

Meanwhile, in the mid-1960s R. Lewontin et al. had drafted the so-called paradox balancing genetic load, and then the extremely high level of genetic variability in human and not only populations repeatedly was discovered and confirmed. The most recent data (Lévesque, 2012) argue the level of genetic load in populations of hominines of the order of 2 mutations per genome per generation. As mathematical calculations show, compensation of the fall in adaptability is equal to about 16 children for each pair of parents during the reproductive period in this case.

A period between successive births in women approaching to 3 years. Thus, given the characteristics of the ecological niche and physiological organization of the reproductive system of hominines, it seems quite unacceptable. Possible explanations are the interaction of individual mutations on the level of the genome and the interaction of different carriers

of mutations in a social group. Potentially, such a mechanism of adaptive compensation can significantly change the value of evolutionary risk or even invert the process of falling adaptability.

In particular, consideration of epigenetic mechanisms and socio-cultural inheritance (adaptive inversion 1) increases significantly adaption genesis rate and raises the threshold of admissible values of the speed changes of habitat. In fact, talking about change of environment becomes incorrect in the old sense of this word. Now, the source of risk is only those environmental factors that are unavailable for rationalistic forecasting, control and management. Adaptation genesis speed is limited by the rate of constructing socio-ecological niches (i.e. noosphere or the techno-sphere). However, this process already is controlled by two or even three systems of generate of adaptive information, and the relationship between them is supported by co-evolution rather than a direct exchange of information.

Thus, there are several components of the system evolution risk as opposed to purely biological form of evolutionary risk.

- The *substantial genetic load* occurs because of the mismatch between the direction and magnitude of selective pressure caused by the influence of environmental and socio-cultural factors of selection. Socio-cultural form of adaption genesis has a much higher rate compared to the biological form. As a result of this discrepancy in the selection vectors, the genetic structure of the population does not adapt to the socio-cultural environment. Instead, most often there is a fixation of a new adaptive cultural innovation, which compensates for some element of biological maladaptivity, but generates a new maladaptivity. So-called epigenetic or genetic "diseases of civilization" are an external manifestation of this component of the evolutionary risk actualization. Actually, substantive load will take accumulation in populations of maladaptive geno- and phenotypes. The reason is the accumulation of socio-cultural and technological adaptive innovations, leading to a change in the socio-cultural environment, and makes possible the social adaptation (survival) of relevant biological defects carriers. The existence of substantial load stems directly from the concept of "disharmony of human nature" by Ilya Mechnikoff. The first sketches of this concept were expressed as early as 1871 and articulated in its final form in his classic publication "The etudes of Human Nature" and "Etudes of optimism" in the early twentieth century (Mechnikoff, 1961: 8-9).

- *Epigenetic loads*. Socio-cultural innovations increase general adaptability, but will affect the biological reaction rate and as result creates an increasing stress on the system of mental physiological homeostasis of human body. Thereby frequency of various pathologies significantly increasing. Perhaps there is increase in the number of cancer and cardiovascular disease, mental illness, etc. that attests to mainstream this evolutionary form of risk. Typically, epigenetic mechanisms modified negative manifestations of pleiotropic gene in the way that their phenotypic expression moves beyond childbearing age or outside the parameters of the ecological environment. Socio-cultural determination of the quality of life can return to these genes phenotypic expression. Thus, an epigenetic load is represented pool of adaptively neutral or beneficial genes, transforming to maladaptive elements in the genome. Any well-known diseases of civilization are the actualization of one of these two trends of evolutionary biological risk. Cultural and technological development of components made possible huge increase in the value of genetic and epigenetic load (biological evolutionary risk), the main trends of which were already outlined by composition of the hominines triad. Its biological adaptation advanced in conflict with existing basic biological functions, and overcoming of conflict occurs within the other two component of SESH only.
- *Balancing genetic load* (in the broadest sense of the word). Genetic compensation of negative manifestations of pleiotropic genetic adaptations, and systemic sociocultural adaptation is achieved at the population level. It is accompanied by decrease in the number and genetic death of some the individuals in population (sickle cell anemia, diabetes and so on). The growing imbalance in the biological and socio-cultural adaptation as a result of different forms of evolutionary risk actualization has been seen since the 1860's. But the conceptualization of the idea of such imbalance was carried out primarily in an ideological and philosophical or socio-humanitarian form (Nietzsche, Freud). The share of natural knowledge was negligible. An influence the actual evolutionary theory and the creation of its explanatory models of this phenomenon can be traced at Ilya Mechnikoff works most strongly. Translate his theorizing in the empirically verifiable constructs has become possible only in recent decades. An example is the publication has repeatedly cited herein Bernard Crespi (2010).

- *Socio-cultural load*. The elimination from the gene pool of individual genetic factors reduce the general adaptability of *Homo sapiens*; at the same time, it can deprive the culture system of biological (genetic) substrate of its system-forming elements. Their maintenance and replication will be further ensured by the systemic nature of the culture itself and the sustainability of the cultural tradition exclusively.
- *Technology (anthropological) load*. Erosion of the biological adaptations complex, which provides the basic system of biological reproduction of *Homo sapiens*, can be a secondary result of the accumulation of cultural load. The elements of this set largely supported by culture and adopted previously cultivated expressions now. In other words, there is expressions of biological adaptations that formalized by culture now. It has clearly realized the anthropological aspect of human self-identification only. Currently, this form is so far largely a potential, but not actual yet. Some example of this kind of technological (anthropological) load is a determination of sexual and reproductive functions that provided and supported by culture. The origins of this trend go back to the Middle Ages. Now, thanks to the development of reproductive technologies, it has become a system-formatting factor of SESH. This kind of evolutionary risks reflects, especially in the philosophical tradition of existentialism. It did not become the subject of theoretical-experimental natural-science analysis as well.

The same can be said in another way: "adaptation", "survival" and "humanity" are not always compatible concepts not only on an individual level, but at the level of the whole of humankind too. As a conclusion, *Homo sapiens* existence as an evolutionary phenomenon cannot invariably occupy space at the top of the pyramid of values priorities. ("There are things that are more important than life," even if "Life" means "Life on Earth" – It is a slightly modified statement by Ronald Reagan.)

> "His watchword is always duty; and he never forgets that the nation which lets its duty get on the opposite side to its interest is lost" (Shaw, 1979: 512).

Bernard Shaw put these words in Napoleon's mouth in one of his plays. It was written long before humanity acquired a degree of technological power such that a necessary and sufficient condition for human existence

would become the imperative of unconditional provision of meaningful coincidence of fitness ("interests") and humanity ("values") as two instrumentally independent concepts.

There is thesis of the integration of intra- and extra-scientific factors into a single set of parameters that determine both the form and content of the scientific theory in theoretical epistemology and sociology of science. It becomes the basic principle of the pragmatic methodology of scientific research and theoretical socio- and biopolitics at last decades.

First of all, it concerns those areas of scientific and technological development that directly create a real or mythological possibility of managing the evolutionary process, and, therefore, are a source of evolutionary risk. At present, biotechnology is such in the form of genetic engineering. It creates the evolutionary risk of the existential level of significance in all of the above manifestations. At the same time, the problems of the genetic and ecological aspects of evolutionary risk became the most significant ones, as the most obvious and easily diagnosed empirically.

> "They face significant difficulties in assessing the risks of genetically modified (GM) crops for biodiversity. These problems arise, first of all, not because of the lack of scientific data (the data are abundant), but, rather, because there are no clear criteria for determining what environmental damage represents. Establishing the criteria that determine evolutionary risk is not a process of scientific cognition, but the process of analyzing and implementing political requirements, and it is for politicians and administrative authorities to determine what should be considered a harm based on the current legislation ... It is incorrect to believe that when a sufficiently large number scientific data will be collected, the choice of policy goals will become apparent. Scientific analysis of data in assessing risks cannot determine political goals (in other words, scientific analysis cannot answer the question "What should be considered harmful?"). Because political goals should be determined by politicians before determining the magnitude of the risk. Although science cannot determine what is good or bad, science can determine whether a particular activity is good or bad, as just what is "good" and what is "bad" will be determined".
> We outlined the initial premise (Sanvido et al., 2012: 82) of the EU research project on the creation of a scientifically sound, i.e., the objective concept of

the model for calculating the magnitude of the risk of genetic technologies (VERDI, 2013).

The general scheme for integrating scientific and technological innovations is presented in the following form. *De facto*, social control applies exclusively to risks from their implementation, while benefits remain exclusively in the sphere of spontaneous market regulation. Socio-cultural, legal and political institutions define the general contours of the risk-provoking landscape and the ultimate configuration of social organization as a result of innovation. From the political and ethical ideal of the future created in this way, the research and commercial sectors of the society proceed, developing socially acceptable means of actualizing this image. So, the spheres of competence of the socio-cultural and rationalistic component of SESH are clearly delineated; and the dominance (rather, hegemony) of the cultural and humanitarian normative "basis" over the technological "super-structure" is ensured.

However, this seemingly logical and non-contradictory scheme is collapsing in the transition from a static section of the relationship between culture (ethics, politics) and science to the evolutionary dynamics of the same social institutions. There are definition of goals and the choice of means to achieve them and to the evaluation of results that occurs in a complex (i.e.interdependent from each other). However, its individual phases and components are not synchronized with each other. As result, the functioning of co-evolutionary ligament "socio-cultural adaptation - scientific and technological innovation" describes fairly tortuous, far from linear trajectory in time. In other words, there are number and composition of the base of empirical scientific data and theoretical concepts, as well as the socio-cultural landscape that influences these parameters. All of them drift, making forward and return movements relative to each other.

When, due to scientific and technological development, the socio-cultural complex undergoes correction, this correction becomes a powerful stimulus, changing the direction of subsequent scientific theoretical and applied developments. A reverse phenomenon is also possible. The development of a scientific field can acquire such powerful inertia that no tendency to revise axiological priorities will long remain marginal members of the pool of cultural innovations.

In this sense, the quotation given above is most interesting from the point of view of estimating the comparative rates of evolutionary changes of different components of SESH. In our opinion, it most testifies to a sharp jump in the rate of change in the socio-cultural, and, consequently, political and ethical subsystems, components and the corresponding effect of socio-cultural inhibition of the rational component of SESH.

We view this process as a systemic adaptation, which reduces the level of evolutionary risk. Until now, this mechanism has provided an acceptable balance of adaptability and sustainability of our species. In this sense, the result of the implementation of this innovation can be considered adequate within a relatively narrow zone of socio-anthropogenesis in the vicinity of the approaching evolutionary singularity. This stage of SESH functioning corresponds to the transition $\boldsymbol{T_{i+1} \rightarrow C_i \rightarrow C_{i+1}}$ on the scheme of genetic-cultural co-evolution and the techno-humanitarian balance (Fig. 1.3).

The VERDI project was mainly devoted to the methodology and technique for calculating environmental risk components, but its scheme, is applicable to the calculation of all forms of risk in general. In any algorithm for calculating the risk, it is necessary to determine the possible damage, i.e. (VERDI, 2013: 83):

- The resource necessary to ensure the existence of man and mankind, since the availability of latter can significantly reduce or disappear;
- The limits of changes in the availability of this factor, which should be higher than the natural stochastic fluctuations and not approach the existential threshold;
- Predicted probability and amount of damages.

The adaptability of *Homo sapiens* is such resource in the coordinate system of the natural science nucleus of the transdisciplinary concept of evolutionary risk;

The maintenance of anthropological self-identity becomes such resource in the coordinate system of the axiological component of the same concept of evolutionary risk of humanity.

Moreover, self-identity has to determine such a subjective intentional and poorly controlled by quantificational interpretation indicator as identity category “humanity” in different generations. The main problem of

evolutionary risk and is to find unambiguous connotations between the two criterions of evolutionary risk.

On one side, the criterion compliance / noncompliance the human evolution trend to certain system of values priorities appears compared to the other systems of values, since it reflects perception of "human nature" by human own at this time and at the culture type. On the other side, its valuation looks more labile and prone to manipulation by the carriers of marginal value systems. However, as closer analysis shows in post academic science this indicator in the strongest degree able to influence the evaluation of the remaining criteria of evolutionary risk. It determines the evolutionary landscape; decide the fate of the adaptive / maladaptive innovations. Moreover, it is the key in terms of the calculation of integral parameters of the evolutionary risk assessment that are an evolutionary correctness and an evolutionary effectiveness.

3.2 Objective and subjective components of the evolutionary risk

The theory of risks assumed the possibility of strict demarcation objective assessment and subjective perception of risk (Kosterev, 2008:86). The second methodological postulate of the theory of risk is the possibility of operational separating the content of these two categories and, accordingly, the parameters of the transfer of risk from the potential in the current form.

In accordance with our model, on the contrary, the objective and subjective risk components belong to different SESH modules.

• The objective component of technological risk is the assessment of the magnitude of the risk stemming from the results of the scientific discourse that is equivalent to the "system of interests" in the social and humanitarian terminology. It is represented by elements of a techno-rational adaptive module;

• The subjective component is socio-cultural predispositions that is equivalent to "the system of value priorities". It belongs to the socio-cultural adaptive module.

The genesis of both components of risk is based on autonomous systems of generation, coding and "inheritance" of information, the connection between them is co-evolutionary and, therefore, nonlinear ones. The effects

of each of them can be divided at each moment of time with certain difficulties, and cannot be demarcated in dynamics. Especially it concerns the direct reduction of the subjective risk component to the objective one in the dynamics of the evolutionary process.

It is impossible to directly modify the system of socio-cultural predispositions by directly transmitting information contained in scientific knowledge. In turn, these predispositions are linked by a similar dependence with the biological module. The cause of the braking effect is the semantic gap between the modules, i.e. differences between socio-cultural and rational-symbolic codes. At least such influences have significant, albeit unclear, limitations.

Since the mid-1990s and up to the present time, the totality of data from the field of practical sociology is fully consistent with this statement of the theoretical SESH model (Slavic, 2016; Anderson, 2013; Micic, 2016; Fabiansson, Fabiansson, 2016, and others). t is especially necessary to note a completely unequivocal negative predisposition with respect to the same descriptions of the benefits and risks of specific products of technological development, depending on the context of the mention of gene technologies (Siegrist et al., 2016). To overcome this socio-cultural effect of inhibition of certain scenarios of subsequent evolution is difficult.

Unfortunately, SESH represents the most obvious subject of post-academician science: the subject and object of research form a coherent system, and its evolution is a series of direct and inverse mutual influence of objective and subjective components. The perception of evolutionary risk at a great extent affects the frequency distribution of possible evolutionary scenarios. There is human-dimension of transdisciplinary scientific knowledge because of the presence of the dual, descriptive and axiological structure of the central nucleus of the disciplinary matrix.

In sociology and political science, this phenomenon is manifested in the simultaneous existence of two parallel systems of argumentation – the objective interests and ideal, subjective values. Ideal and spiritual component is equally necessary for the existence of the species *Homo sapiens* as affiliation of socio-cultural module of SESH. It ensures its viability as the effects of biological and technoraationalistic modules at the same time.

At the time, Pitirim Sorokin argued that each type of civilization based and supported by a system of values. The values complex creates, develops and embody civilization throughout its life cycle; values and civilization becomes a cause-and-semantic unity (cited by Kuzyk, 2006:54).

Thus, the optimal level of techno-humanitarian balance and balance of gene-cultural co-evolution is achieved only by the coincidence of subjective and objective criteria for the evolutionary risk. But the relationship of values and perceptions is rather complicated social and psychological process whereby the subjective component of risk is not constant.

In turn, implementation of specific evolutionary scenario affects in the strongest measure not only the distribution of individual risk perception, but also their composition.

Probably, the assessment and prediction of the evolutionary risk dynamics serves as a borderline example of the threshold magnitude of the complexity of a self-organizing system in relation to the subject of our study. When passing through this threshold, the accuracy and meaning of the description become mutually complementary and mutually exclusive parameters. It is so-called principle of the incompatibility (Kosterev, 2008:230).

It makes the forecast of further evolution of SESH extremely difficult, situational short-term for the socio-cultural type, and requiring offsetting of objective mental components of evolutionary risk in their systemic unity. Perception of risk is reflected in the parameter "evolutionary correctness" and is just as important as the objective value at risk.

In other words, the presence of epistemological duality in explanatory model to streamline the process of human evolution implies ontological duality. In culture-techno-anthropogenesis, the evolutionary trajectory and the magnitude of the evolutionary risk are determined not by one - objectively spontaneous parameter (adaptation, adaptive value), but by two - spontaneously descriptive (evolutionary efficiency) and creative-teleological (evolutionary correctness) ones. Combined both options cannot reduce to each other. This thesis we propose to call the *principle of evolutionary complementarity*.

We will try to substantiate this assertion. Size evolutionary efficiency by definition lies in the range $0 < E < 1$. However, we can confine ourselves to three characteristic values: -1 (ethical inadmissibility), 0 (ethical neutrality)

and +1 (optimality) for preliminary assessment of evolutionary risk. But in the case K > 0, the evolutionary trajectory will be defined solely by the technological feasibility only. So, the virtual value of evolutionary risk corresponding evolutionary correctness equals R = 1- K.

The range of values R < 0 means the irreversible passage of the evolutionary singularity point, and advent Posthuman era of global evolution, when alternative will replace the existing humanistic value system. A new system of values priorities as a foundation of evolutionary correctness is referred as "posthumanism". Passage of the point of singularity would mean an end to the existence of *Homo sapiens* in the framework of the paradigm of physical and socio-cultural anthropology,

Thus, the value of the objective component of the evolutionary risk (R_{obj}) is determinate by evolutionary efficiency, subjective component (R_{ideal}) is determinate by parameter of evolutionary correctness, and the resultant evolutionary risk components (R_{int}) is determinate by the system of equations

$$R_{obj} = 1 - E \quad (3.17)$$
$$R_{ideal} = 1 - K \quad (3.18)$$
$$R_{int} = 1 - EK, \quad (3.19)$$

R_{int} is characteristic value of the evolutionary risk, EK corresponds to a change amount of risk parameters evolutionary interaction efficiency and correctness.

The objective component of evolutionary risk can be determined by decomposing of a contribution of each SESH module into total evolutionary efficiency to components. The connections between the modules are co-evolutionary in nature and are based on autonomous mechanisms for generating and transforming adaptive information. Therefore, this contribution can be divided into the contribution created by the module itself and the contribution that has arisen due to the direct action of the other two modules.

The first,actually modular component owes its origin to the direct adaptation of the module to the ecological environment (W_{ec}). The adaptability created by the second component arises from the transforming action of other modules that transform adaptively neutral or maladaptive

elements of this module into adaptations. The survival of carriers of hereditary pathologies and the so-called "diseases of civilization" associated with mutation (sickle cells anemia, diabetes, constant activity of lactase in ontogenesis); and epigenetic modifications of genetic determinants (nearsightedness, flat feet) is determined by the technological and socio-cultural possibilities of their compensation.

Thus, the adaptability of the SESH biological module can be divided into ecological (W_{ec}), cultural (W_{cult}), and techno-rational (W_{tech}) components. In this case, the contribution of the biological module consists of a relatively stable (W_{ec}), internal and labile "externally-induced" components. As the technologies of controlled evolution develop, the value of the stable component progressively decreases. Taking into account the ranked sequence of evolutionary rates

Techno-genesis >> socio-culture genesis >> biogenesis > cosmogenesis,

the magnitude of evolutionary risk is equal to:

- $R = 1 - W_{ec} = W_{cult} + W_{tech}$ for the biological module;
- $R = 1 - W_{ec} \approx W_{tech}$ for the sociocultural module;
- $R = 1\ W_{ec} \approx W_{cult}$ for an rationalist module.

(In modern conditions, $dW_{bio} / dt << dW_{cult} / dt << dWt_{ech} / dt$.)

3.3. Evolutionary effectiveness

Evolutionary efficiency E is defined as the geometric mean of the relative adaptivibility W of all the members of the evolving configuration, in our case – of the genome (g), the culture (s) and technology (st):

$$E = \sqrt[3]{W_g W_c W_{st}}\ , \qquad (3.11)$$

The definition of this parameter contains a latent logical paradox. As we know, adaptability is a relative value, defined as the proportion of homogeneous self-replicating objects that are carriers of a given trait or a stable complex of traits transmitted to the next generation. It, therefore, lies in the range $0<W<1$. Thus, in the case of stable existence of a set of objects that participating in the evolutionary process, their average adaptability must be 1. Any other result means their progressive elimination. This

conclusion applies to the evolutionary efficiency: its value as a derivative of the three components of adaptability may not fall below the unit.

But if the deviation evolutionary efficiency magnitude of any components from unit must be compensated (and, obviously, really compensated) by excessive quantities remain components of SESH. In other words, the virtual component values of the parameter E must exceed the unit, that contradicts the definition of W.

The solution to this paradox is as follows. Adaptability of biological module is calculated for individual genes and individuals in the population, adaptability of socio-cultural module is calculated for individuals and social groups, and adaptability of techno-rational module is calculated for social groups mainly. Since at equation of the evolutionary efficiency this fact is not reflected, the value of $E \rightarrow 1$, but does not reach the latter.

In Neo-Darwinism, biological (gene) additivity is related to the selection coefficient s by the relation $W = 1\text{-}s$. However, in the three-modular structure of the SESH, adaptability is determined not only by the selective factor, but also by the influence of the socio-cultural and technological context, i.e. by adaptive significance of specific features and genes that are created by culture and technogenic modifications of living conditions. The content of these influences can be identified with meaning as a category of semantics. Meaning is attached to the elements of adaptability by the system of value priorities (i.e. by *co-evolutionary semantics*). In their direction and size, theyare not identical to selective pressure, as a rule. As a result, the total value of adaptability is determined as the resultant of the selective (s_1) and semantic (s_2) factors, $W=1-s_1+ s_2$.

In other words, the virtual values of the components of the parameter E should exceed unity, which contradicts the definition of the value of W. For importing and implementing technological innovations, the "success" or "failure" of integrating technological innovations is determined both by their own effectiveness and the relationship with the system values and priorities of a socio-cultural type.

There are many hereditary pathologies, such as diabetes, phenylketonuria, congenital dislocation of the hip, which had an adaptability of zero and $s_1 = -1$ in traditional society. In modern civilization, these pathologies are characterized by survival and reproductive potential, which practically indistinguishable from the norm ($E = 1$, $s_2 \rightarrow +1$). This

corresponds to the values of socio-cultural and techno-rationalistic components above one.

Then, it becomes possible to eliminate those elements of the biological component, the negative occurrences of which are observed outside the reproductive age (Alzheimer's disease, Huntington's chorea, some forms of diabetes). This phase of development of the techno-rationalistic module is equivalent to the decline of biological adaptability on these grounds to zero and $s_2 - s_1 \rightarrow 1$. And finally, a moment comes when the biological module is subjected to genetic manipulation and some of its elements are eliminated or are replaced by technological designs (*Human Genome Enhancement*).

In all these cases, the value of E changes abruptly, both in general and within the modular components, and the selection factor of adaptation genesis does not have time to "notice" it. Such quantum transitions are equivalent to changes in the communicative semantic code of inter-modular communication. (It refers to the change of the adaptive significance of the elements of the module under the influence of the other modules.)

As a result, the evolutionary process undergoes a dichotomy and is divided into two evolutionary mechanisms, the classical Darwinian selection and the evolutionary semantics provided by the socio-cultural module. The existence of co-evolutionary semantics (Cheshko et al., 2015:256) indicates on the existence of spontaneously objective and subjective-axiological parameters of the evolution of reality in parallel.

The above arguments forced us to ultimately abandon the use of the puzzling term "inclusive (integral) adaptivity" in favor of "evolutionary efficiency", although both of these expressions can be found in the text as equivalent ones.

The evolutionary meaning of these mathematical calculations reduces to the following. Socio-cultural and techno-rationalistic adaptations translate biological maladaptation into a state concealed from the action of selective factors of evolution, which manifests itself suddenly upon reaching the boundary $Wg = 0$. After reaching this point in the evolutionary trajectory, only two variants of the same evolutionary scenario are possible: direct extinction of the biological species *Homo sapiens* (1), or technological reconstruction of its genome (2). Both ones are equivalent to the destruction of the three-member structure of SESH.

The same arguments apply to the co-evolutionary bundle of the socio-cultural and rationalist module. In this case, the boundary condition is defined as reaching the point Wc = 0. At this stage, the compensation of biological maladaptations is replaced by their replacement through technological innovations. Given the 4-phase evolutionary history of SESH, the consequence of this will be the elimination of the genetic foundation of co-evolutionary relationships between the SESH modules.

As an illustration, we give an approximate and incomplete example. Of necessity, it is not a basis for an accurate forecast or estimate. In the literature, the following calculations circulate. It is attributed to Norman Borlaug, one of the "founding fathers" of the green revolution. According to them, selection methods based on knowledge of the laws of classical genetics and chromosome theory provided food for 6 billion people (Glazko, 2002: 43). Since the population of the Earth at that time was about 2-2.5 billion people, the possibility of hunger in the developed countries of the world, to which these technological innovations were available, was excluded, i.e. their "adaptability" was equal to 1 ($W_t = 1$). On the other hand, if we recalculate to a potential opportunity to feed 3.5 billion more, then the "virtual", uncompensated by biological and socio-cultural factors, individual adaptability of the technological sector would be 6.0/2.5=2.4. But even in the period of the greatest success of the Green Revolution, the death from hunger in many countries was not ruled out. Thus, the compensatory effect of the techno-humanitarian balance reduced the evolutionary efficiency of technological innovation by almost 2.5-3 times.

Similarly, the development of medicine and improving the quality of life saves lives, but it contributes to the accumulation of genetic load, which in this work is considered as a consequence of an imbalance of gene-cultural coevolution. However, at the same time, this difference illustrates the magnitude of the evolutionary risk, if the possibilities of the corresponding adaptive innovations are exhausted.

Thus, if evolutionary success is achieved by eliminating at least one SESH component, it is equivalent to reducing evolutionary efficiency to zero. In other words, in the biological evolutionary aspect, this parameter turns out to be relative to the evolutionary risk equal to $R_{gen} = 1 - E$.

The justification of this thesis connects the indicator E with the integrative parameter − the system integrity (cohesion) S. It is the presence of mutual conjugation (co-evolution)

1. Between the three (biological, cultural and technological) "mega-components" of SESH and
2. Between elements within each component.

The first type of connectivity is called the integrative systemic effect; the second one is the internal systemic effect. Both types are provided by pleiotropy and partial overlapping of the functions of the set of single adaptations. Thus, the drop in evolutionary efficiency to zero can be due to integrity, when some SESH component induces the disintegration of the bond system within the remaining components.

The disintegration extends to the co-evolutionary relationship between individual types of adaptations. At the same time, if the adaptability of individual parameters is controlled by elementary adaptations, it can continue to grow, although outside the channelizing influence of others ones. SESH turns into a set of independent adaptively significant parameters, and their evolutionary trajectories are completely autonomous from each other. Selective impact on each of them occurs on the principle of *ad hoc* (zugzwang or slippery slope). This process, having begun, concludes with the elimination or loss of the specific characteristics of the genome of *Homo sapiens.*

This megatrend of the anthropogenesis course is very clearly and metaphorically described by Russian publicists N.Yutanov and S.Pereslegin who consider it not only a natural and inevitable law of the internally contradictory evolution of intelligent species (Yutanov, 2003: 335):

> "Natural development of the species *Homo* leads this species to the rejection of a number (if not all) of mammal traits. (...) Anthropogenesis is the first example of natural sapientation leading to the creation of beings with external pregnancy, a social form of life organization, polymorphic, capable of creating their own habitat. It seems natural to attribute such creatures to a new biological class − the class of Reasonable".

However, if the process of "natural sapientation" [7] is spontaneous, then the inhibiting and channeling "innovative resistance" [8] of culture will be just as objectively spontaneous due to the SESH's systemic nature. Therefore, the tirades about the irrationality of the movement of the green and other alarmist anti-technological social movements looks illogical in comparison with the previous fragment (Yutanov, 2003: 292):

> "Mass appearances of the "green" public have lost their seemingly hysterical character, and a steel political technology calculation has been seen behind their wall. Concerned governments and obedient parliaments are stamping out decrees aimed at protecting the environment. Lawyers defend the interests of "wildlife" in the Supreme Courts. A whole industry emerged to satisfy the needs of the environmental movement; its turnover is now billions of dollars. With these dollars, you cannot correlate any real produced values. We are talking about administrative control over financial flows, the possibility of redistributing the money earned by other actors."

Emotionally described by the authors for post-Soviet readers, the "Innovative Resistance of Culture" is a completely explainable adaptive response of SESH. It is aimed at preserving a rational person as a biological species, in particular, its material embodiment, not civilization, intelligent life, etc. This conclusion follows from our model, which, of course, needs empirical verification.

3.4 Evolutionary correctness

At the socio-cultural (humanistic) aspect of evolutionary risk is initiated by the discrepancy between the most effective ($\boldsymbol{E_{eff}}$) and optimal ($\boldsymbol{E_{opt}}$) evolutionary scenarios (trends):

$$\frac{dR_{hum}}{dt} = \frac{d(E_{eff} - E_{opt})}{dt} \tag{3.12}$$

So, unlike the evolutionary strategies of other biological organisms, it proves necessary to incorporate in the descriptive model evolution of SESH a subjective parameter. Evolutionary correctness (K) will be considered as

[7] We following the terminology of the authors.

[8] We following the author's terminology again

$$K = \left(1 - \frac{dV}{dt}\right), \tag{3.13}$$

where V is the temporary difference between the real evolutionary scenario and the recognized best (i.e. correct) evolutionary scenario under a certain set of criteria. Its value can be defined as the sum of the parameters (f_i) for (self-) identification of person. Identification in this context means the assignment of an individual to humanity (f_{human}) or refusal of such identification ($f_{dehuman}$). With the purpose of transferring this quantity to a dimensionless form, it correlates with the total number of factors of humanization / dehumanization, *N*

$$V = \sum (f_{human} - f_{dehuman})/N \tag{3.14}$$

Within the framework of the statistical concept of risk (Kosterev, 2008:70) this difference can be expressed as a function of generation frequency (p_i) of some evolutionary innovations spontaneous or / and initiated by technological modules of SESH and their implications (d), evaluated in terms of identifying their bearers as belonging to humanity (human *versus* dehuman)

$$V = \sum p_i (f_{human} - f_{dehuman})/_N \tag{3.15}$$

For techno-rationalistic interventions in the biological and socio-cultural modules, this value can be calculated by the difference of the validity and reliability of their scientific justification and emotional perception by "public opinion" (mentality). The first indicator corresponds to the number and content of scientific publications, the second indicator is the number and content of (positive / negative) reviews in the media, web, opinion polls, etc.

A similar idea of "Socio-technical Imaginaries" as factors of human biosocial evolution was independently and simultaneously represented by Sheila Jasanoff (2015, 2016; Hurlbut, Tirosh-Samuelson, 2016: 73-103). With reference to the techno-rationalistic component of SESH, the ideological precursor of both hypotheses is the concept of the episteme created by Michel Foucault (Foucault, 1996). In his opinion, an episteme is an aggregate of hidden, historically determined cultural-cognitive *a priori*

preconditions that determine the form of mental processes for the formation of the content and limits of scientific knowledge, in particular. The integration of the idea of the episteme into the general construction of Karl Popper's evolutionary epistemology leads to our interpretation.

We propose the initial metaphysical premise that the teleological essence of anthropogenesis has become completely compatible with the concept of the objective nature of the evolutionary process in parallel with the development of technologies of controlled evolution. Moreover, there is simultaneous existence of several conjugately evolving systems for the generation and inheritance of adaptive traits that makes teleology quite "natural" one under the condition that the rates of adaptability genesis in each of them are unequal.

The mechanism of influence of each module on the evolution of the two remaining modules of SESH *a priori* can be ambiguous:

1. Direct selective pressure, i.e., adaptive changes in the values of individual controlled or maintained by genetically, technologically, or by training traits- innovations;

2.Semantic co-evolution, i.e. epigenetic change in qualitative or quantitative expression of a particular trait in the course of its implementation as a result of contact with adaptive elements of other modules of SESH.

As follows from the above, biosemantic communication is understood as the presence of a certain system of rules of compliance (semantic code) between the adaptive significance of the elements belonging to different modules of SESH and reproducible using independent systems of inheritance. The value of this form of co-evolutionary interactions increases as the difference of adaption genesis rates between autonomous members of the communicative pairs. In this case, more rapidly evolving element becomes sense-factor for your partner. Therefore, the semantics of the dual evolution of the socio-cultural and biological modules (gene-culture co-evolution), on the one hand, and socio-cultural and techno-rationalistic (techno-humanitarian balance) modules, on the other hand, are the most essential.

There are examples of changes in gene frequencies in a population as a result of the selective pressure of changes in the sociocultural environment; and they have been cited several times in this study. In this case, semantic

coevolution includes epigenetic modification of realization of genetic information under the influence of sociocultural factors, such as ethical imperatives, rituals, beliefs, behavioral acts, etc. All these factors can potentially cause a psychosomatic reaction and over time become self-preserving cycles.

The mechanisms of interaction of genes and culture are similar to the placebo effect in this context. As we know, the placebo effect is the psychosomatic therapeutic action of a certain kind of acts of communication, rituals, physical operations, not directly pharmaceutical value. According to the latest, yet hypothetical constructions, the placebo effect may be due to changes in the activity of the nerve centers of the brain activation and various neurotransmitters synthesis. As result, the synthesis of specific information molecules (RNA, proteins) is activated or inhibited too (Hall, 2015). It established a functional link between the behavioral act and physiological response, which is based on the original psychological predisposition. Introduced by the authors of the cited work the concept of "placebome", in our opinion, may be a more general description of the special case of epigenetic transmission mechanism; a latter establishes an adaptive interaction between biological and socio-cultural module of SESH. It is important to note that co-evolutionary connection between genes and elements of culture is formed in this way, and specific adaptive value "assigned" to each of them.

Thus, semantic, co-evolution captures not the frequency of specific genetic determinants, but a pattern of epigenetic variability. This pattern resulting from the establishment of evolutionary correspondences between systemic adaptations (for example, the socio-cultural) of SESH module and the individual elements of the other modules.

If the selective value of such elements and the lifetime of systemic adaptations are long enough, semantic co-evolution becomes informational co-evolution, and the frequencies of adaptively significant individual elements are fixed in the population. As examples, such phenomena occurred in cases of fixation of sickle cell anemia determinants in parallel with the development of civilizations of tropical irrigated agriculture, as well as the growth of population frequencies of genes of lactase constant level in ontogenesis after the establishment of dairy cattle in a relatively cold climate of European regions. The implementation mechanism here is

the Baldwin effect as a gradual replacement of culture-induced epigenetic variations by genetic mutations.

If the selective pressure is not enough and the system adaptations of the more rapidly evolving (socio-cultural) module often replace each other, the patterns of the semantic association of the socio-cultural and biological modules overlap. As a result, a variability of slow (biological) module increases in parallel socio-cultural genesis. DNA structure variations, maintained by extant cultural types, coexist along with newly emerging genetic and epigenetic variations as relics.

The increase of genetic variability in culture evolution and in technogenesis is next accessible empirical falsification argument of the concept of three-modal SESH. At the same time, it must be observed both in relation to *Homo sapiens* itself and in respect of domesticated animals and plants that were drawn into the scope of socio-cultural predispositions.

Actually, a similar phenomenon should be observed in the evolution of techno-humanitarian balance.

A "semantic gap" category is used to denote the incompatibility between the semantic codes of information systems of different levels. Typically, there is a conflict between the organization of the software and the operator (Hein, 2010).

We denote a semantic code discrepancies by "semantic gaps", which serve as the source of the semantic component of evolutionary risk. Due to significant differences in the rates of evolutionary transformations of individual SESH modules, semantic gaps should appear between them. Their external manifestations are examples of co-evolutionary inter-modular conflicts such as growth of the relative number of homosexuals in the population, inhibition of the Flynn effect etc. We will discuss them in more detail in the following sections

Due to the differences in the evolution rates of each adaptive module and to the systemic nature of the relationships between the intra-modular elements, inter-modular conflicts between adaptations are the cause of the emergence of a potential evolutionary risk, and its latent accumulation and sudden actualization too. The transition from the semantic phase of the co-evolutionary interaction to the selective form acts as a key point of actualization of risk. The process can be called "inflating of adaptive

bubble" by analogy with "asset bubble" and by a similar mechanism of formation, development and solution of economic risk, perhaps.

The causes of this phenomenon are depletion of reserves of bio-diversity as a "building material" for the maintenance of socio-cultural innovations and the environment for updating their technological analogues. The effectiveness of selection, as is known, decreases as the number of selectable elements increases, since their individual phenotypic manifestations decrease and the pleiotropy of each of them increases. Consequently, the transition from semantic inter-modular co-evolution to its selective form turns out to be limited, especially with a significant difference in the evolution rates of each module.

Adaptive innovations of the more rapidly evolving socio-cultural and techno-rationalist modules give the semantic significance to an increasing number of elements of the biological module due to systemic effects. In this case, the pool of genetically and epigenetically determined members of the co-evolutionary ligaments increases permanently in many directions and approaches to limits of the adaptive population norm. It can be said, the number of points of application of selective pressure grows too, and one puncture (going beyond the adaptive norm for a single vector) is enough to collapse of entire bubble.

The number of elements that are simultaneously controlled efficiently by selective pressure (inclusive adaptability parameter) is limited. The number of elements controlled by the semantic evolutionary mechanism (evolutionary correctness parameter) is limited too. As a result, the boundaries of the multidimensional window of adaptability expand teleological way by most important features and stochastically converging to a dangerous limit for others. Despite the periodically adjusted ratings of same, "not particularly important features" in the scale of value priorities in the direction of increasing, the instability of inclusive adaptability over time should tend to increase.

As alternative, the transition to the selective phase can be replaced by gene technological innovations, but the process of inflation of the adaptive bubble in techno-cultural co-evolutionary bonds is included. The collapse

means the loss of socio-cultural self-identity (the destruction of the system of values of a given socio-cultural type), in this case.

In the phase IV of the evolution of SESH, the system of value priorities as an element of a sociocultural module performs the function of an interpreter and sets the adaptive significance of the elements of the biological and techno-rationalistic modules. These elements play the role of operators, respectively.

An "intermodal co-evolutionary conflict: is the divergence of trends in the transformation of evolutionary efficiency and evolutionary correctness; and it may end by a semantic discontinuity, i.e. transition of evolutionary risk into an actual form. Phenomenological sign that diagnoses this event is the intersection of the evolutionary correctness of the boundaries of the biological adaptive norm ($W_g = 0$) or the disappearance of the civilizational type ($W_c = 0$).

Evolutionary correctness allows to translate into the plane of empirical verifiable concept of semantic co-evolution, in our opinion,. According to the ideas of Steven D. Cousins (2014: 160–191), the integrity of the co-evolutionary binary opposition "Genes – Culture" supported by informational correlations and semantic correspondences. At information aspect, the co-evolutionary relationships between the two arrays of adaptive information is provided by the correspondences between adaptations supported by biological and socio-cultural inheritance; and at semantic aspect, we are talking about the rules of such correspondence.

Depending on the magnitude of the binding vector, the nature of the relationships between the elements of different adaptive windows can be divided into two sets.

The first set of communicative connections arises when there is a powerful system-forming adaptation within one module and its adaptive window that gives individual elements of another module a high selective advantage. Then the elements of such informational connection of different modules form a *co-adaptive self-support link*.

In the second case, communication between modules is created by inter-modular links of a certain system-forming adaptation with a high absolute value of adaptivity w or selection coefficient s ($1 > w = 1-s >> 0$), and the set of elements of the other module. Each of these elements has poorly expressed adaptability, which correlates with systemic adaptation. When the

adaptation is eliminated, this set becomes adaptively neutral and lasts for a long time or accumulates. Such communication can, unlike the first, be called a *semantic connotation link*.

Within the framework of the three-module SESH model, co-evolutionary semantics is interpreted as an analysis of the information code that changes during the course of human evolution, providing inter-modular interactions within the entire SESH system. Therefore, it is the evolution of double mutual connotations between the elements of the biological and socio-cultural, socio-cultural and techno-rationalist modules.

As a result of such interactions that changing in the course of evolution, a specific pattern of substantial relationships is established: the elements of the biological module serve as the substrate base for a pool of socio-cultural adaptations; elements of the socio-cultural module serve as a selective filter that accelerates or retards the development of technological innovation.

In this interpretation, the point of application of selection is not genes, not memes (culture-genes), and not technological innovations, but their co-evolutionary inter-modular complexes. In the simplest case, such complexes are binary opposition such as gene-meme, mem-technoinnovation. The aggregate pool of such co-evolutionary links (oppositions) is a unit of a discrete evolving unit in the process of socio-cultural anthropogenesis in a separate socio-cultural type, by analogy with the genetic structure of the population in Neo-Darwinism. In general, co-evolutionary complexes are network structures with a single center:

$$MEME_J - (GENE_1,.. GENE_I,..GENE_N) - (TECH_1,.. TECH_I,.. TECH_N).$$

In this scheme, an adaptive inter-modular complex is formed around a single center. Such center is a behavioral stereotype that self-replicates through socio-cultural transmission. (Strictly speaking, the most accurate name for such objects is the term “cultural replicator”. However, following Richard Dawkins (Dawkins, 1999: 109), we will designate such structures as mems or culture-genes).

This element of the socio-cultural module is associated with elements of the biological and techno-rationalistic modules that act as conditions for stabilizers of its existence and for effective functioning as inclusive adaptation.

Such a system does not need additional techno-rational amplifiers and stabilizers, if the co-evolutionary correspondence (evolutionary efficiency) is sufficiently pronounced between the elements of the socio-cultural and biological modules.

Otherwise, if socio-cultural innovations cannot rely on existing genetic-biological preadaptation, socio-cultural evolution will stimulate a search for techno-rationalist innovations that support it. The latter do not necessarily create biotechnological analogues of existing biological innovations, i.e. belong to the class High Hume. They can create a favorable social and natural (ecological) environment for the implementation of appropriate socio-cultural stereotypes that belong to High Tech class.

Through this transfer mechanism, the adaptation system of one module preforms the selective space of the others ones. S.Cousins calls him an "*intendant*", because his attention is focused on culture as a set of psychological intentions and predispositions (Cousins, 2012). From our point of view, the term *operator* would be more appropriate and lexically neutral in a different linguistic context. In any case, the content of this term is revealed through the arising spontaneously or rationally ideal image of the set of target settings, which predetermines the self-reproducing structure of the adaptivity / maladaptivity relations of the individual elements of each module. This structure further determinates the direction of the evolution of SESH as a whole and its individual elements in particular.

So refined three-modal model of SESH organization includes

- Three information module (bio-, culture- and techno-rational ones), each with its own system of generating, encoding and inheritance of adaptive information;
- Three semantic operator (transmission mechanism) connecting the modules to each other, and the semantic connotations of the members of co-evolutionary bundles vary in time.

Such links are concentrated around the elements of the socio-cultural module. Their combined structure is multidimensional in time and in space. There is a temporal sequence of group socio-cultural predispositions and the consequent replacement of socially demanded social roles that performed by each individual in different phases of his ontogenesis are superimposed on the spatial differentiation of socio-cultural types. (Trivial statements of social psychology are the passage by the individual of a certain sequence of

psychophysiological stages during the life cycle, as well as heterogeneity in the predisposition to the performance of a particular social role.)

There is a sphere of biosocial conditioning and changing of the psychological state, behavioral stereotypes and social roles in human ontogenesis that is extremely interesting for the study of the semantic component of the evolutionary process. Due to the relative constancy of the qualitative composition of genetic information in the course of individual development, any modifications of the psyche and consciousness are either caused by the action of the socio-ecological environment or are epigenetic in nature. ("Epigenetic" in this context is not a strict term, but a metaphor for any processes of modification of the expression of genetic information without changing its content.)

In other words, they are caused by changes in the social and natural environment, directly or indirectly. Thus, the group selection of the adaptive elements of the socio-cultural module "chooses" (imparts an adaptive meaning) the available phenotypic expressions of the biological module. Phenotypic modifications in subsequent generations and under the condition of a long-running rather powerful "social demand" can be replaced by genetic mutations.

A possible illustration of the above considerations is the so-called Malthusian trap (Korotayev et al., 2005: 288; Korotayev et al., 2019; Sadovnichy et al., 2012; Tisdell, Svizzero, 2015). It is the wave-like dependence of macro-dynamics of social evolution on the demographic structure of the population. This dependence is manifested, in particular, as a regular alternation of the periods of the revolutionary and evolutionary development of preindustrial society. In the course of social evolution, the improvement in the quality of life entails a rise in the birth rate and a corresponding increase in the proportion of a relatively young population more prone to risk-taking behavior. As a result, the rate of social change increases, and the intensity of depopulation processes increases too. In parallel to economic development, these fluctuations are mitigated by fertility decline (that deterministic by cultural transformations) and by the increase in lifetime and the aging of the population that deterministic by techno-rationalistic module. With age, "revolutionary" behavioral patterns are forced out in the psyche by intention to stabilize the parameters of the socio-environment niche. In this sense (and only in this sense), the thesis of

aging as a group systemic adaptation (Mitteldorf, 2016: 9) seems to be sufficiently substantiated, on our opinion.

A Russian-American group of researchers carried out a mathematical study of the model presented here (Friedkin et al., 2016). In contrast to the model presented here, they were interested in complexes of associations of elements of socio-psychological beliefs (predispositions).

In accordance with their conception, a new element of the socio-cultural module is spreading in the population as a result of the formation of an association with already fixed "memes". The destruction of this complex as a result of elimination of its central elements led to evolutionary divergence and the disintegration of a single social community into independent social groups that adhere to the remaining socio-cultural predispositions. In other words, it serves to the actualization of the potential evolutionary risk.

(It is interesting to note that it can explain the evolutionary trajectory of the US foreign policy and military activity in the Middle East in 1992-2003, in the opinion of the cited researchers (Friedkin et al., 2016). The role of nodal socio-cultural predisposition in this case was played by the thesis of possessing a regional political leader with weapons of mass destruction. The discrediting of this thesis proves to be the initiating factor for the geo- and socio-political crisis of the interregional level.)

Regardless of the validity of concrete examples, the stated mathematical general scheme is quite phenomenological one. It applicable to the subject of the technogenic evolutionary risk of SESH: the destruction of the central element of the intermodular adaptive complex should initiate an avalanche-like process of evolutionary divergence and destruction of the biosocial substrate of human civilization.

As we have repeatedly pointed out, the existing configuration of SESH forms a closed cycle, and its integrity is supported by co-evolutionary-semantic link between biological and socio-cultural modules, on the one hand, and between socio-cultural and techno-rational ones, on the other hand.

This configuration is extremely unstable due to advancing technology development at the present time. Its destruction will have extremely serious consequences for the evolutionary fate of *Homo sapiens* too. The magnitude of the evolutionary risk will jump to 1, in this case. This will mean the

completion of the evolutionary and civilizational history of humankind. Let us consider this thesis in more detail.

A meta-semantic correspondence is established between paradigm-relevant categories in the socio-humanitarian and natural-science conceptual-categorical framework of evolutionary theory. In its logical structure, the system of objective interests corresponds to evolutionary efficiency and evolutionary correctness corresponds to adequate system of values priorities. Thus, two pair categories series provide the intersection of social-imperative and descriptive parts of trans-disciplinary theory matrix of anthropogenesis due to the overlap of their content.

The configuration of the semantic code is determined by the system of value priorities (socio-culture module) and the by system of rationally grounded interests (techno-rationalistic module). As we can assume *a priori*, the semantic code of inter-modular interaction passes through periods of relative stability and periods of discontinuous restructuring. Periods of active restructuring of the semantic code are initiated by the reconstruction of the value system in the socio-cultural module or by the revolutionary transformation of objective knowledge and its practical applications in the technical-rationalistic module[9]. Such a reorganization of semantic connotations is fraught with a sharp intensification of adaptive conflicts and with an increase in the magnitude of evolutionary load and evolutionary risk.

Semantic analysis, therefore, is applicable equally to all co-evolutionary cycles (operators) in SESH. There are gene-cultural co-evolution, and techno-humanitarian balance, and any forms of a techno-biological transformations among the cycles. The study of semantic differences between the elements of binary techno-cultural and gene-cultural ligaments serves as the basis for determining the current value of the evolutionary trend and current evolutionary risk of *Homo sapiens*.

Phenomenological changes of evolutionary correctness determined by the dynamics of humanization / dehumanization. Dehumanization defined as intuitive or rational comparison of individuals with a self-identifying

[9] By definition, changes in semantic code determine the correspondence between the states of individual modules; and they are initiated by a module whose evolution rate is greater.

itself as "humans" community. "Weakening" phenomenon of dehumanization is the infra-humanization, i.e. perception of members of a wider social community ("outgroup") as holders of an incomplete or insufficiently quantitative expressed set of human traits.

Significant importance is the following fact. The act of humanization or dehumanization is realized intuitively, unconsciously for most of humanity, and it is supported by emotional reactions. We can assume that the mechanism of biosocial human / nonhuman recognition integrated into SESH, more precisely, in its biological and socio-cultural modules. This mechanism is certainly available for rationalistic modification, however, the limits of such intervention are not clear now.

As the findings of social psychology, dehumanization is a common social phenomenon. There are factors that initiates and supports dehumanization, and they are quite varied and may have different (ethnic, cultural, economic, etc.) nature. One of the major factors causing infra-humanization, and dehumanization is the own belonging to the social elite, i.e., to the "in-group" with high social status on any criteria as power, civilization, education, welfare and so on (Haslam, 2014).

For our study, it is important that de(infra)humanization is a two-way process and related terms have dual content:

• On the one hand, dehumanization is determined by the existing system of criteria of humanity that is innate to in-group;

• On the other hand, dehumanization stimulated by the emergence in out-group of new attributes that may be regarded as signs of humanity loss.

Thus, there is the complementarity of a binary system of alternative criteria of belonging to a certain multitude of reasonable beings (humankind). Consequently, a dehumanization becomes self-sustaining evolutionary process that leads in perspective to the divergence of the species into two or more taxa. A prerequisite of this scenario becomes fixing of accumulated within social groups changes. Thus in- and out-groups transformed into evolving in different directions populations.

Otherwise, if the technology of controlled evolution is absent or in the embryonic state, there is a different balance between opposing intentions and predispositions in the mentality on human essence. It stabilizes the structure of SESH in general and its sociocultural and biological module in particular.

Thus, evolutionary correctness depends on the specific criteria of "optimal" evolutionary process. This system is equivalent to the above-mentioned basic system irrevocable parameters within the system of human values. Under this system, there is an ensemble of parameters of the evolutionary process that in fact is or only looks as uniquely identified set. This belief may turn out to be inadequate, but only in retrospect, *post hoc*.

In other words, a distinctive feature of the SESH is the presence of rational component in generation of adaptive information, in particular. Rationality implies the bundle of the ideal model of reality in the "World of Entity" and "World Proper". There is an entails of an objective (evolutionary efficiency) and axiological criterions (evolutionary correctness) that can`t be reduced to a purely objective parameters of the evolutionary process. Therefore, the process of evolution is introduced an additional parameter that is free choice of selection criteria or criterion of adaptability within the culture.

In this context, the selection criteria and the criteria of adaptability are a conceptual field of the humanities and science in parallel. In this context, the selection criteria and the criteria for adaptability are the conceptual field of the humanities and sciences, since they are not always identical. Indeed, if they become equivalent concepts, the equation 3.13 takes the form that fits into the neo-Darwinian mathematical theory of natural selection ("survive at any cost"):

$$K = \left(1 - \frac{dL}{dt}\right), \tag{3.16}$$

where

$$L = \sum \left(Z - Z_{opt}/\gamma\right)$$

is evolutionary load, defined as the difference between the average value of the adaptability of the population ($\hat{z}$) and its optimal value (z_{opt}), γ is rate of adaptability distribution (associated with the responsiveness of the fitness of the population on the selective pressure parameter – the higher γ, the less adaptation changes in time under the influence of selection).

W_{cult} is present here, explicitly (for a biological and techno-rationalistic module) or implicitly when calculating components of evolutionary risk. The latter includes, as an integral component, a system of value priorities, i.e. parameter of evolutionary correctness. The characteristic points of the last equation are given in Table 3.1.

Table 1.1 − Characteristic points of interaction of parameters of evolutionary efficiency (E), evolutionary correctness (K) and evolutionary risk (R_{gen}).

E	K	R_{int}	Characteristic
1	2	3	4
0	-1	1	Singularity (existential risk)
	-0,5	1	
	0	1	
	0,5	1	
	+1	1	
0,5	-1	1,5	Post-human
	-0,5	1,25	
	0	1	Singularity
	0,5	0,75	high evolutionary risk
	+1	0,5	the average evolutionary risk
1	-1	2	Post-human
	0	1	Singularity ь
	+1	0	no risk

As can be seen from the table, existential risk represents situations when the dynamics of evolutionary efficiency and evolutionary correctness are anti-parallel, i.e. they change in opposite directions.

Similar conclusions can be obtained in a different way.

"Quality of Life" (QoL) is used in sociology as an integral, including objective and subjective components measure of individual and group satisfaction by socio-ecological conditions of the existence of human beings. David Wilson, repeatedly quoted in the present study, regards this category as logically related to the explanatory model of niche construction (Wilson, 2016). We can agree with the thesis by specifying that the quality of life in this case can be defined as a measure of the synergy of evolutionary efficiency (inclusive adaptability) and evolutionary correctness as integral factors of evolution. In turn, the degree of synergy is defined as the product of both specified parameters –

$$QoL = EK \tag{3.20}$$

The co-evolutionary interpretation of the content of this concept allows, in our opinion, to remove the antinomic contradiction between three hundred-year-old philosophical interpretations of this concept that noted by experts. Traditionally, philosophers have and are still focusing on either subjectivist ("satisfaction") or objectivist ("living conditions") attributes of the quality of life (Fleury-Bahi et al, 2017:10-12).

It is necessary, however, to take into account the following considerations.

1. Both these parameters (E and K) are themselves derived from autonomously changing components (for example, inclusive adaptability is a resultant adaptability created by the biological, socio-cultural and techno-rationalistic SESH modules, each of which is the result of interaction of elementary adaptively significant features). As a result,

2. Evolutionary efficiency and evolutionary correctness should be considered as vector quantities in the multidimensional space of elementary adaptations;

3. Inclusive adaptability, and evolutionary correctness are in co-evolutionary relations with each other; and their values are changed by a partner's change abruptly;

4. Accordingly, the dynamics of the change in the quality of life in time is described by the two-way functional dependence of two vectors

$$\frac{dQoL}{dt} = \frac{d\left[\vec{E}(K)\vec{K}(E)\right]}{dt} \quad (3.21)$$

In the case of the anti-parallel orientation of vectors of evolutionary efficiency and evolutionary correctness, the characteristic value of risk crosses the boundaries of the "physical" meaning very quickly ($R_{int} > 1$). Achieving this point means the irreversible destruction of the system of value priorities, the central core of which is the concepts of humanity and human nature.

This interpretation demonstrates the potential and actual risk of both genetic and sociological reductionism in the biopolitics of modern society.

A genetic reductionism hopes for the possibility of solving all evolutionary conflicts by genetic engineering purely. These conflicts arise as a result of the dysfunctionality of the human genome the socio-ecological niche occupied and created by *Homo sapiens*. The danger of this approach is obvious and socially demanded. A statement of genetic engineering risks meets the most positive feedback among humanities experts and in the mass consciousness, which forms the electorate of modern Western democracies.

In our opinion, the danger of sociological and cultural reductionism meets primarily the support of natural scientists, although its consequences can be as anti-humane as the uncontrollable (bio) technological imperative.

As D.S. Wilson recently ironically wrote (Wilson, 2016:335), happiness and satisfaction are merely adaptive mechanisms that provide short-term reproductive success, like the rest of human emotions. In the three-module SESH, this emotion "happiness" and corresponding psychophysiological state of euphoria are a means of psychological motivation (Grinde, 2012:20), which is part of the complex ensuring the evolutionary success of human beings. This complex includes active and passive self-maintenance, life support and reproduction. In other words, the state of happiness and euphoria are the transfer mechanism that provides communication between socio-cultural and biological adaptive modules of SESH.

It can explain, for example, the paradoxical, at first glance, sense of spiritual uplift, the euphoric state experienced by an individual in moments of active struggle for survival, requiring mental stress and / or prolonged

physical effort (the so-called "runner euphoria" in sports physiology). Russian poet Alexander Pushkin described it in 19th century[10]:

There is an ecstasy in battle,
And at the of edge of darkest chasm,
And in the enraged ocean
Amidst furious waves and turbulent night,
And in the Arabian sandstorm,
And in a breathing of the Plague
All, all, that is frightening with destruction,
To the mortal's heart covertly holds
The inexplicable pleasures,
The immortality's promise, perhaps!
And happy is the one who amidst the turmoil
Can find and feel them

The mobilization of the body's resources in the course of the competitive struggle for survival is starting point in the concept of the general adaptation syndrome (stress) of Hans Selye (2013). According to Selye, there is a complex of nonspecific adaptive reactions of the organism to the influence of various unfavorable factors-stressors, which disturbs its homeostasis, and also the corresponding state of the nervous system of the organism in our case.

Due to adaptive inversion 1, stressors are usually factors of a socio-ecological niche that are specific to different sociocultural types and, accordingly, determine differentiated sociocultural adaptations.

Equally, this refers to factors that cause a positive emotional response in general. In other words, the feeling of satisfaction and the more so the state of euphoria in different cultures forms complex network structures with different elements (memes) of the socio-cultural module. The composition and situation of the activation of clusters of similar cultural species

[10]Quote taken from the tragedy "A Feast in Time of Plague" (Pushkin, 1960). Formally, this piece is a loose poetic translation of the works of John Wilson. However, this quote is absent in the source. Return English version by M. Korsakov-Kreyn was taken from https:harpers.org/blog/2008/01/pushkin-a -feast-in-the-time-of-plague/

associated with a sense of satisfaction, moreover, are historically conditioned.

Therefore, as a basis for a long-term practical policy, the measurement of the value of subjective satisfaction of people is a source of evolutionary social risk. Its value is quite comparable to the risk of a policy that is based solely on the economic criteria.

The empirical evidence of this thesis is superfluous, obviously. Suffice it to refer to the use of drugs, alcoholism and other "hedonistic social practices" that generate the state of euphoria (Wilson, 2016:335). At this point, D. Wilson and the authors of this study disagree with Bjorn Grinde, the author of the most fundamental study of the evolutionary meaning of the emotion "happiness" in socio-cultural anthropogenesis. Grinde believes that the level of "happiness", satisfaction should be the main criterion for an adequate trend in the development of the biopolitical situation and, accordingly, the progress of biosocial evolution. The necessary prerequisites in his opinion are (Grinde, 2012:95-101):

• Formation of habitat adequate to the human biological constitution;

• Ensuring the level of production necessary to meet vital needs, and

• Developing social practices for generating positive emotions in the brain.

The main drawback of this algorithm is its orientation on providing the organization of the biological module only, whereas the results of our study follows the homeostatic nature of the triple structure of SESH and the maintenance of cultural identity (i.e. evolutionary correctness) as civilizational and global evolutionary development criteria.

Let us add that the triad "quality of life – inclusive adaptivity – evolutionary correctness" in Equation 3.21 form a homeostat that balances biological and technological evolutionary trends. The latter functions due to the presence of an appropriate value system, produced by the socio-cultural module (Fig. 7, phase III of the evolution of SESH).

It seems quite logical to make two clarificationsThe first of these concerns the epistemological origins of the concept of "evolutionary correctness," whose attachment to humanities, and in particular to axiology and ethics, is beyond doubt.

Indeed, the thesis of overcoming the biological-genetic substrate of human nature was formed within the framework of philosophical anthropology and epistemology, above all. At the same time, the thesis is based on an analysis of the transformations of characteristic of thinking, mentality peculiar to the technological civilization. By the end of the twentieth century, it has become a common statement of parallelism

between the dominant mentality in the technological civilization and, for example, system-anthropological characteristics of cultural type.

Civilization transformations here were considered as associated with the distribution of social roles of male and female inherited from biogenesis, etc.

> "Today, we are experiencing something very similar to the death of the modern, Western man. Maybe the end of "man" is near. But the man did not have a goal. Human is something that must be overcome and complete reunion with femininity", R.Tarnas wrote in the early 1990s (1995).

The radical transformation of the Western civilization, is linked not only to the transformation of the world, but also to the transformation of human nature in general whatever is meant by this term. There is actualizing the possibility of an expanded interpretation of the "human nature"; an it is equivalent to changing of the perspective of the vision of socio-anthropogenesis from the epistemological to the ontological and anthropological aspects, as we see. As a result, the narrative theory of evolution included uniquely compelling axiological elements that reflected in the term "evolutionary correctness".

The second clarification is a consequence of the first one. It comes down to the acquisition by the evolutionary process, since its object is a human, rational and teleological orientation, cyclically updated and implemented through the technological component of SESH.

This idea arose earlier in humanities and philosophy also. Mark Coeckelbergh approached to the developed here concept of evolutionary risk most close in his recent monograph (Coeckelbergh, 2013: 203-205) . On notions Coeckelbergh human continuously produces rational technological tools for actualization of some evolutionary scenario that corresponding to the dominant system of value priorities (and, simultaneously, the system-objectified interests on our opinion). The purpose of this scenario is elimination of exist evolutionary factors of risk, i.e. increase adaptability. (M. Coeckelbergh uses the term "eliminating of vulnerability".) Thus, *Homo sapiens* produces new maladaptations (vulnerability) as a side effect immanent to the technological schemes used; and a cycle of Risk 1 – Removal Risk 1 – Risk 2 closes.

(M. Coeckelbergh uses the myth of Achilles as a successful model-metaphor for the relationship between technology, adaptation and evolutionary risk (Coeckelbergh, 2013: 203-205). The invulnerability of the hero was due to apply the magical "technology", but each such technology creates potentially making a new vulnerability new factor, own Achilles' heel. Replacing a technology other just changes one such vulnerability to

another, but absolute invulnerability (as absolute adaptability) does not exist, they always have meaning only in comparison with other ones.)

Each phase of this cycle is initiated as a result to the prevailing value priorities. As long as they are powerful enough, the subjective determination of the objective of the process of human evolution persists. In short, the process of anthropogenesis is the artifact. However, the concept remains outside the intent to establish a system of formalized empirically verificated risk criteria, and is in the framework of a purely philosophical and anthropological interpretations. In our study, it is proposed to achieve the target and using the criterion of evolutionary correctness. It is assumed that criterion of evolutionary correctness is proportional to the divergence between the thematic composition of scientific publications and patents and publications of mass media, because scientific publications more correlated with the disciplinary matrix of knowledge of the relevant field, and publications of mass media more correlated with the emotional and value perception of same scientific and technological innovation.

If both these arguments are justified, the magnitude of the evolutionary correctness can be approximated and predicted based on the content analysis of the corresponding data sets. Thus, the problem arises of comparing the subjective and objective components of the SESH evolutionary risk.

The situation of choosing the optimal (correct) the evolutionary scenario is a moral in nature. In reality, the system of value priorities itself has some heterogeneity and situational non-uniqueness. Therefore, a chain of logical paradoxes arises as a natural result of the "subjective rationalization" of the evolutionary process in general and human evolution as a subject of evolution, in particular.

There is a translation of this uncertainty of evolutionary process from the humanitarian sphere to the sphere of scientific (objectified) knowledge that carried out by means of the parameter "evolutionary correctness". However, it's impossible to achieve absolutely unambiguous results by the way. Of course, the divergence between the circulating in the scientific community views and images of the mentality of the mass consciousness can be considered as a trivial truth. However, in recent social and psychological studies, convincing empirical evidence has been obtained that this discrepancy cannot be overcome simply by enlightenment.

Thus, in a series of studies of Australian psychologists S.G.Wilson and N. Haslam (Wilson, 2013: 375) it shows that the mentality of the modern civilization of the Western type is characterized by the existence of two mutually exclusive basic predisposition or intentions regarding the prospects of improvement of the biological and socio-cultural modules of SESH.

The authors come to this conclusion on the basis of a socio-psychological analysis of the three main components of human behavior, namely, emotional, mental and characterological ones. In the experiment, respondents asked to assess the significance of signs, which determines the range of self-identification and the identification of other individuals as belonging to the categories of "Human", "Humankind". As it turned out, these attributes in the minds of recipients clearly fall into two clusters. The last translated into two conceptual designs, and its central categories have the concept of "human nature" (HN) and "humanity" (HU).

Human nature (HN) emphasizes the understanding of the essence of human as a complex set of fundamental genetically determinate signs of *Homo sapiens*, partially shared with other species. These symptoms are seen as imperative innate, universal for all types of cultures and positive valued by society.

Cluster features HN respectively estimated the parameters of a positive emotional response to the possibility of extending certain signs among humankind:

(1) Positivity ("How desirable or positive is the presence of this feature in human beings?");

(2) Prevalence ("How common is this feature among human beings?");

(3) Universality ("How universal is this feature in human beings, belonging to different cultural and social communities?").

The correlation coefficients of these parameters human nature of the respondents ranged from 0.66 (Universality) to 0.90 (Prevalence). According to the authors, in the mass consciousness, this complex is characterized by a holistic, systemic effect and its selective or mosaic technological modification will entail dehumanization, i.e. growing evolutionary risk. The risk is diagnosed upon violation of the criterion of evolutionary correctness.

Dehumanization as the actualization of evolutionary risk manifests itself as a weakening of the manifestations of emotional life, replacing them with rational manifestations of mental processes in such perception and such interpretation. A person within the framework of such a model risks losing its essence, turning into an automaton, a machine, whose behavior is entirely determined by external circumstances. (We consider the structure of the images of the intentions of the mass consciousness, and not the logically consistent scientific or philosophical concept here.)

"Humanity" emphasizes the uniqueness of humans, the occurrence of its features and attributes can`t be explained by evolution of biological module, but are fixed by social heredity. Judging by the results of the same test, cluster HU positively correlated with evidence of ability to learn (r =

0.65, p <0.01), age (r = 0.34, p <0.01) and learning disabilities (r = 0 81, p <0.01), but, strangely, not a morality (r = -0.04). Dehumanization (updated evolutionary risk) in this perception and this interpretation appears as a weakening of the "high" emotional manifestations of life, such as love (in all its forms), conscience, patriotism, etc. Dehumanization in this model is equivalent to increase of animal origin.

Further analysis of the results of these observations in the context of our study can be carried out in two complementary aspects:

- Particularly psychological aspect is process of formation and modification of identification / self-identification of individuals by their belonging to the human race), and
- Globally-evolutional aspect as elements of the techno-humanitarian balance and gene-culture co-evolution affecting the outcome of macro-evolution of *Homo sapiens*.

Socio-psychological perspective allows us to estimate not only the reliability and significance of the binary opposition intentions HN and HU as factors

- Of the perception of the prospects of High Hume technologies and, consequently, the prospects of the evolutionary destiny of our species, as bearers of a certain type of evolutionary strategy, and
- Of humanity as a carrier of a certain system of values defined as humanism (in the philosophical sense of the word).

The type characters are components of the describe personality in diagnostic system of coordinates within the framework of psychological concepts (McWilliams, 2001). D. Shapiro describes so-called "neurotic styles." This term combines the styles of thinking, perception and emotional response that are ways of psychological activity characteristic to neurotic states. They are formed as a result of decompensation of adaptive abilities and, therefore, are outside the normal range (Shapiro, 2000).

Affiliation of the person to a particular type determines the combination of drives, affects and temperament, the repertoire of psychological defenses and the specificity of the course of adaptation processes. It can significantly affect the assessment of the signs presented as "animalistic" and "robot-like" in the experiment of S.Wilson and N.Haselam.

Answers of obsessive, compulsive, or schizoid individuals can reveal the greatest probability of deviations from the average indicator in the direction of reducing the proportion of characteristics rated as robot-like. Psychopathic and hysterical individuals may exhibit similar deviations for traits assessed as animal-like.

Thus, it can be assumed that the results of the study may differ depending on the distribution of types of personality in the sample due to

the prevalence of one type or another in the population. There is apparent adaptive advantage of the obsessive-compulsive style at the present stage of civilization development, for example.

The conditioned "demand" for a certain cognitive style contributes both

1. To an increase in the prevalence of obsessive-compulsive disorders, and
2. To an assessment of its obvious deficiency characteristics (rigidity of thinking, attention to detail at the expense of perception of the whole, a violation of the sense of autonomy, etc.) as advantages over less productive in the field of achievements, but more harmonious and full perception and experience of reality.

There is process of rejecting another person for recognizing him as a person that depends largely on the level of empathy and projective-introjective balance; it can change toward the predominance of projection or introjection depending on the actual state of the mind. Obviously, there are external causes that facilitate its course.

In all likelihood, the scenario of the "dehumanizing" process must be individual in each particular case. However, we take into account the worldwide trend towards the growth of narcissistic and borderline personality disorders, and an increase in the level of depressions related to the disturbance of maintenance of affective homeostasis too.

According to some experts (Rudnev, 2001), depression is the closest to the animalistic state. Therefore, we can assume some of the vectors of dehumanization is predominant. Due to the lack of personality development, inability to subjectivity leads to a specific violation of interpersonal relations. Another individual is perceived more as a regulator of narcissistic homeostasis, and not as an independent person.

Such a state of personality can contribute to the distortion of perception and the refusal of another to recognize its unique characteristics belonging to the HU cluster, first of all. The enhancer is a combination of the characteristic depression of the actualization of primitive sensations with the reduction of the ability to semiosis and the loss of the ability to experience human feelings.

In other words, there is a formation o chain of causal connections and evolutionary conflicts as their consequences in the socio-psychological sphere: (1) cognitive dissonance caused by a gene-sociocultural inter-modular conflict – (2) depression – (3) narcissism – (4) xenophobia – (5)exaggerated negative perception of targeted intervention in the somatic norm.

If our short-term socio-psychological forecast covering a maximum of several decades proves to be reasonable, there will be an increase in the

social inhibition of the biotechnological sector of the NBIC-complex (management and manipulation by the genetic code) in Western societies. There is a relatively smaller, but also increasing mental resistance in relation to various "humanitarian" technological schemes (management and manipulation by cognitive and socio-cultural codes) too.

The forecast is based on the spontaneous properties of the mentality. It does not take into account the influence of the elements of the techno-rationalistic module that are external with respect to the mentality, which are "humanitarian" technologies in themselves. The collision of various patterns of behavior modification of the electorate can significantly affect the previous conclusion.

The theoretical foundation of the described model is the concept of primary and secondary emotions (Smith, 2014: 817). In accordance with it, the HN cluster is based on the so-called primary emotions that determine the initial adaptive behavioral programs, the cluster HU is based on secondary emotions derived from primary ones. Secondary emotions are emotional complexes necessary to provide social adaptive programs.

Binary bundles of adaptive reactions and primary emotions includes (Izard, 1977:33-35):

- Acceptance and Incorporation-ingestion of food and water;
- Disgust and Rejection-riddance reaction, excretion, vomiting; Anger and Destruction-removal of barrier to satisfaction;
- Fear and Protection-primarily the response to pain or threats of pain or harm;
- Joy and Reproduction-responses associated with sexual behavior; Sorrow and Deprivation-loss of pleasurable object;
- Startle and Orientation-response to contact with new or strange object;
- Expectation and Exploration-more or less random activities in exploring environment.

The dynamics of the process of humanization / dehumanization is determined by the perception of signs that activate the primary emotions and are transmitted through biological inheritance. So, secondary emotions are emotional complexes of primary ones. In response to the emotional stimulus, several adaptive programs are activated at once, and as a result, a qualitatively new adaptive response is formed. The basis for the formation of secondary emotional complexes is socio-culturally supported association (Cheshko, 2012). If there is a minimal discrepancy of efficiency, it is equivalent to the absence of differences between attribution of signs as members of the corresponding cluster in the system of sociocultural predispositions and within the framework of a proven disciplinary matrix.

Another word, this discrepancy is equivalent to minimum value of evolutionary risk.

Let's note one more complicating circumstance. There is overlapping of the spheres of application of various adaptations related to the clusters “Humanity” and “Human Nature”, which leads to an evolutionary conflict. So, explicit group of socio-cultural adaptive predispositions are mostly confronted with hidden individual adaptations. An interesting example is the so-called “dark triad” of personality traits (narcissism, manipulativity and psychopathy). In mentality, they are usually perceived as dysfunctional, i.e. unconditionally related to the diagnostic complex of dehumanization within the framework of the considered scheme. However, direct studies have demonstrated that from the point of view of personal success, they can play a positive role, acting as side effects of separate attributes of humanity, and this effect positively correlates with living conditions and individual challenges posed by modern technological civilization (Jonason, 2014; Jonason et al., 2015).

If we integrate S. Wilson's and N.Haslem's arguments into the logical-terminological scheme of the SESH concept, their adaptive-evolutionary significance seems obvious. The psychological signs and intentions integrated in first concept (“human nature”) are a systemic adaptations stabilizing the biological module, while the components of second concept (“humanity”) stabilizes the socio-cultural module of SESH.

In general, they represent a homeostatic bundle of oppositely directed intentions, stabilizing the level of the techno-humanitarian balance and, consequently, the organization of SESH. In the socio-humanitarian interpretation they represent a means of ensuring the self-identity of a person in the process of technogenesis. In other words, the adaptive value of both concepts reaches a maximum during the development of controlled evolution in its biological (genetic engineering) and socio-cultural (social engineering) variants.

However, there is the paradox of using of the technologies of controlled evolution for the improvement of the psycho-emotional and mental-moral spheres. It consists in trans-module character of these technologies. The technological fixation or strengthening transfers the attributes of humanity from the socio-cultural to the biological module SESH; it makes such signs by a species characteristics of *Homo sapiens*, and not a socio-cultural characteristics of humankind. There is a transfer of the attributes of humanity to the attributes of human nature in terms of social psychology.

This paradox was revealed by Ingmar Persson and Julian Savulescu. They formulate it from the position of transhumanism and use it to substantiate the admissibility of a person’s moral bio-improvement with

arguments to the contrary (Persson, 2010). However, in fact this paradox will not be resolved logically, since its logical core represents an ideological antinomy HUMAN NATURE *versus* HUMANITY.

This logical antinomy is not unique as a representation of the corresponding binary opposition of socio-cultural pre-dispositions within the module. Besides it, there are other antinomies. For example,Brian Terner indicates the antinomy "biologically reducible NEEDS *versus* "cultural reducible DESIRES" in his classic study of the sociology of human physicality. It is rightly, in our view. This antinomy stabilizes the socioeconomic evolution of modern society, acting in this context as a consumer society (Terner, 2008:31-32).

Both sectors of technology-driven evolution are interconnected cycle with positive feedback. As a result, in the presence of economic stimulus , the advanced development of humanitarian technologies will cause a secondary wave, in which biotech schemes are perceived as being more appropriate to the cultural and ethical point of view. In turn, genetic engineering "improvement" opens more opportunities and improves the efficiency of "humanitarian" technological sector. *A priori*, there should be an overlay of sociocultural and technical-rational cycles (bio-and humanitarian technologies of human design), which creates a self-oscillating, tuned autoresonance circuit. A result of its functioning is the probability of transition potential evolutionary risk in actual form; and it is equivalent to SESH destruction and the loss of the basis for the identity of humankind in time.

Even more striking example is found antinomy "SEX *versus* GENDER". The first term is corresponding to biological component, and the second member matches socio-cultural counterpart of antinomy.

Michel Foucault argues the rupture of a biological phenomenon by its socio-cultural counterpart and the subsequent autonomy of gender as follows:

> "The concept of "sex" allowed, firstly, to regroup, in accordance with some artificial unity of anatomical elements, biological functions, behavior, senses and pleasure, and secondly, allowed this fictitious unity to function as a causal principle, omnipresent meaning everywhere requiring detection secrets: sex, thus, could function as the only signifier and as the universal significance" (Foucault, 1996:261-262).

Finally, we note another interesting, but so far exist only as a hypothesis fact. There are results of psychological tests, constructed in the form of gaming economic behavior, which suggests that there are two predisposition and, accordingly, the two behavioral stereotypes in the human psyche at the same time. First stereotype provides for the extraction of maximum personal

benefit (individual adaptability), and the other stereotype provides for the a group benefit (i.e. group adaptability). In the latter case, the effect extends beyond one generation. As far as can be judged, the decision-making mechanism plays the role of a trigger that ensures the implementation of individual or group priorities. This mechanism is realized either by the individual himself or in the process of communication with other individuals (Rand, 2014).

There is ability to spread beyond the life of an individual carrier of an adaptive genotype as one of the hallmarks of the association between inherited as polygenic-biological and socio-cultural signs, as we believe. In the description of the phenomenon of "Genghis Khan haplotype", we have already talked about this phenomenon. In other words, such an association is an attribute of gene-cultural co-evolution at all.

Generalizing examples, we can obtain the following chain of logical arguments and conclusions. In anthropology, there has been an evolutionary split of initial adaptive complexes of biological module on the proper biological and socio-cultural counterparts. This co-evolutionary binary bunch performs identical or overlapping adaptive function and represents a common pattern of SESH evolution. The reason it can be considered the emergence of a number of parallel coding systems for generation and inheritance adaptively significant traits.

Since both HN and HU concepts established in mentality long before the creation of the technology of controlled evolution, they have the pre-adaptive origin, and their mechanism remains unclear. Perhaps, of course, that in their totality they originally were in the internal homeostatic system of integrity of socio-cultural module, and prevent the spread of destructive innovation. By "destructiveness" we denote a gap in the co-evolutionary correspondence between a culture and a biological modules of SESH. Examples of such destructive innovations can serve the spread of extreme versions of "mortification of the flesh", or, on the contrary, a cynicism as a complete denial of independence and self-worth of the spiritual life. In this regard, we recall that the religious concept of the carnal and a spiritual duality of human nature has a very ancient history. (There is great Russian poet Derzhavin's famous aphorism

"I am King, I am slave, I am worm, I am God".)

It is easy to see that the effectiveness of the evolutionary scenario as a result of social choice cannot exceed the maximum possible for this type of SESH and this ecological and cultural landscape, $E_{eff} \geq E_{opt}$.

The total value of the evolutionary risk is defined as the sum of the biological and cultural components, $R = R_{gen} + R_{hum}$. The technology adaptive innovations (R_{tech}) enter into this equation in a hidden form as third component of the adaptive strategy, because they are derived from the social order (i.e. social and cultural adaptations), and the latter, in turn, formed a divergence of techno-humanitarian balance through dysgenesis of genetic and cultural co-evolution.

Thus, the technological evolutionary risk is the derivative function of its biological and socio-cultural components. The above equation assumes the risk of the value of the evolutionary final appearance

$$R = R_{gen}(R_{hum}) + R_{hum}(R_{gen}) + R_{tech}(R_{gen}R_{hum}) \quad (3.22)$$

The system integrity of SESH is determined both by the connectivity of each of its components, and the continuity of the configurations of the direct and inverse connections between the components. However, transformations flows within the socio-cultural component of SESH are the key processes here.

The organization and composition of value priorities will determine the future vectors of spontaneously irrational, biological and techno-rationalistic evolution of humanity. The formation of value priorities occurs within the culture itself by definition; it is self-reflected by culture as a "moral choice" of the attributes of "humanity".

The resolution of the situation of moral choice can go in accordance with one of three alternative scenarios for the subsequent course of anthropogenesis:

1. *Genetic reductionism (biocentrism)* is maintenance of the genetic constitution of *Homo sapiens* ("the human genome is the heritage of humanity") as a substrate of continuity of humanistic foundations of culture evolution;
2. *Culture-centrism* is direct conservation of the system of humanistic values, ensured by rationalization and technologization of culture autoreplication;
3. *Technological imperative (techno-centrism)* is priority technologies as a means of solving all problems of existence (survival) of intelligent life.

The set of these options is itself an invariant of the evolution of SESH. The first two alternatives accentuate the conservative-protective (bioethical) trends of anthropogenesis; third alternative is progressism, transhumanistic trend leading to the inevitable disintegration SESH. Actually this scenario

means the achievement existential evolutionary risk, as in this case, the elimination of the two components of risk (R_{gen} and R_{hum}) depends entirely on the technological potential (R_{tech}).

"Visualization" of the third (technology) component of evolution would mean the risk of destruction of the integrated organization of SESH, and its total reduction to technological innovation and optimizing the environment in terms of adaptation of intelligence carriers to support the effective implementation of the same technologies.

(As stated in the commentary to the Russian translation of the book Forrester's "World Dynamics" (Forrester, 2003),

> "only a post-industrial person corresponds to a post-industrial society. There is no reason to believe that it is easier to train and educate a carrier of post-industrial culture than the notorious builder of communism" (Jutanov, Pereslegin, 2003:355).

It is obviously due to a conflict between the complex biological, cultural and rationalistic adaptations.)

In this case, the equation radically simplified since only includes technology components: $R = R_{tech} = 1$.

The remaining components in Equation 3.22 cease to influence each other and the integral value of the evolutionary risk, and can be equated to zero, since these components reflect the mutual conjugation of the biological and socio-cultural components of SESH. Thus, the co-evolutionary triad of SESH ceases to exist and can be reduced to a "Posthuman future" or technogenesis. The same conclusion we made on the basis of purely conceptual analysis of the role of socio-cultural component in the structural transformation of SESH earlier.

The potential for such evolutionary scenario is determined by the relative autonomy of cognitive subsystem (that is theoretical science) and the projective-activity ones (actual technology) of techno-rationalistic module. Technological subsystem and not theoretical science directly affected by changes in lifestyle and social environment to socio-cultural component of SESH.

In the first half of the 20th century, there was occurred first attempt to implementation of the transition of the organization of SESH from homeostatic relatively stable structure of the third phase of evolution to the uncompensated contour direct links and feedbacks of fourth phase. However, eugenics scheme of technologizing biological human evolution did not pass the sieve of selection. The main reason for this "failure" was not the incompatibility with the basic value priorities of the humanistic Western culture, but it was rather the low efficiency of technologies based

on the laws of classical genetics. Activation of the resistance of culture to technological innovations of this kind came later, as a result of the geopolitical and ideological confrontation with Nazi Germany.

In this case, the initiating impetus was evolutionary transformations within culture and mentality, using technological schemes as a factor of expanding their influence in the society, nevertheless. There was actualization of schemes for the evolutionary transformation of the human gene pool in Nazi Germany, but also in a number of democratic countries (Scandinavia, the United States, etc.). This tendency was associated with the parallel progress of the "formation of a new man" and "Michurin genetics" in the former USSR as antagonistic to the eugenic political doctrine. At the same time, both of them are surprisingly similar in their organization. Elimination of both these nominees for cultural adaptation was predetermined by insufficient values of the balance of efficiency and maladaptive effects associated with the already existing socio-cultural adaptations.

Modern gene therapy and genetic engineering schemes have a much greater potential efficiency, which significantly increases their chances of integration into existing systems of the socio-cultural adaptive complex. The results of such integration will be destructive for the internal connectivity of the existing system of value priorities and will extend also to the genetic component of SESH.

Thus, in the 1900-1970, two competing innovations were formed within the sociocultural sphere, and the differences between them did not concern the actual technologization of the evolutionary process; but now the situation is different.

In today's society, a clearly delineated systemic innovation of the priority of the socio-cultural component of SESH in comparison with technology. In the field of mental rationalism, this innovation was constituted as a concept of bioethics. Bioethics actually introduced the maintenance of the biological substratum basis of human existence as a general human right. Thus, the biosocial nature of man was included in the system of universal human values of the humanistic worldview, subject to protection and maintenance in the "optimal" scenario of the future course of anthropogenesis. In the sphere of social organization, a formally relatively effective biopolitical mechanism has emerged for the actualization of these values. In other words, in recent decades, the final trajectory of global evolution has focused on maintaining the continuity of

the existing cultural tradition as a basic value, which is more in line with the culture-centric rather than the technocratic scenario.

The next factors of the possible destruction are the mechanism of generation of elementary adaptations and their integration into the overall system of adaption genesis. For the most part, as the emergence and selection of a new "nominee" place of the mosaic type i.e. solving evolutionarily adaptive problem *ad hoc*.

The integration of the individual adaptations in a unified system is realized only *a posteriori*, by further adjustment, selection and differential modification of the original, usually pleiotropic effects.

Not so long ago, American psychologist, cognitive scientist and popularizer G.Markus wrote that there are adaptive products of evolution in general and organizations of the human brain in particular, which are a set of sequences for relatively ineffective individually adaptive or technical solutions; but the latter combine to form an extremely efficient adaptive complex. (Markus , 2011: 5).

This conclusion the author refers to the biological (genetic) adaptation only, but in the same way, it applies to the socio-cultural adaptations too. In both cases, adaptations or maladaptions formed as an attribute of the discrete pieces of information. However, it occurs only in conjunction with other similar fragments in the context of particular environments. Therefore, in our opinion, the obvious interchange of the mentioned evolutionary-psychological ideas of G. Marcus and, let's say, the key points of B. Malinovsky's functional theory of culture (Malinovsky, 2005) should not be surprising.

It is a consequence of the internal mechanism of evolutionary process, in general, and of progressive evolution as increasing system complexity, in particular. Elementary adaptive transformations are formed on the basis of the available pool of information fragments. The latter are formed not only by existing socio-ecological environment, but by previous evolutionary history (by genetic drift in the case of biogenesis) too.

In turn, specific adaptive "innovations" can be based on the magnitude of ecological and ontogenetic plasticity and population variability of individual traits. Finally, the point of application of specific adaptations can be either an individual or a social group. To this must be added the pleiotropic manifestations of individual structural genes, further increased due to various epigenetic modifications (Sih, 2011:368).

In the gene-cultural co-evolution and techno-humanitarian balance, i.e. in both co-evolutionary bundles, a more slowly evolving member of the binary opposition initiates an adaptive-innovation process in a more dynamic partner. The latter either returns the evolutionary impulse back

after the generation of a single adaptive innovation, or turns into a self-sustaining generation cycle of secondary, tertiary, etc. intra-modular innovation.

It is important to note, in this cycle of conjugate acts of adaptation genesis, direct links pass between synchronous phases of the partners, and the reverse effects are recursive, i.e. are carried out by some delay. Such a system has as its main attribute a property that can be enunciated as "imperfect coordination and relative order" (Nazaretyan, 2013:39). Maladaptations are constantly overcome by some parameters and is generated by others.

In this way, a transmission mechanism is formed that extends from the sphere of proper biological (genetic) adaptations to the field of SESH's socio-cultural and technological modules. According to the laws of feedback, adaptive and non-adaptive evolutionary history outlines the boundaries of sensory and cognitive processes and behavior, and other signs that have an adaptive value *in potentio*, as well as their genetic variations in the future. It opens a new cycle of reverse influences on the future evolution of individual and group (social) adaptivity.

3.5. Intra- and intermodal co-evolutionary conflicts as a mechanism for generating of evolutionary risk

So, adaptation in each particular case solves the local evolutionary problem by optimizing the interaction parameters of some evolving, self-organizing system with the habitat, if these parameters are priority for the future existence of the system at a given time and place. Both the "problem situations" themselves and the evolutionary solves are autonomous and relate to autonomous, often mutually exclusive or conflicting system parameters.

Thus, the generation and fixation of adaptive innovations is built on the fractal-modular principle. The same applies to their cumulative at this time result. As we remember, the very organization of the stable adaptive strategy of *Homo sapiens* is an example of such a modular organization.

Clearly, the same principle applies within each element of SESH. There is the emergence of binary oppositions "actual adaptation − potential maladaptation" as the simplest case of the generation of evolutionary risk. Also, there is a fixation in a population of a self-replicating element that optimizes integrative adaptability in one of the parameters of fitness / survival.

In a parameter that was previously insignificant, it may become a causal factor for reducing integrative adaptability. For example, occurred in the genome of primates about 3.5 million years ago point mutation resulted in the replacement of arginine on glutamine at position 332 in polypeptide chain protein TRIM5α. Carriers of this mutation were immune to the PtERV1 virus, which now leads to the development of leukemia in mice and, most likely, was a serious threat to human ancestors at that time. Apparently, the protein TRIM5α functions on the principle of a trigger that provides resistance to only one type of so-called retro-virus, either HIV or PtERV1. Over time, the PtERV1 virus has lost its virulence and now exists as an element of the genome of individual primate taxa (Kaiser, 2007).

Now, there are formed radically modification of the genetic components of the evolutionary risk of SESH as result of changes in the epidemiological situation and its socio-environmental "context". An adaptive triple fractal clusters are presented more sophisticated and capable to increase the amount of risk development. Thus, the resistance to HIV infection in primates is controlled by three groups of related genes (Ortiz et al., 2009: 2870).

A triple modular structure arises at the basis of the genome as a biological adaptive module of SESH. The latter includes three sets of functionally independent but overlapping in the software and information aspect genetic clusters. These clusters serving to development of intelligence, the sexual process and feeding of juvenile age individuals. The latter feature is even more significant in comparison with other species of mammals due to the extremely long period of childhood and puberty. In turn, the importance of the latter factor stems from the combination of adaptive cephalization on the one hand and difficulties of reproduction in conditions of bipedalism, on the other hand.

This conflict forms increase the likelihood of developing cancer tissue degeneration *versus* accelerated aging and loss of regenerative capacity as one of the main gradient of evolutionary risk in biological module of SESH. It is "Genetic axis of Evil" in the terminology of some modern evolutionists (Crespi, 2010: 96).

This option may be called "Cultural axis of Evil" with respect to socio-cultural adaptation module, if we adopt the metaphor. It is formed along the gradient of social stability *versus* progressionism / expansionism, or closed society *versus* open society for "phenotypic" expression, in accordance with the described algorithm of evolutionary risk genesis.

"Technological Axis of Evil" is formed by the existing imbalance between the power of technology and the ability of society to control their consequences by not strong enough techno-humanitarian balance. However,

“social control ability” Is determined by the imbalance between individual and group behavioral adaptability.

This imbalance is determined by the conflict of socio-cultural and genetic-biological modules of SESH. During the first phase of the evolution of SESH, dominant behavioral stereotypes were formed as biological adaptations to the survival of small social groups in conditions of low or low level of technology. Subsequently, behavioral adaptations were provided by the adaptation of the sociocultural module and contributed to the survival of steadily increasing in size and structurally complicating social groups in the context of technological progress. This trend dominated throughout phases II-III of SESH evolution

At his time, N.Moiseeff found very successful in our opinion the metaphor for

- non-compliance of attitude and genetic heritage of hunters tribes ,
- non-compliance of power of modern civilization and common sense of society,
- non-compliance of infinitely growing human material needs and the planet's limited resources, and
- “the lack of understanding of the responsibilities of each person for the fate of the planetary community”.

He called this contradictory complex “Pithecanthropus generic labels”.

All these features are adaptive only under relatively small groups and weak technological capacity. This fact is so obvious that it can be considered trivial. It is equally obvious that the overcoming of the “Pithecanthropus generic labels” was carried out within the framework of the socio-cultural module of SESH.

However, socio-cultural adaptations were developed through the system of epigenetic transfer mechanisms of the genetically determined individual or small group behavioral stereotypes as regulators of social and socio-technological development (morals), providing a large group adaptive advantages.

Thus, the “System axis of Evil” emerges as the main source of the evolutionary risk of the phase IV of the evolution of SESH. The system axis includes a three-component co-evolutionary node in the composition of the individual behavior, group morality, and technological capabilities. In fact, it is the result of a discrepancy between gene-cultural co-evolution and the techno-humanitarian balance. The inevitability of this discrepancy arises from the different rates of adaptation of the biological, socio-cultural and rational SESH modules.

On the part of the mass media and the public, keen interest is attracted by inconsistencies and conflicts between various adaptations belonging to

the same and, especially, different SESH modules. The public feels in them a source of potential danger for themselves and other representatives of our biological species, obviously unconsciously. As a result, there are non-fiction books and other publications affecting or directly devoted to external manifestations of SESH systemic inter-module conflicts. These publications use rather outrageous forms of presenting information designed to exploit this feature of social psychology, which carries signs of systemic anti-risk adaptation, in turn. (However, this thesis itself needs an empirical justification and theoretical reasoning.)

Suffice it to mention only two such publications in recent years. There are already cited book of Marcus and the work of "the neurophysiologist and comedian" by Dene Barnett under the pretentious title "The Idiot Brain" (Burnett, 2016) as described in the Guardian and in the annotation. The examples are rather demonstrative and do not serve as indicators of the evolutionary risk associated with the existential level of danger.

The most striking of them are the effect of motion sickness that occurs in certain individuals when using vehicles and is characterized by the worst ability of almost everyone to memorize names compared to the visual memory of their owners. In the first case, the cause is a conflict between vestibular and visual systems, orientation in space, and the second phenomenon is due to the different efficacy of the neurophysiological "support systems" of the participants of social communications. However, in both cases, the origin of adaptive conflicts is associated with incomplete compliance of the requirements imposed by the newly emerging adaptive innovations of the socio-cultural and techno-rationalistic modules and the elements of the biological module they use. As a result, the parameters of the human body approach the boundaries of the biological adaptive zone by individual indicators. There are many such examples.

In our previous publications (Cheshko, 2012: 288) has argued the hypothesis that in a history, this conflict is associated with adaptive interaction in the mental life of two information systems. They act for each other as figurative-emotional (images) and verbal-logical (discourse) information substrates. As a result, the evolution of a mental image of a trajectory having two assemblies points. These assemblies corresponding to the dominance of religion or rationalism in the spiritual culture.

Pleiotropic effects form a wave of adaptive evolutionary transformations in multidimensional space of adaption genesis. These transformations apply to all components of adaptive strategy, as well as on socio-cultural and ecological environment. Number of dimensions in the case of evolutionary landscape of *Homo sapiens* proportional $N_{gen}N_{hum}N_{tech}$ in first approximation only. Result is a two-dimensional diagram of the evolution

of a single innovation that not fit fully into the binary bundle of moving and stabilizing selection.

Vice versa, it takes the form of an extremely complicated path on trajectory projections on a multidimensional graph of frequency distribution of a set of an innovation. In practice, elementary adaptations are relative to each other in a state of constantly generated and overcome conflict.

In contrast to the elementary acts of adaptation to changes in the ecological environment, such inter-adaptive conflicts evolve according to a co-evolutionary mechanism; their outcome is initially open and lasts a considerable time on an evolutionary scale (Crespi, 2010: 85). Similarly, autism is the result of such an adaptive conflict between social intelligence and cognitive-systematization ability in the case.

Intermodular adaptation conflicts should be even more stable and unpredictable in their trajectory and dynamics due to the significant difference in the pace of development between the individual modelsules.

Conflicts between the elements of one module generate inter-modular conflicts. An example is the conflict of adaptations between biological adaptations to cyclically or stochastically changing each other's hunger and the abundance of food. Such intra-biological conflicts make the biological module of SESH sensitive to factors that have a socio-cultural origin to the economic and political characteristics of the given society, in particular.

As a result, the population passing through the period of modernization of societies has an increased genetic and metabolic risk of accumulation of excess weight in mature and old age, and not enough rapid weight gain during childhood and adolescence.

This double risk has a single socio-cultural determination caused by adaptive changes in the quality and mode of life of a modern society. The present stage of evolution of SESH is determined by the appearance of technology-driven evolution or more precisely, a proto-technology of this type, and these technologies capable carrying out the rationalistic management or manipulation by genetic, socio-cultural and cognitive codes. Before it, the Gordian knot was formed by co-evolutionary oppositions: gene *versus* culture, culture *versus* technology, gene *versus* technology; and it was resolved through cultural transformations. Now “superposition” of biological, cultural and technological adaptive SESH modules may use only in a metaphorical sense, since the possibility of independent linear transformation of individual elements of superposition is lost.

By linear extrapolation of the evolutionary imbalance of the risk of the SESH socio-cultural and biological module, the causes of the risk can be reduced to differences in the rates of adaptation genesis in each module only.

The occurrence of "diseases of civilization" is considered as a permanent adaptation genesis incompleteness in its biological form because significantly higher rate of socio-cultural evolution within linear aproxymational model. Then the speed of accumulating genetic load in a population is a measure of evolutionary risk. Removal solution is achieved automatically by the emergence of created by genetic engineering additional feedback loops of "technology−genome". In fact, thus the linear model becomes invalid, and the risk level of evolutionary approaches close to the existential level as we will try to argue in the future.

Moreover, this conclusion is not only concerned with a particular adaptive module, but the entire system of SESH in general. It can be extended to any anthropogenic ecological systems of any complexity level, including technological and noosphere. Or, as is written in a review of the global economy evolution in the journal "Nature" (Helbing, 2013: 51),

> "Today's strongly connected, global networks have produced highly interdependent systems that we do not understand and cannot control well. These systems are vulnerable to failure at all scales, posing serious threats to society, even when external shocks are absent. As the complexity and interaction strengths in our networked world increase, man-made systems can become unstable, creating uncontrollable situations even when decision-makers are well-skilled, have all data and technology at their disposal, and do their best. To make these systems manageable, a fundamental redesign is needed. A 'Global Systems Science' might create the required knowledge and paradigm shift in thinking".

From the point of view of the author of the cited article, a member of the Risk Center of Swiss Federal Institute of Technology Dirk Hedling, the new configuration of the network environment of mankind is characterized by a high probability of cascade processes. Such processes have the fundamental feature that initiates an impetus is not comparable in magnitude with the value and duration of the process. It is only necessary to add that from the perspective of evolutionary theory, the core of this network of interconnected technological, anthropological or noosphere systems are stable evolutionary strategy of its "information carrier" and, at the same time, the "operator" – a person.

Therefore, the discrepancy between elementary effects on the resulting value of adaptive efficiency means growth, and convergence means a reduction in evolutionary risk. In other words, the risk is an evolutionary byproduct of adaption genesis. It arises from co-evolutionary and stochastic but not functional and causal relationships between its autonomous elements.

There are the association between the individual elements of the genome, culture and technology, which have a clear tendency to increase in the number of carriers and / or strengthening of expressiveness in such systems. It is the argument for the existence of these phenomena:

1. Intra-genomic co-evolution and intragenomic conflicts as a result of the stochastic mechanism of generating of adaptive / maladaptive genetic information between the individual pleiotropic fragments in accordance with the Darwin-Weismann modus;
2. Gene-cultural co-evolution, during which elementary fragments of genetic information are used as a substrate for the socio-cultural adaptation, regardless of their own biological adaptive values;
3. Inter-cultural co-evolution between the elements of culture, whose occurrence is due to the different aspects of bio-social life, or appeared in a different ecological and cultural environment, but is retained as a result of semantic association with the supporting elements of the adaptive overall system of cultural values and mental stereotypes;
4. Techno-humanitarian balance that is equivalent to culture-technology co-evolution, and based on the spontaneously occurring associations between new technological developments and socio-cultural resources to support them;
5. Inter-technological conflicts (technological traps) caused by mutually exclusive or hardly compatible requirements of individual technological innovations to the socio-cultural environment or by imbalance of the demands of various social communities to such developments.

All these five types of destructive co-evolution (evolutionary risk) are reduced to a conflict between adaptation reactions to the effects of different factors, or between adaption genesis trends genetic and socio-cultural structures of undifferentiated population.

Assessments of integral indicators of evolutionary risk for all the above components are not found in modern publications. It is understandable, taking into account the undeveloped concept of evolutionary risk in general. However, there are some indirect data to assess the particular manifestations of the evolutionary risk in relation to the genetic (biological) component of SESH. These data are an increase in the frequencies of various molecular genetic pathologies.

There are calculations by a Canadian-American researcher in the field of evolutionary biology Bernard Crespi. According to him, there are hereditary diseases associated with structural genes or individual haplotypes that have a positive selection pressure diagnosed. Over the past 10 thousand years of human evolution, their relative values are 17-21% for neurological disorders and 15-21% for other etiological diseases. In the control group

analogous index fluctuated between 21-25%. (Gene pool whose positive selection during the relevant period of anthropogenesis was not observed.)

Crespi comes to an obvious conclusion that evidence of accumulation of genes determining the development of hereditary pathologies has not been obtained to date (Crespi, 2010).

However, in the same way as quoted, researcher argues that among the genes that have been accumulating for the past periods of evolution of *Homo sapiens*, found more often than usual determinants associated with neuro-psychiatric disorders. These include such pathologies as schizophrenia, manic-depressive psychosis, depression, dyslexia, autism, Alzheimer's and Parkinson's diseases, epilepsy (Crespi, 2010:300).

The impression is created that there is expression of specific "human" traits involved in the development of speech, symbolic thinking and social and emotional intelligence, and these traits are excessive in relation to the biological norm. Many "sapiens" human signs largely overlap with a plurality of psychotic affective symptoms.

If this conclusion is not to be reviewed in the course of further research, it is quite adequately fit into our concept of stable adaptive evolutionary strategy and evolutionary risk. In essence, an association between genetic maladaptation and cultural adaptation should be observed more often than binary bundles of genetic and socio-cultural adaptation, and this hypothesis is directly corresponds to the to our conception.

The conclusion follows from the foregoing. There is the transformation of culture into a selective factor that determines the fixation or elimination of specific fragments of genetic information according to their adaptability or non-adaptability in the socio-cultural environment; and the significance of it far exceeds even very strong selective incentives from the actual ecological evolutionary landscape.

This thesis creates the impression of an "attenuation" of the biological form of adaptation genesis in human evolution. However, the set of possible mechanisms of gene-cultural co-evolution is not exhausted. In addition to selective pressure on the human gene pool, two more effects appear (Milbrath, 2013:406). This refers to the transformation of existing functional significance of genetic variation in the population or in social group in accordance with the new adaptive socio-cultural landscape. The essence of this phenomenon is determined as the evolution by the change of function. Sometimes it is call exaptation with a view to distinguishing this phenomenon from classical adaptation.

Exaptation (genetic evolutionary correctness of our terminology) becomes an adaptive significance in the genetically adaptive cultural complex only. Potentially selective advantage given to those genetic and

cultural co-adaptations, and latter then converted biological maladaptation to basic adaptation as part of the integrated gene-cultural complex. At phenomenological aspect, the effect creates the impression of a direct genetic pressure on the general trends of cultural evolution and its elementary components. In other words, it provides empirical material for genetic reductionist interpretations of anthropogenesis and ethnogenesis.

For example, there is a correlation between phonetic features of the Italian and some African tribe's languages and genotypic variability in the structure of the vocal apparatus respective ethnic groups that serve as curious, although highly controversial example. A hypothetical explanation is the pressure of the previous population genetic differences in the general direction of a particular language phonetics (Dediu, 2013:153-154). An alternative hypothesis is the selective pressure on the population structure of linguistics[11]. But last assumptions faced with some difficulties. It seems unlikely that minor differences in pronunciation can have a marked selective value.

There is third mechanism of the evolutionary cultural-biological and, obviously, cultural-technological interfaces of the SESH components. It is associated with cultural inhibition of adaptive modular differentiation of the genome. More rapid cultural and technological adaptive response to problems of survival makes redundant development of a similar adaptive evolutionary transformation within the genomic cluster. Although biological adaptation would have been possible to solve the same problem.

As result, firstly, adaptive evolution of genome is replaced by stochastic processes, i.e. by genetic drift and, secondly, there is a gradual erosion of adaptive components of SESH, i.e. increase of genetic load.

So, three original type of culture and genome co-evolutionary relationship can be reduced to two types: coadaptation (Darwinian adaptation and exaptation) and disintegration. *A priori* the same types of convolution relations apply to a pair of culture – technology.

Thus, the organization of SESH always admits either an increase in systemic complexity or disintegration as two possible scenarios for future evolution. The second scenario implies the fallout of individual elements of the SESH co-evolutionary triad. The ratio of the probability of actualization of both evolutionary scenarios is changing with the emergence of each particular genetic, cultural and technological innovation. The magnitude of the resulting effect determined for the total amount of SESH adaptability by the configuration and ranges from 0 to 1, and therefore requires constant monitoring.

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[11] Genetically drived co-evolutionary semantics in the ''pure'' – Auth.

Therefore, equivalent concepts are the establishment of an association of biological maladaptation and sociocultural adaptation and the establishment of co-evolutionary relations between them. Compensation occurs of maladaptive manifestation of the individual elements of the genome and its derivatives (proteinom, metabulom, etc.) by the associated elements of culture. As result, these genomic factors become elements of culture themselves. On the next phase of development of co-evolutionary relationship, the integration becomes of genetic-biological component in the overall system of socio-cultural adaptation as its biological prerequisites.

However, a coevolutionary ligament appears of cultural elements with biologically non-adaptive characters and genes, which can be established without going through the first (compensatory) phase of its genesis.

In this phase, the negative individual selection is replaced by positive selection at the group level. As has been repeatedly mentioned here, an example is the spread of sickle cell anemia and other hematopathy genes in irrigated tropical areas of agriculture.

Selective factor in this case is the spread of the pathogen and malaria vectors. The resulting adaptive efficiency is determined by the aggregate balance of the two maladaptive, but antagonistic effects of sickle cell allele on one side and adaptability of the techno-cultural balance in the rice-growing areas on the other. (It should be noted that the presence of a cultural and technological complex associated with the development of irrigated agriculture and the choice of rice as the main grain crop became not the root cause, but only an enhancements of the accumulation of genetic load associated with sickle cell anemia.).

Recently discovered examples of this kind are high concentrations of genes that increase the likelihood of excessive accumulation of cholesterol and cardiovascular diseases in populations of northern Siberia (Clemente et al, 2014). The transition to existence in the conditions of the North was associated with an almost complete replacement of crop products by meat diet. This process was determined and replicated by culture. It led to the replacement of the previously dominant “glucose-centric” metabolic type by “lipids-centric” metabolic type.

This metabolic type led to the accumulation in the organism of ketone bodies as the assimilation products of lipids and lipoproteins. Distribution of the mutations in the population served to neutralize harmful consequences of this process. It was secondary effect of the biological coadaptation to socio-cultural coadaptation.

In the 20th century, there was initiation of a new set of social, cultural and techno-rationalist transformations, which led to a revival of the original lifestyle and “glucose-centric” diet and returned described mutation in the

category maladaptive ones. There is a cycle of mutual coadaptation of three elements of SESH, and the gene-cultural conflict is initiated and evolutionary risk is updated but is not reached the existential level.

Similarly, the elimination of lactase deficiency genes in adulthood develops in the population of European countriesations. The inability to ferment lactose occurs at no more than 2% of the Dutch and other Western Europeans and at 98% of Chinese and Japanese after the end of breastfeeding period in children (Vogel, 1990: 41-43).

Obviously, the inverse relationship must be seen in the ability to absorb the soy protein and neutralize of saponins contained in soy. In this case, genetic differences are initiated by the choice of a diet option that can solve the problem of protein nutrition in areas of rice cultivation as sociocultural transformations of lifestyle.

Another example is currently a hypothetical evolutionary mechanism (Benner, 2013) of fixing and geographical distribution of genetic variants of the enzyme alcohol dehydrogenase's key element in the metabolism of ethanol (alcohol) in the body. Initially, this enzyme catalyzes the metabolism of terpene alcohols. With the transition of hominines to terrestrial lifestyle and bipedalism, sociocultural adaptation has changed the direction of selection. The spread in the population received the variants of structural genes that enable the consumption of fruit, in which the fermentation has already begun (Dudley, 2014; Benner, 2014).

Probably, the initiating and stimulating factors were the reduction of the area of tropical forests and the related transition to a terrestrial lifestyle and a new diet. The physiological significance of alcohol is multiple and includes the energy, psycho-physiological and toxicological effects on the physiological and metabolic processes. Each of the components is caused not only by ethanol itself, but also by the products of its metabolism, acetaldehyde, first of all. Accordingly, a complex set of genetic facts was formed in the biological module of SESH, which optimizes this complex of processes and attributes.

There are stress relieving, communication simplification, increasing aggressiveness in case of intergroup conflict, etc. as a side effects of alcohol on the psyche, which is not related to participation in energy metabolism. It became dominant in adaptation genesis gradually. On the other hand, the activity of enzymes (alcohol dehydrogenase, primarily) is determined by socio-cultural inheritance for metabolism, utilization and neutralization of the toxic effect of alcohol and the frequency of the corresponding genes in the population. First of all, the cultural practices of drinking have influenced the selection of genetic determinants affecting psychotropic substances and their effects.

As a result, the use or non-use of alcohol and alcoholism drifted from the sphere of the biological module to the area of the socio-cultural component of SESH. This process was intensified by the involvement of the technological module in the distribution of alcohol consumption. A change of SESH configuration was the consequence of the invention and implementation in the culture of winemaking, brewing, etc. Due to its availability, alcohol consumption has been transformed into a self-catalyzed process and has approached the boundaries of the "window of socio-cultural adaptability", the emergence of a compensatory complex of socio-cultural adaptations, the socio-cultural differentiation of different societies on this basis, etc.

Later, a similar phenomenon occurred with tobacco smoking, according to the latest theoretical investigations of evolutionary genomics (Wrangham, 2009; Aarts et al., 2016) . The approval of smoking occurred after Columbus as a general cultural innovation. The physiological consequences of tobacco smoking are quite complex, although, of course, long-term negative effects significantly exceed the weak short-term positive, mainly psychophysiological and anti-stress manifestations. In conditions of low average human life expectancy, the overall negative balance was masked until the beginning of the 20th century.

However, the ground for this socio-cultural innovation was laid by a mastery of fire as global socio-cultural and techno-rationalistic adaptation. It created immediate evolutionary-semantic and then selective consequences for the SESH biological module. A high adaptive status received the genetic determinants that reduce the pathological effect of gas-dispersed combustion products. *A priori,* it can be assumed that this process was accompanied by the accumulation of genetic factors that, first, postponed the negative effects of combustion products until the end of reproductive age, and, secondly, integrated the metabolic derivatives of these products into the general system of adaptive metabolism.

As a consequence, there are secondary adaptive effects of smoking in mature age and maladaptive and pathological ones in the final phases of human ontogenesis.

The hypothesis has not yet received definitive empirical evidence: "detoxification genes" are noted in the genomes of chimpanzees and Neanderthals, that are much earlier than the appearance of mastery of fire in the evolutionary history (Aarts et al., 2016:13).

Along with it, there is an assumption that the accumulation of "detoxification genes" for substances of plant origin is the result of a more general pattern. The latter was arised from the expansion of their set, not directly related to the use of fire, but, for example, with diet changes, habitat

transformation and so on. But even if the described phenomena are caused simply by the expansion of the diet during anthropogenesis, the thesis of the primacy of the co-evolutionary-semantic component in the evolution of SESH will not be refuted: the presence of genetic diversity is a necessary prerequisite for the development of a socio-cultural adaptive module that uses it.

At the same time, the socio-cultural environment serves as a powerful epigenetic factor that influences the formation of phenotypes in genes associated with the metabolism of food products. The "diet" chosen by the cultural module, therefore, is both a prerequisite and reason for the configuration of this type of civilization (Nabhan, 2013).

Another interesting example of this kind is the relatively high frequency in human populations of the sign of male homosexuality. As mentioned much higher, sexual selection could become the leading form of evolution in conditions of primate populations environment that was rich in food resources. The male reproductive strategy of r-type has been formed. It focused on the largest number of descendants with a weak parental behavior. As result, each male individual maintained reproductive contacts with a significant number of female individuals. Such communicative structure is corresponded to so-called polygyny as one of the varieties of polygamy. It implied a rather complex system of inter-personal contacts within the social group and, consequently, a positive selective pressure on the development of social intelligence; and it is confirmed in a whole complex of biological characteristics of hominines, including anatomical ones (Dixson, 2009, 2012).

On the other hand, the same set of factors contributed to the presence in the population of a fairly significant reserve of genetic and epigenetic variability in the factors affecting sexual attraction.

After the change in the ecological situation, a new distribution of social roles arose, and latter provides for a much greater adaptive significance of the male's parental behavior. In adaptive inversion 1, the leading role was played not by biological heritability but by cultural transmission with the corresponding change in the relationship between the biological and socio-cultural modules of SESH. The maintenance of newly emerging social adaptive functions required the association of new socio-cultural elements with those already present in the population. The cultural transmission has given an adaptive significance to pre-existing signs that does not directly correlate with its previous genetically and epigenetically determined values.

The most adaptive significance was acquired by those genetically determined characteristics, including marginal ones, which were involved by the socio-cultural module in the mechanism of providing socio-cultural

transmission and the regulation of the demographic structure by non-biological adaptations.

At least modern reference books (Leca, Vasey, 2016) indicate the mutual complementarity of the connection with pleiotropic biological determinants and / or their cohesion (1), and involvement and subsequent integration in the implementation of non-reproductive social functions (2) as two explanatory models and mechanisms for the emergence and maintenance of the "third sex" in population of primate. The elements of the bio-semantic associations between reproductive-sexual and social subsystems are:

• Firstly, extending the life span of at least a female beyond reproductive age and,

• Secondly, the presence in the population of homo- and asexual marginal sexual orientations.

It confirms the special role of the sexual-reproductive behavioral subsystem of the biological module and sexual selection in the formation of a complex of behavioral stereotypes of purely social communication.

The social institution of grandmothers provided social components of group reproduction, storage and efficient transmission of socio-cultural adaptively relevant information; the second sign participated primarily in the regulation of the demographic situation, although their importance as "enhancers" and stabilizers of the process of socio-cultural transmission is significant in all world cultures in certain periods of their existence too. (It is enough to recall the role of monasteries as custodians of cultural self-identity and scientific and humanitarian knowledge.)

There is a clear intention to consider homosexuality as one of the variants of the genetic-population and cultural norm in modern Western society. In cultural history and in modern cultural diversity, such behavior often either is recognized as openly normal and not contrary to moral standards (Ancient Greece, modern USA and EU); either is an essential part preformed by existing system of culture and therefore a relatively widespread interpersonal relationship system actually (Victorian England).

This phenomenon does not occur in any species of mammals and other animals on such a scale; and all attempts were unsuccessful to explain in the framework of the classical theory of natural selection. In general, homo- and asexuality is found in populations of certain species of primates and dolphins living in social groups. The same can be said of "social institute of grandmothers". This is another confirmation of the above explanatory models.

Therefore, it received the name "Darwinian paradox" among some researchers. This is already a necessary but not sufficient argument in the

framework of the concept of SESH to suggest that we are dealing with one of the examples of genetic-cultural co-evolution drived by the culture.

The well-grounded, though controversial, hypothesis (Barthes, 2013) assumes the following. A combination of some genetic and socio-cultural factors is initial mechanism of fixation at society of genetic determinants of homosexual behavior. The factors resulting co-evolutionary interactions turned into a single coadaptaptional complex. It include

• A human bisexual mechanism for determining the sex traits complex, in which the development of the behavioral stereotypes of male or female pattern determined by the action of regulatory triggers during critical periods of ontogenesis;

• Incompletely limited by sex action of genetic determinants of increased sexual attraction in women, and these genetic determinants are localized in autosomes;

• Rigid social stratification of social structure coupled with the ability for women to achieve a rapid increase of their own sexual-reproductive pairs with the higher social strata.

In the case of a complete confirmation of the social status, as well as the status of the next of kin ("social elevator") by forming stable hypothesis, there is the mechanism of sexual and reproductive behavior in population that appropriate to a certain stage of socio-genesis and to socio-cultural type. A "genes of homosexuality" are an autosomal genes of female sexual attraction. They are supplemented, replaced or eliminated as elements of culture and elements of the transformation of the social and ecological environment after establishing the initial population equilibrium of gene frequencies. *A priori*, for example, it seems likely that the growth of tolerance or intolerance to manifestations of homosexuality, let alone integration or exclusion included in the complex socio-cultural demographics regulators.

An ancient Greek civilization was a system of city-states with the main part of the population living in a relatively small territory. These features were co-evolutionary prerequisite for the spread of above kind of relations, and, especially, among the aristocracy. The idea is probably trivial to those, for example, who are familiar with the biographies of ancient Greek philosophers by Diogenes Laertius, the classical Greek poetry, etc.

In his classic study, Werner Jaeger (Jaeger, 2001:242) in the early twentieth century wrote:

> "The love of a men for a boy or young men was a significant historic element in the early Greek aristocratic society inextricably linked with its moral and class ideals... Athenian poets and legislators in Athens mention or praise it as a matter of course. They have a particularly

noble origin, since Solon. In his poems, the love of boys is mentioned among the higher living blessings".

Modern researchers claim that the fundamental differences between sexual mores in ancient Greece and our society makes it difficult to compare two cultures (Mondimor, 2002: 20). This confirms the conclusion about the spread of the phenomenon of homosexuality in a given human population as a result of socio-cultural transmitted relatively autonomously from biological mechanism of the phenomenon.

The basis of modern Western culture become the cultural constructivism concept of sexual behavior and sexual roles. Its initial postulate is the assertion that sexual behavior determined or constructed by the culture in which human lives (Lev-Starovich 1991:20). At the same time, gender is acquired through a process of socialization or enculturation. An individual learns, sometimes overtly and at other times more subtly, how to behave, dress, labor, couple, emote, speak, etc. in socially appropriate ways (Geller, 2017: 5). As result, occurrence of the trait in population is explains by "grasping" of cultural inheritance and is adaptively significant, so to speak, "by definition". Michel Foucault draws this hypothetical process (see: Geller, 2017: 7) by the way:

> "A task that consists of not…treating discourses as groups of signs (signifying elements referring to contents of representations) but as practices that systematically form the objects of which they speak. Of course, discourses are composed of signs; but what they do is more than use these signs to designate things. It is this more that renders them irreducible to the language (langue) and to speech. It is this 'more' that we must reveal and describe",

However, sexual orientation is accountable by many biological rules and because homosexuality cannot be considered a purely social "construct". Everything indicates that there is a biological basis of sexual orientation (Lev-Starovich, 1991:213). To encompass the relationship between gender, sex and sexuality, the modern researcher (Geller, 2017: 8) uses the term "socio-sexual". It refers to (self) identity as complex, situationally, and intersecting in different variables, such as gender and sexuality, age, race, ethnicity, class, etc.

Indeed, modern methods of analyzing large databases lead researchers to the conclusion that there is a multidimensional complex of genetic, epigenetic, socio-environmental factors that together form a sexual-gender orientation and behavior (Ganna et al, 2019: 882). It is symptomatic that the commentary on this study focuses on the socio-political consequences of

this conclusion, and indicates the need for a "socio-genomic approach" to the problem (Mills, (2019: 870).

Let us emphasize the logical derivability of this sociological thesis from our evolutionary metaphysical concept of SESH. According to the Geller (2017: 17-18),

> "There is a need to deliberate about emic body scapes, those of the cultures under study, which could feasibly derail *a priori* and naturalized notions about sex, gender, and sexuality".

To demonstrate that socio-sexual diversity has existed through time and space, we could look for those individuals whose identities were defined by a queer status according to our contemporary understanding of the concept, individuals with intersex conditions, homosexuals, transsexuals, etc.

Hellenistic culture can be traced apparent discrepancy reproductive and sexual behavior stereotypes, and it stated by historians of culture for a long time. At the time, this feature did not receive further development due to natural limitations associated with the biological component of SESH.

In the Middle Ages, there was a combination of socio-economic conditions with specific demographics. It contributed to the stratification of the original system of socio-cultural regulation of the sexually reproductive sphere. There was a noticeable increase in the influence of the social institution of monasticism in social organization. In parallel, there was the approval of a categorical rejection of sexual behavior that does not ensure the realization of reproductive function in ethics. According to the modern researcher,

> "Any sexual relationship, not take to the conceiving a child, were considered as illegal and "unnatural". Gradually rejected by various forms of sexual intercourse have a general definition of "sodomy" (Lev-Starovich, 1991: 41).

A gene-culture co-evolutionary trend of tolerance is formed in modern Western (trans-Atlantic) culture that is similar to the ancient Greek. This trend supported by the new configuration of the techno-humanitarian balance. It is implemented in the dichotomy of a common complex of sexual and reproductive functions into two independent components of SESH (Cohn, 2001:34).

In a sense, the reproductive technologies are substrate support of sexual revolution. It can be seen as the final stage of evolutionary splitting of sexual and reproductive behavioral complex directed by culture. The main trend of the process is the progressive erosion of an unambiguous correspondence between the genome as set of genetic determinants and

phenome as set of phenotypic traits of *Homo sapiens* in a sphere of behavioral stereotypes.

In particular, sexual and reproductive emotional complex is one of the three core elements supporting the proto-hominines culture. As Friedrich Schiller written over 200 years ago,

> ”Hunger und Liebe regieren die Welt” ─ “Hunger and Love rule the world”.

(He did not mention a Power as the third element). In the social and cultural transformation, it diverged to five alternative cultural models (Lev-Starovich, 1991: 25-26), namely, platonic, sensual, integrated psycho-physical, antagonistic, negative “Loves”. Each of them provides an association of physiological functions and adequate emotional response in their own design.

As we assume, the basis of such behavioral multiplication is more complex and plastic system of structural and functional association of individual self-replicating cultural elements (“memes”, “culture-genes”) in comparison with genes. These relationships can be built as purely conscious or unconscious emotional ones, and may have verbal and logical nature too. As a result, the cultural component loses a formal similarity with initial basic biological adaptation or maladaptation without losing their evolutionary continuity with it.

This feature distinguishes the social groups of hominines and human societies from social insects, whose evolution is based on the functional differentiation provided by biological (genetic and epigenetic) mechanisms. It is the type of sociality that Edward Wilson called “true” (eu) sociality. The type of sociality peculiar to *Homo sapiens* is based on sociocultural mechanisms and consists in the differentiation of social roles played by individuals, beyond the unambiguous direct connection with their genetic characteristics. It implies the possibility of increasing separation of individual biological functions and the increasing intervention of the technological module in maintaining not only individual viability, but also the human survival.

As a result of (bio) technological reconstruction of the sexual and reproductive adaptive complex, extreme trends of possible evolutionary divergence can be either (1) severe social stratification by the type of “eusocial” families of social insects as unlikely scenario, or (2) the technologization of humanity's self-reproduction following the example of “Brave New World” by Aldous Huxley.

At present, both scenarios of the future human evolution seem to be marginal in the ethical aspect and, ultimately, question the principle of free will as a natural human right. In turn, the last statement comes from the

highest priority of the uniqueness of the human beings in the system of values. Note that this argument implicitly considers "human nature" as a starting point and a factor that sets the moral limits of subsequent social evolution. In other words, the results of biological evolution acquire ethical significance, confirming our proposed concept of dichotomy of objectively-descriptive and subjectively-axiological components of the evolutionary process.

As some empirical evidence of the potentiality of both evolutionary scenarios, there is the fact. Among the social insects, some species are with organization of intra-family communications that is based on self-organization of the links between homogeneous individuals. It correspond to the type of hominines social groups and to the general dominance of the evolutionary trend of eusociality described above.

In these cases, the process of socio-cultural transmission of the basic elements of the adaptive complex "technological civilization" is preserved. If both described scenarios prove to be unrealized, the evolutionary trajectory of this civilizational type breaks off due to the exhaustion of the potential for further adaptive transformations in the socio-cultural module.

As example of an evolutionary conflict from another sphere, there is the growth of two positively correlated parameters of the value of the intellectual coefficient and the level of education in modern technologically developed countries. The development of science and technology is a systemic adaptation that ensures the vital activity and vitality of a modern civilization of technological type.

The volume of scientific knowledge is growing exponentially in the last centuries (Price, 1965). In addition, this volume reached the limits of the physiological possibilities of assimilation by an individual more than two hundred years ago. The time of encyclopaedists mastered almost all accessible to mankind knowledge was held at the end of the 18th century.

As a result of the progressive differentiation of the growing in the scope of scientific knowledge and the complexity of the problems solved by it, there was an increase in the educational attainment (EA) and the intellectual coefficient (IQ) in the 20th century. The latter phenomenon is called the "Flynn effect" (Herrnstein, Murray, 1994, 2007: 307-309; Flynn, 2007) by the name of the researcher who discovered him. But after 1978, the increase in the "reasonableness" of the population has slowed noticeably, the Flynn effect fades (Teasdale, Owen, 2005). Both parameters are linked by a positive correlation; and the coefficient of intelligence increases significantly with the increase in the level of education. The increase in these interrelated indicators is potentially influenced by the factors of all three SESH modules.

The more interesting, that modern studies using molecular genetic technologies, revealed simultaneously:

- A high degree of biological heritability (h> 30-40%) of the level of education;
- A large number of genetic determinants, the presence of which in the genome of the individual positively correlates with its level of education (more precisely, with the ability of the individual to long-term learning);
- Obvious signs of negative selection of the same genetic determinants in the modern population.

Observation means that there is a decrease in the biological, mainly individual adaptability of the carriers of these "intelligence genes" with an increase in the number of such genes. At the same time, group adaptation increases with the number of carriers of "educational genes," since the adaptability of society is determined by the ability of its members to learn new knowledge and learn new technologies.There are signs of co-evolutionary conflict between elements of the biological and socio-cultural modules, which serves as a source of evolutionary risk.

This conclusion was first obtained by studying a large sample of the US population (Beauchamp, 2016) and, naturally, needed verification and confirmation, but several months later similar results were published by Icelandic researchers (Kong et al., 2017). Further analysis revealed the causes of this conflict (see Lee J. J. et al. 2018 and others).

The ability to assimilate and generate new knowledge as a socio-culturally determined adaptation, according to our model, should form co-evolutionary links with biologically deterministic traits, giving them a system-adaptive significance. Obviously, the performance of the cognitive function is associated with the switching of individual resources, previously directed to other processes of life, including reproduction. Socially demanded creativity as the ability to purposefully transform reality and biologically deterministic reproduction form a binary opposition, linked by a cycle of direct and reverse competitive and synergistic connections.

The antagonistic component of this cycle was noted by researchers of a wide variety of disciplines. In particular, Sigmund Freud introduced the term "sublimation" as the switching of sexual activity to the achievement of acceptable, above all, primarily creative and cognitive socio-cultural goals. The solution of this co-evolutionary contradiction lies in the shift in the reproductive activity of individuals for a later period.

"Genes of education"[12] concentrate activity on the search and assimilation of information and, therefore, can affect the magnitude of other indicators of biological adaptability, such as

1. The total number of descendants of the individual throughout the life cycle;
2. The age at which the first child is born;
3. The average reproductive age of the parent, in which he leaves descendants.

As follows from the cited studies, with increasing genetic predisposition to continuing education ($POLY_{EDU}$), the first parameter (the number of offspring of the individual) falls, and the second and third grow.

At the same time, beginning at about the age of 30 years, the curve of dependence of reproductive indicators on the level of $POLY_{EDU}$ is changing, and a male with a high level of education begins to leave a greater number of offspring compared with the rest.

In the framework of the SESH model proposed by us, the interpretation of the genesis of evolutionary conflict and evolutionary risk looks obvious. The development of the evolutionary efficiency of technological civilization gives adaptive significance to a certain set of pre-existing biological adaptations and gradually "pulls" the meaning of the relevant traits to the boundaries of the biological adaptive norm. The Flynn effect is due not to the expansion of the genetic basis of the ability for long-term learning, but to the progressive optimization of socio-cultural factors that predispose pre-existing individual liabilities. Obviously, one of the most powerful socio-cultural "enhancers" here is the high status of self-realization of personal characteristics in the scale of value priorities of the Western variant of technological civilization.

But we can offer a more generalized explanatory model. A very interesting consequence entails the co-evolutionary interaction of techno-rationalist and socio-cultural modules within the framework of the same Lamarck mode: techno-rationalistic innovations are adaptations of the group level of expression by definition. They are represented in the sociocultural module in the form of sociocultural stereotypes of life activity and behavior, out of direct connection with the replication of scientific knowledge, which is information fragments of a techno-rationalistic module. The reason for this lies in the various systems for generating and replicating the adaptive information of both modules.

[12] "Genes of education" is a metaphorical name used solely for convenience of presentation.

As a result, the amount of such information accumulated in the technical and rational module significantly exceeds that in the individual. Thus, for of the selective factor, the point of application is a social community, and not a separate individual. In the epistemological context, this pattern is reflected as a progressive disciplinary differentiation of scientific knowledge. In the aspect of biological evolution, the same phenomenon manifests itself in the form of a recent decrease in the size of the brain in representatives of our biological species (Henrich, 2016).

In such case, the maintenance and expansion of adaptively relevant information is ensured by the incorporation of new members in the relevant sector of the scientific community based on socio-cultural inheritance. The innovations generated by them are disseminated and integrated through the system of repetition of the techno-rationalistic and socio-cultural modules in parallel. Accordingly, individuals who are outside the set of the carriers of innovation receive adaptive benefits. As soon as it was said, it is implemented by the assimilation of the corresponding socio-cultural standards.

So, there is an inhibition of the processes underlying the Flynn effect; which indicates an increase in the magnitude of the potential evolutionary risk and the approach of the point of risk transition to the actual form. There is a need for a purely biological or (bio) technological adjustment of cognitive abilities as a condition for the maintenance of technological civilization.

There is another example of the initiation and development of evolutionary risk due to the semantic gap between the SESH modules. It is associated with the approach of lifetime to the limits of the adaptive capabilities of a *Homo sapiens* as biological species, which has been discovered in recent years. All indicators of the phenomenon are integral and defined as the resultant of the effects of all SESH modules already by definition (Cheshko, 2016). Therefore, here you can only give a sketch of this problem.

During the late Middle Ages and Renaissance in the Western mentality, there was occurred a whole complex of evolutionary transformations. These innovations were associated with the genesis of technological civilization.

One of them was the desire to achieve a much longevity. With all fluctuations, a life span remained relatively constant in the preceding centuries (20-30 years). Over the past centuries, the average lifetime in Europe and North America has increased from about 30 years in 1500-1600; up to 35-38 in 1700-1800, 45-50 in the 1900's. and now in industrialized countries is no less than 78-80 years. In Russia and the USSR, since 1896, the average lifetime has increased from 30 to 70 years by the

end of the twentieth century, but then again began to lag behind those of Western Europe and other developed countries (World Health Organization, 2001).

Further improvement in living conditions no longer increases the maximum possible life expectancy, or at least reduces the effectiveness of social and technological efforts in this area in recent decades. Based on these data, the expert evaluation of the species lifetime of *Homo sapiens* lies between 115-125 years. In other words, now the possibilities of extending the average life expectancy are close to exhaustion, if we are talking about the introduction of cultural and technological innovations that optimize the functioning of the biological module (Dong et al, 2016; Olshansky, 2016; Marck et al., 2017).

In all these examples, there is a set of possible scenarios for the evolutionary development of the SESH structure; and it is reduced to the possibility of technological transformation of the biological module or to the elimination of that variant of the SESH structure, which is called technological civilization. The latter script will be a result of the loss by SESH socio-cultural module of the potential for further adaptive transformations.

As we see, the trans-module genetic-cultural and cultural-technological interrelations are carried out according to the type of a chain of overlapping cycles of direct and inverse co-adaptive influences. In our opinion, this explains the complex and, as a result, difficultly recognizable picture of such dependencies. So, functional and adaptive connections are maintained between social behavioral acts of an individual and genetic factors, mediated by the socio-cultural context, initiated or repressed by epigenetic signals, which are social representations and cultural.

As the next step (Settle et al., 2010), the post-transmodular epigenetic transmission mechanism postulated:

- Political preferences as elements of a rationalistic module are likely to find a correlation with the presence of certain genes in a biological module;
- It happens only in the conditions of a certain communicative structure, in which
- The carrier of such preferences is included in a certain period of ontogenesis that controlled by the sociocultural module.

This scheme has a rather complex and nonlinear structure. Therefore, it is a substrate for the formation of “free will” as a basic value priority.

Similarly, there is a tendency to accumulate excess body weight depending on the expression of certain genes; and the nature of this dependence changes depending on the historical era when a person “was

lucky to live" (Rosenquista et al., 2015). Expression of "risk genes", which we also talked about, is more pronounced in individuals belonging to a "cattle-breeding" cultural type, etc.

The empirical data of scientific publications are selected relatively arbitrarily, as we recognize. Nevertheless, these data serve as falsifiers, confirming the original postulate of our concept. As we recall, this postulate is reduced to the existence of a special three-modular stable evolutionary strategy, representing discrete system integrity, as a unique species characteristic of hominines. Individual modules of this system cannot evolve beyond adequate dependencies with the evolution of other modules. This dependency can be either dynamic or static. Dynamic dependence implies a change in the composition and frequency of the elements of the module. Static dependence is a change in the correlative value of individual elements of the module while maintaining its composition.

Ultimately, the interaction of genetic and cultural adaptations plays a significant role in the epidemiology as a way to assess differential structure of the risk of development of pathological processes in ontogenesis (Cederroth, 2009: 34).

Historical infectious epidemiology represents one of the most striking and indisputable examples confirming the above elementary processes of the genesis of evolutionary risk in its system integrity. The origin of most infectious epidemics periodically ravaged human populations, and put civilization on the verge of ruin due to the Neolithic revolution.

It was first global technological innovation that played the largest role of progressive system adaptation in techno-culture-anthropogenesis. Unexpectedly, but logically, by its nature, it can be attributed to the biotechnological component of the modern NBIC technological complex. Animal husbandry and plant breeding tied the evolutionary history of *Homo sapiens* in the Gordian knot with an evolutionary fate of domesticated plants and animal, but with other species as members of the same ecological system too. A significant increase in the number of a social groups became an additional factor to catalyze progressive complexity of the *Homo sapiens* adaptive system. It was a necessary condition for the effectiveness of this type of technological innovation.

The previous links in the chain of causes are the direct dependence of the production of the agrarian and pastoral economy on the area of the earth's surface used, solar energy and photosynthesis. One of the direct consequences was the change in the structure of ecological relations within anthropogenic ecological systems.

First adaptive changes to the new environmental conditions have affected the genomes of organisms whose life cycles were associated with

the animals involved in the process of domestication. Pathological microorganisms and other parasites joined to the environmental contact with people whose ability to resist infection was very low. As a result, they have implemented relatively rapid evolutionary process of the transition to a new ecological niche.

Traces of this process have preserved in the complex life cycles of parasites. The cycles involve a complicated sequence of life forms and, in parallel, vectors (Wolfe, 2007; Thomas, 2012).

In addition to this, eight of the fifteen human infectious diseases is likely to have passed to humans from animals (diphtheria, influenza, measles, mumps, whooping cough, smallpox, tuberculosis); three probably were originally agents of infectious pathologies of primates (hepatitis B) and rodents (plague, typhus), four (rubella, syphilis, tetanus, typhoid fever) have yet unknown origin. Thus, agro-bio-eco-system was "constructed" by *Homo sapiens* 11-15 ths years ago as a new ecological niche, and it does not completely fit into the already existing human adaptive complex.

There are a significantly increases the integrated adaptability as a significant weakening of the problem of resources supplies, primarily in Neolithic revolution. But some of the innovational features had a side maladaptive effect. Importance of side effect permanently increased in conjunction with the accompanying socio-cultural and biological adaptations and at integrated evolutionary dynamics. These secondary maladaptive manifestation and evolution have become a source of risk in the future.

Low innate immunity *Homo sapiens* has led to imbalance of host-parasite co-evolutionary ligaments. In other words, stochastic oscillations acquired a significant scale in the Volterra-Lotka cycle with the participation of humans and pathological organisms compared with those usually observed in nature.

As a result, severe and protracted epidemics have become for several millennia a powerful factor in human evolution in the broadest sense of the word, including human genetics, cultural and social order, etc. They determined the global evolutionary landscape to a large extent, and the vectors of development of the gene pool, mental and behavioral traditions and scientific and technological developments in historical time and the multi-cultural space in particular. The result of these systemic innovation outside biological components of SESH was the destruction of the Volterra-Lotka cycle for most new infectious pathologies whose evolutionary strategies providing high virulence and short latency period of infection. This result would be unattainable in terms slow or insufficiently pronounced immune response in the human population. The implementation of this

evolutionary scenario is achieved as a by-product of socio-cultural adaptation.

The alternative adaptive strategy of the causative agents of other infectious diseases (first of all, tuberculosis, AIDS, etc.) proved to be more advantageous. These pathogens have moved to a strategy of chronic infections characterized by prolonged and less acute course of pathogenesis. As a rule, in this case they are also associated with certain elements of the biological or socio-cultural component of SESH as their adverse manifestations. Such infectious diseases (Comas et al., 2013) become socially determined "civilization diseases" that cannot be cured without a complete reconstruction of the integrity of the complex adaptive system of a given civilization type. These include AIDS, venereal diseases, tuberculosis

As result, technological innovation remain the most effective means to control the evolutionary risk but not complete elimination of its components. Non-excludable logical assumption is integration during further evolution of such pathogens in the overall structure of the adaptive complex created by SESH. The hypothesis of an infectious origin of cancer, ulcers, mental pathologies, etc., at recent years, receive some empirical support, although far from a decisive confirmation or refutation (Wolfe, 2007, Thomas et al., 2012; Comas et al., 2013). In any case, however, the genesis an evolution of any diseases of civilization is a quite understandable side effect of internally conflicting evolution of SESH, its modules and intra-modular elements.

Certainly, plague is the most striking example of the mass infections effect on the evolution of SESH. There is a description of the significance of the plague as an evolutionary risk factor in the history of Western civilization and a mechanism for overcoming it in the scientific literature (Suntsov, Suntsova, 2006; Supotnitsky, Supotnitskaya, 2006; Cheshko, 2012: 500, etc.). Here we repeat this description in thesis form.

Perhaps not by accident, the point of radical change in the history of Western civilization was the 14th century, so rich in events and processes in various spheres of public life. The totality of these phenomena is considered by modern researchers as a system-forming factor in the chain of social evolutionary transformations "Medieval - Renaissance - Enlightenment". All of them, however, have an unusually powerful emotional response as common distinctive feature.

In this sense, probably, the champion is a plague that penetrated into Europe from the Mongol-Tatar invasion across Cafu (now Feodosia) in 1346 and then took away a quarter of Europe's population. (Her impressive description left Boccaccio in his "Decameron".)

Plague has generated strong social and psychological stress, and manifestation of this stress was the expectation of the Second Coming, the Last Judgment and the related series of disasters and catastrophes. That is when the emotional intensity of social reaction has gained the most extreme, is clearly beyond the socio-adaptive response, and therefore destructive manifestations. In 13th century, a flagellant sect ("self-blaming") emerges, which becomes a massive social movement in parallel with the intensification of the epidemic. The number of some groups migrating throughout Europe has reached 100, and, despite the opposition of secular and spiritual authorities, including the pope, the sect has proven to be very viable and numerous, at least for several decades.

Often the actions of the desperate and those who asked for salvation took on the character of mass psychosis. It was manifested in the form of local foci of convulsive dances and then covered the whole crowd. In psychiatry, these symptoms are considered a kind of so-called chorea. According to historians, there was a complex of reasons for the decline of the Middle Ages and the transition to the Renaissance, and then to the Modern era. Some of them were the powerlessness of secular authorities and the Church in the face of death, together with subsequent emotional depression. A mental hegemony of Mind over blind Faith was characteristic to new social order (Herlihy, 1997).

Thus, the plague caused a number of adaptive changes in biological (changes in the frequency of blood groups A and B, having immune significance), sociocultural and technological modules of SESH, along with other socio-environmental factors of the late Middle Ages. The evolutionary transformations of the sociocultural and technological-rationalistic components of adaptation genesis led to a decrease in the level of the evolutionary risk of pandemics of infectious diseases, practically to zero later.

But even more importantly, they have become an epoch-making system-forming innovation that has significantly increased the importance of the integral adaptability of mankind. The evolutionary potential of this adaptation has not yet been exhausted. Usually, this system adaptation is called "technological civilization".

The configuration of the first, gene-cultural co-evolve ligament serves as a criterion for fixation / elimination of specific configurations of techno-humanitarian balance and its components. A synergetic mental aspect of the same civilization is the growth of gene-cultural component of the evolutionary risk of technological civilization. The content of this affirmation in its weaker form is reduced to the priority of the degree of "freedom" for an individual to choose a specific social role from the

available repertoire as a criterion of social and humanitarian progress (Cheshko, 2012: 337).

This consideration is the most adequate interpretation of the thesis that goes back to Fourier. According to him, the overcoming of the biological determination of the gender roles in public life serves as a measure of women's emancipation, in particular, and social progress, in general (Beauvoir. 1997: 11). Thus, a basic element of the modern liberal-humanistic worldview becomes the association of overcoming the biological predetermination of the "individual existential project" and the equality of the sexes as two cultural and psychological attitudes. (A gender equality includes the equality of all sexual orientations in modern neoliberal interpretation.)

An example is the theological-philosophical essay of Walter Mead (Mead, 2016). He starts by stating the conflict between the biological and socio-cultural modules of the adaptive strategy (if we use the terminological apparatus of our study):

> "The libraries in the world are filled with books that contain wise and profound advice. They also contain stories that document our inability as a kind to follow them".

The next member of the proposed syllogism points to the biblical idea of overcoming the dominance of the biological, somatic component and the prevalence of the spiritual-cultural principle in human nature:

> "Jesus is unique, and women are free and equal in the representation of God".

Perhaps imperceptibly for the author himself, but this is no less logical conclusion about the divine justification of technological intervention in ensuring the triumph of the spiritual beginning over the bodily:

> "When Christians say that Jesus was born of a virgin, these people emphasize that Jesus is the son God, he is connected with the Creator of the universe in a unique and special way"

This logical exercise is historically too ambiguous and represents only one possible way of interpreting the dogma of the immaculate conception in the history of Christianity and the civilization based on Christianity as a whole.

However, Mead's reasoning is quite symptomatic. It reveals the systematic evolutionary-semantic tendency of the development of Western culture in the interpretation of historical facts in general and about the motivation of the first Christians in particular. The technological way of changing the biological foundation to ensure rational-ethical postulates turns out to belong to the deep semantic layers of the adaptive strategy of technological civilization in its Western variant. Characteristically, the empirical basis for this interpretation is precisely the sex-reproductive sphere of being of *Homo sapiens*.

Already in ancient Greece (Agamben, 1998; Lemke et al, 2011; Ojakangas, 2016), the ontology of human existence has undergone a dichotomy of Bios and Zoe as two verbal symbol-concepts. Here, Bios is social life, which is humanity in modern anthropology; and Zoe is animal being, which is human nature in modern anthropology.

In the Middle Ages, this antinomy was transformed to an opposition between the spiritual and carnal (animal) principle of the human essence. This opposition was interpreted as an antagonism between virtue and sin and was resolved as an imperative of the "victory of the spirit over the flesh", the Divine over the Devil in the human essence. In fact, this meant not just the primacy of the Spirit over Matter, but the ignoring of the Zoe and its unconditional submission to the dictatorship of Bios as "sovereign power".

Through the Renaissance and Modernity, there is an implicit up to 20th century trend on the establishment of certain rules of correspondence between the socio-political and biological life of human beings. The beginning of this trend was laid by the concept of "natural human rights".

The primacy of culture (socio-cultural module in our model) has been preserved in relation to the biological needs (biological module) of *Homo sapiens*, however. Exceptions in the history of philosophy of the 19-20th centuries are few and they are internally contradictory. (An example is the "Übermensch, Beyond-Man" of Friedrich Nietzsche).

Technology and science provide tools for the restructuring of Zoe, that is, for the reorganization of human nature in accordance with the parameters of the niche of the social environment. The latter is formed because of the evolution of Bios. In other words, the human socio-cultural existence is provided by scientific and technological development. To strive for the liberation of the Spirit from the needs of the Flesh, Freedom turns into a technological dependence; the "Biopower" becomes the mechanism for the

realization and proliferation of this dependence (i.e. “biopolitics”). Accordingly, the evolution of culture becomes the object of technological manipulation; in response, bioethics appears as an adaptive response of a sociocultural module.

Genetic-reproductive technologies belong to the systemic features of this civilization that is predetermined by the dominance of the sociocultural module over the biological one through the transformation of the elements of the techno-rationalist component of SESH.

So, the basic concepts of the theory of evolution in the Anthropocene age take the form of socio-cultural constructs, but this judgment means only the rationalization and technological development of evolutionary processes, applied to humankind and to eco-systems involving human beings.

As most obvious conclusion, it applies to categories of sex, gender, race, health, norm, equality and so on. All of them are united by extremely high and growing political urgency. It creates an equally rapidly growing social demand for the development of technological controls and arbitrary modifications, i.e. acts that determined by the subjective choice of a personal existential project.

“Existential project” as the humanitarian hypostasis of this attribute finds its natural-technological equivalent in the concept of “life history”. The cultural diversity of human beings in the past was provided by two factors:

- First, by the presence of several alternative behavioral strategies within the framework of the genetically determined behavior of the hominines, and,
- Secondly, the possibility of epigenetic, rigidly deterministic or situational re-engraving between them in time (i.e. depending on the stage of the life history) and in space (i.e. according to local social and environmental parameters).

The evolution of the techno-rational adaptive module closes the evolutionary cycle of positive feedback between the socio-cultural and biological modules of a SESH, and creates conditions for biological and socio-cultural evolutionary transformation and / or divergence.

This trend is also manifested in the interpretation of data about the evolutionary relationships of Sex as the biological component of sexuality and Gender as its social counterpart. The data are accumulated and

interpreted in physical and cultural anthropologies intensively; and its totality is quite ambiguous.

In most publications clearly traced the following argument. If the distribution of roles between the various sexes was determined earlier by genetic inheritance, then this causally link was overcome. The typical name of a recent article can serve as an example. It is

> "Stepping Out of the Caveman's Shadow: Nations' Gender Gap Predicts Degree of Sex Differentiation in Mate Preferences" (Zentner, 2012).

Based on their own research, the authors argue that the statistical distribution of gender roles correlates primarily with the statistical distribution of the economic status of male and female, and not with the distribution of social roles between the sexes within the social group formed during the early stages of anthropogenesis.

Within our concept, these data show only that the adaptive windows of the biological and socio-cultural modules for this indicator overlap enough to eliminate the irreversible gap between sex and gender now. This situation may change dramatically as the border of the adaptability of the sociocultural module approaches the limits set by border of the analogous window of the biological module.

In the latter case, the vector of evolutionary changes of the techno-rationalistic module will be reoriented to the correction of the two remaining ones. At the same time, technological correction is currently the most developed with respect to the biological module. Such an outcome seems more likely also because it is adequate to the intention to "liberate" the western version of the technological civilization described above.

From this perspective, it becomes clear an unusually wide range of emotional motivation to modification of the own corporeality. This predisposition widespread in all socio-cultural types, seemingly, outside the direct connection with the adaptability (Wohlrab, 2007). Indeed, this is an adaptation of the system of not direct action, which provides the ability to overcome the inhibitory effect of biological (slower) components in SESH adaptation genesis. "The victory of spirit over the body" is the guarantee of a high adaptive individual plasticity, group adaptability, but a higher level of evolutionary risk too.

A sustainable development is provided by balance this predisposition by other evolutionary trend with opposite expression. Paradoxically, the liberation from the "dictatorship of the flesh" introduces biological deviations of individual existential projects into the adaptive space of the

socio-ecological niche through technological innovations. This statement is true both in social and in demographic aspects.

The above conclusion can be interpreted in the framework of the described concept in this way: the non-linear interaction of the two links of the coevolutionary bundles of SESH determines the spectrum of normal and pathological phenotypes found in ethno-genetic, ecological and cultural contexts. The secondary result is the unification of socially demanded technological developments with the aim of their normalization.

So, the "norm" is a function of somatic genetic basis of human existence not only, but of differentiated socio-cultural life, in which somatic human corporeality "fits" too.

There are the facts that serve by indirect confirmation of the leading role of gene-cultural co-evolution imbalance as the main source of evolutionary risk, at least until modern phase of SESH evolution. A "paradoxical" vector of positive selection is noted during the last phases of anthropogenesis for most genes that are somehow associated with neurophysiological pathologies and considered as source of intra-genomic conflicts for this reason (Crespi, 2010).

As contemporary sociology of human biological corporeality concluded, it is impossible in the framework of Cartesian rationalism. As Chris Schiller, one of the founders of this research sphere, declared (Shilling, 2003:3),

> "We now have the means to exert an unprecedented degree of control over bodies, yet we are also living in an age which has thrown into radical doubt our knowledge of what bodies are and how we should control them. As a result of developments in spheres as diverse as biological reproduction, genetic engineering, plastic surgery and sports science, the body is becoming increasingly a phenomenon of options and choices. These developments have advanced the potential many people have to control their own bodies, and to have them controlled by others. As science facilitates greater degrees of intervention into the body, it destabilizes our knowledge of what bodies are, and runs ahead of our ability to make moral judgments about how far science should be allowed to reconstruct the body. Indeed, it would not be too much of an oversimplification to argue that the more we have been able to control and alter the limits of the body, the greater has been our uncertainty about what constitutes an individual's body, and what is 'natural' about a body."

There is a decline of the religious shackles, which are built on a stable ontological and existential certainty having its source outside the person, and there is transformation of our somatic organization in the central element of the mass consumer culture as a symbolic value in parallel.

As result, a modern human led to increasingly give bodily organization value as only foundation of self-expression. As a result of the elimination

or weakening in Western culture of religion as a factor of evolutionary, trans-individual and trans-personal semantic stabilization, only your own body is the material basis of your individual, but not a group, to a much lesser degree of universal self-realization.

> "My body is my affair",

the slogan goes far beyond the scope of the feminist movement, and it is the nominee for the title of the main brand High Hume technologies age (Cheshko, 2012).

Very relief typical for the West (Atlantic) version of technological civilization predisposition of "self-identification liberation" from biological basis diktat is expressed in a newspaper quote:

> "... Jenner says that she is a woman, then so it is. This is the only the logical conclusion that can make a tolerant and civilized society. However, racial dysphoria exists solely in the brain. There is good and reasonable argument: men feel like a woman, "women" who feel men and ever-increasing army of doubters – all this for me is quite acceptable, and there are no problems. It is clear that sexual identity – is something more than having a penis or vagina. Who can deny the existence of the hidden feelings of people? We can`t bring to life Jenner, except medical devices that would smooth her gender transition"[13].

Note several circumstances. There are a separation of sexual and gender identity on the one hand and ethnicity and race, on the other hand; and it seems unjustified and avoidable in the subsequent course of the techno-culture-anthropogenesis. In the end, there is conversion of any type of personal identity in the subject of individual choice that is determined exclusively by plasticity of biological module in the variable context of the culture and manipulative possibilities of technological module with respect to the attributes of identity.

In this sense, racial and ethnic identification are for the individual much less of a problem than with the sex-gender counterpart. There is a number of empirical evidence in the history of any ethnic group. (These are Ethiopian roots of Pushkin, Lermontov Scottish ancestry, ethnic roots of Mendeleev, Vernadsky, Mechnikoff, Tolstoy family clan and other representatives of culture of the Russian ethnos.)

And indeed the above quotation is taken from the reports of a white woman, Rachel Dolezal, which for many years posed as the representative of African Americans and served in Washington as the regional branch

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[13] http:www.independent.co.uk/voices/comment/man-becomes-woman-and-white-becomes-black-in-this-age-of-transition-10321779.htm

President of the National Association for the Advancement of Colored People, the oldest and most prestigious human rights organization[14].

There are plentiful similar examples of full integration into social commonality other race, which served as the basis for the storyline of classic literary stories of Mark Twain, Sinclair Lewis and others.

In contrast to the gender / sexual orientation, such transformation can be achieved within the framework of socio-cultural module of SESH, technological innovation affect only race determinants which reinforce this process of ethnic (self) identification of persons. The adaptive value of biological ethnic or racial determinants is caused by the dominant evolutionary semantic of social group. The semantics system allows to group identity by comparing the communicative relationship between socio-cultural qualifiers belonging to “own” or “foreign” race and individual biological characteristics as race determinants. There are among them epicanthus of Mongoloids and dark skin of Negroids, blue eyes and blonde hair of Europeans, etc.

Obviously, in the race’s “diagnostic symtoms”, the significance of the actual biological traits decreased and the importance of social and cultural determinants increased in the Western mentality over several centuries. Top position eventually took the presence of the representatives of the respective race in the genealogy in the ranking of such attributes “outsiders”. Thus, in the mentality, there is an older predisposition to objective criteria of the race, which usually coincides with the paradigm of physical anthropology, and there is a new predisposition to the "unnatural", sociocultural character of racial identification, which is a key moment in the sociological paradigm of the concept of race. The second predisposition established itself as an element of the central conceptual core of the Western Civilization viewpoint.

This consideration makes it possible to interpret the discrepancy between the arbitrariness of “gender choice” and the objectivity of racial (self) identification. The rank of biological determinants of sex has not been overcome now. Paradoxically, this fact places an axiological emphasis on the cultural and psychological components of gender (self) identification.

However, in accordance with predispositions of the socio-cultural origin racial identity genetic determinants play no role in the formation of cultural elements of the module; but according to predispositions of objective existence of racial differences, racial identity is objective cultural and social phenomenon. Racial identity is usually regarded in the modern Western mentality as having social and ethical values. Therefore, the socio-cultural

[14]http:inosmi.ru/world/20150619/228677116.html#ixzz3dVmCUGrp

motivation to change "racial profiling" seems meaningless in terms of personal social status. Resolution of the conflict between biological and socio-cultural components of racial differentiation is seen as solvable solely by means of socio-cultural module of SESH in the Western mentality and culture.

This is not to say about gender identity related to the satisfaction of basic vital needs. There is conflict between the biological and socio-cultural components as well as between individual elements of biological adaptive complex that is essential to the social situation and the individual psycho-physiological comfort. There is a social need for technological innovations that provide for overcoming co-evolutionary conflict. Personal self-determination becomes extremely significant for lifestyle, position in society, membership in a social group, sub-cultural type ("one of us!"), etc.

We go back to the original thesis. At the absence of socio-cultural norms and constraints, humans will be transformed in the future into a product of self-design and self-manipulation in a technological civilization; and this evolutionary trend is limited solely by the composition and power of the techno-rational module of SESH extremely. These delimiters themselves allow sharp stochastic or deliberate deviations, as we shall see.

The value system stabilizes the result of the previous stages of bio-socio-cultural genesis that is not subject to revision without destroying biosocial identity. This determines the evolutionary role of this factor in the global evolutionary process.

In the terms of *Homo sapiens*, the set of optimal scenarios of the subsequent evolution is protected by the existential meaning of the notorious, mundane, but necessary system of universal human values. Its existence puts limits just described conflicts between supra-individual group adaptations; and it channels the group selection at a genetic and socio-cultural level too.

Sociological studies provide rich empirical material for the subsequent analysis of semantic cultural components of society differentiation in accordance with biological markers. According to the estimates of Mark Penn, an American sociologist, developed Western society has approximately 75 marginal but very rapidly increasing social groups at the beginning of the 21st century. The conclusion was made according to the social monitoring of the US population (Penn, Zalesne, 2007).

At least ¼ of them are diagnosed by genetically or epigenically dependent trait or signs directly affecting the psychophysiology of human beings according to our calculations. Such markers include, for example, sexual orientation, the age of parents at the time of the birth of the first child, the parental age ratio, obesity, the length of the sleep and hibernation period,

and their ratio, right- and left-handedness, corporal images and anatomic features through tattoos, plastic surgery, pharmaceutics, etc., etc. However, in themselves these data for our research are useless without clarifying the genetic and epigenetic links with changes in the socio-cultural landscape. It is for this reason that in the present study they are extremely rarely used in pure form, although they are certainly taken into account.

As general conclusions from the contents of the two preceding chapters, we can suggest postulates concerning the mechanisms of actualization of evolutionary risk. These postulates are deductively justified by the three-modular model of the stable evolutionary strategy of hominines and by the totality of the experimental data of modern natural science and empirical sociology.

1. The intermodal co-evolutionary conflicts are the source of the evolutionary risk of the existential level of significance;
2. There is the complex of a fragmentation of the adaptive complexes of the biological module and a dissociation of the links of the biological module with the elements of the socio-cultural module as a result of the individualism of the technological civilization and the high priority value of the free choice of a personal existential project;
3. The presence of technological innovations act as a tool for implementing the free premise of an existential project and turn the splitting of intra-and inter-modular co-adaptive links into an autocatalytic process;
4. The external expression of such dissociation is progressive social differentiation based or connected on characteristics related to systemic biological adaptations or complex signs.

This potentially destructive cycle for the SESH is caused by the interaction of the socio-cultural and techno-rationalistic modulesIts effect can be compensated by the development of a compensatory mechanism in the gray zone between these modules. Such a stabilizer is simultaneously a spontaneous socio-cultural adaptation guiding technological development and a rationalistic innovation that

- Based on the currently available knowledge about the consequences of such innovations and
- Forming a theoretical system of ethical norms for ensuring biological and socio-cultural identity.

To analyze the possible nominees for this role, we will proceed now.

CHAPTER 4.

EPISTEMOLOGICAL AND EVOLUTIONARY ADAPTIVE ASPECTS OF POST-ACADEMICIAN SCIENCE

Valentin T.Cheshko, Valery I.Glazko

Adaptive response of SESH aims to restore the optimum techno-cultural (the techno-humanitarian, in another terminology) balance. This balance is developed in technological civilization, and it is based on rigid autonomy of actually scientific research. “Science” seen by us as a key element of techno-rationalist module of SESH. Today it perceived as excessively dangerous component of SESH. Within the framework of SESH concept, the evolution of scientific rationality is the result of the action of a homeostatic mechanism ensuring coevolutional integrity. The three successive phases of this evolutionary trend are the classical, non-classical and, subsequently, the post-non-classical (human-dimensional, post-academician) types of rationality.

In other words, the genesis and evolution of bioethics, and the organization of its co-evolutionary links with science is a socio-cultural adaptation to the new landscape of socio-culture-anthropogenesis. A technological innovation rates can return to available to socio-cultural control magnitude by this way.

The emergence of a trans-disciplinary, human-dimensional modern scientific rationality was the last system adaptation of the techno-rationalistic module that was initiated by the transformation of the evolutionary process and human beings into an object of technological manipulation and control.

Previous socio-cultural transmutation of Western mentality, made the principle of social autonomy of science institution supporting rods of technological civilization. In parallel, bioethics is one of the main structures of the new mentality, which is formed by a socio-cultural module, since this civilization is in the phase of a society of global evolutionary existential risk.

This conclusion may seem paradoxical from the point of view of classical epistemology, where the main criterion for evaluating a scientific concept is its empirical verifiability and freedom from evaluative and imperative judgments. Within the framework of a new evolutionary epistemology, it seems quite correct, since verifiability place is taken by adaptability that is the efficiency from the point of view of survival of the self-organizing system. (Above we gave this process the name of adaptive inversion 3, emphasizing its recursive nature.)

There is general outline of the genesis of this social phenomenon, which is as follows.

1. After the end of the Second World War in the socio-cultural discourse of the West as a result of mental transmutation realization in the scale of value predispositions, the highest status is occupied by the right and the possibility of personal self-realization. This priority entailed a chain of secondary appraisal concept-parameters, such as an individual existential project, self-determination of personal social status, image and lifestyle, etc.

2. The paradigmatic concept of the biological species changes in parallel. In the natural-scientific discourse and in evolutionary theory, especially, a typological concept was replaced by a relativistic population concept. According to typological concept, each species is associated with a prototype as a system of basic attributes of species identity. Population concept argues that the species is a collection of individuals with a common gene pool.

3. The synergistic information interaction of both discourses leads to the crisis of the concept of natural human rights, based on the typological paradigm. According to the concept, human rights are the species determinants of *Homo sapiens*. The categories of "socio-cultural and genetic diversity" and "individual existential project" are affirmed as the basic attributes of humanity and the socio-cultural plasticity in the scientific and public types of discourses. The great American geneticist and evolutionist of Ukrainian-Russian origin, Th. Dobzhansky played a significant role in incorporating a new conceptual and categorical framework into the socio-political theory of human rights in the 1950s, (Dobzhansky, 1956).

4. In connection with the development of biomedical technology in the early 1960s, ethical committees were established in the hospitals (Seattle USA). Their composition should reflect the social composition of the population on ethnic, property and religious grounds. Committees must address issues related to patient access to limited biomedical resources (Tishchenko, 2011:45-48);

5. In a series of works, and then a book in 1970, american oncologist Ronceler Van Potter developed the philosophical foundations of ethical and global humanitarian problems of technological civilization associated with the implementation of biotechnologies, he first used the term "bioethics" in the modern sense of the word. The term was used by Fritz Jahr as far back as 1926, but as applied to problems of use animals in biological research.

6. A beginning of the development of the genetic engineering toolkit led in 1975 to a voluntary moratorium on genetic engineering research and improvement of recombinant DNA technologies and to the subsequent development of clear biosafety rules by the Asilomar Conference (USA, California). Since this year, bioethical issues have reached the level of awareness of the existential risk of modern technologies. This turning point in the development of the bioethical paradigm is reflected in the emergence of the concepts of "global bioethics" by Potter or "ethics of *Homo Sapiens* species" by J. Habermas (2003);

7. New epoch comes with beginning of the third millennium. The theoretical research of biotechnologists came very close to the so-called evolutionary singularity, i.e. to *Human Enhancement* as applied development of the reconstruction and improvement of human nature. The publication of two UNESCO Declarations has become a frontier; its intersection has been initiated by an awareness of the global evolutionary implications of the development of genetic engineering and other High Hume technologies. The first of these, the "Universal Declaration on the Human Genome and Human Rights" (November 11, 1997) proclaims by its Article 1 (United Nations Educational, 1998:41):

> The human genome underlies the fundamental unity of all members the human family, as well as the recognition of their inherent dignity and diversity. Thus for the first time consciously recognized the interdependence of cultural and biological forms of self-identification of a person. The content of the declaration leaves no doubt that technological interference in genetic information needs to be controlled by the basic norms of the system of human rights and social institutions. It is implicitly believed that such an intervention is potentially capable of destroying human values as the spiritual basis of human civilization. To denote the admissibility of a technologically controlled change in the course of the evolutionary process in relation to man, the term "dignity" is used with difficulty in translating into the language of the natural science description. Subsequently, this trend towards a subjective-humanistic assessment of the results of the objective process of evolution was developed in the Universal Declaration on Bioethics and Human Rights (October 19, 2005) (United Nations Educational, 2005:74).

Thus, culture became a factor of evolution, giving the latter a clear integral teleological nature in accordance with value priorities and despite the initial objective spontaneity.

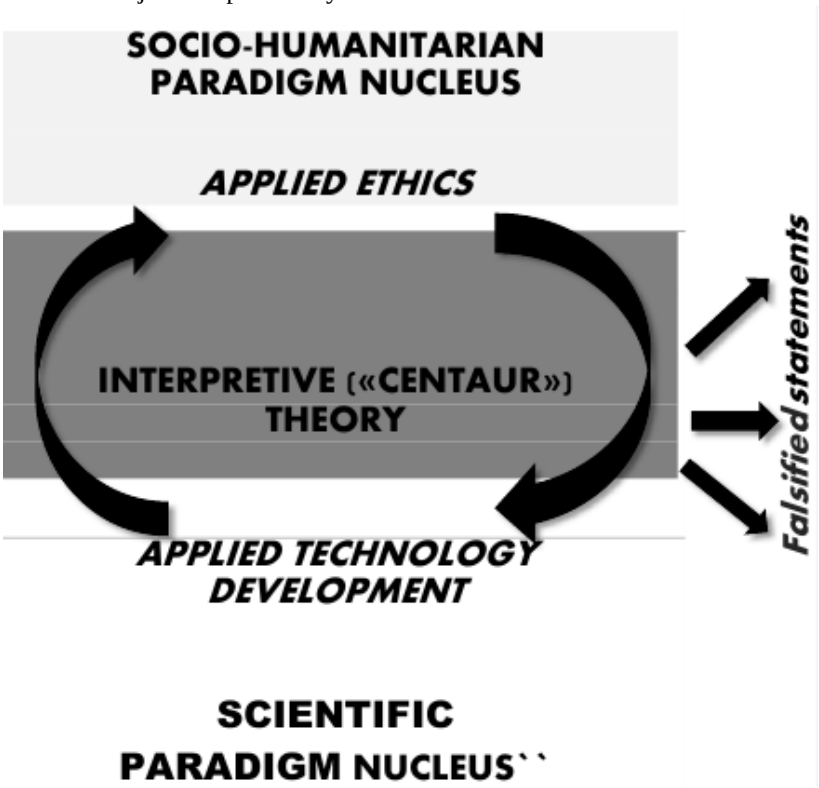

Fig. 4.1. Block diagram of the disciplinary matrix of bioethics and other interpretive ("Centaur") theories of post-academician science

By the end of the twentieth century, two seemingly mutually exclusive, methodological trends clearly appeared in the evolution of the theoretical foundation of bioethics (Winkler, 1996). There are

1. Empirical approach (Kon, 2009), which is based on the interpretation and specific historical studies of the development of the theoretical and global foundations of medicine in the concept of "bio-power" by Michel Foucault (1996). There is need to "contextualization" of the solution of emerging ethical more precisely, social problems arising (1) in the implementation of biomedical and biomedical technologies and (2) in

relation to a particular socio-cultural type. This approach means that the proposed solutions are necessarily *ad hoc*, and cannot be generalized. In our model, this corresponds to the socio-cultural adaptations of the society, which ensures its maintenance in the course of "scientific and technological progress".

2. Search for a common meta-theoretical paradigm. The prospects for the creation of the Global bioethics of R. Van Potter are now perceived by many as unrealizable (Engelhardt, 2006). In our interpretation, this concept is equivalent to a systemic socio-cultural adaptation that ensures the maintenance of the biological and / or socio-cultural self-identity of humanity in the implementation of technological schemes of moral and material "*Human Enhancement*".

The contradiction between the two approaches is removed within the framework of the "natural-philosophical bioethical project" proposed here. Indeed, the adaptive function of bioethics is a maintenance of self-identity in the process of technological evolution; and the function is divided to an individual and group and universal ones. The first "daughter" function corresponds to the level of evolutionary risk of a substantially lower existential level; the second one comes to the forefront near the evolutionary singularity, with a risk level close to unity.

At binary conjunction of Bioethics and Transhumanism, Bioethics was constituted quickly as a typical example of a new, post-academician organization of scientific research and scientific theory as its product (Cheshko, 2011; Cheshko, 2012).

Features of the new organization of scientific theory can convey by a transdisciplinarity as very capacious category (Interdisciplinary in biotechnology, 2012; Cockell et al., 2011). It is related to the so-called interpretive scientific knowledge in other scientific concepts.

The Bioethics explanatory model has not one but two, scientifical and socio-humanitarian systems of initial postulates and principles that are compatible with one another only partially. The relationship between them carried out through application-projective exits of theoretical concepts.

Accordingly, the "disciplinary matrix" of bioethics has two central core and overlapping zones of projective-applied developments, and the latters are theoretically possible to empirically verified / falsified. The general scheme of such paradigm structure is follows (fig. 4.1). As you can see, represented scheme combines the individual elements of the paradigm concept of T.Kuhn (Kuhn, 1977), research program of I.Lakatos (Lakatos, 1978) and the network organization of theoretical science of L.Laudan (Laudan, 1994).

A case-study on the sociology of diverse concepts can serve as an empirical basis of the dual-core model of paradigm structure in post-academician science. A direct analysis of the logical structure of theoretical concepts is no less important.

For example, there is fundamental monograph on the logical analysis of the concept of "biodiversity" that is key in modern socio-environment and biopolitical constructions. The author, Donald Mayer argues that the objective component of the argument inevitably contains logical and empirical contradictions. As he concludes by no means academic in form (Maier, 2012:3),

> "When it comes to biodiversity and a range of arguments that are protected and built on its possible significance, it is difficult to get rid of the impression of cultural conditioning, uncritical acceptance on faith and incorrect disciplinary correlation. Cyclicality, confusion, insufficient justification, normative prejudices, and dubious empirical evidence go unnoticed and are not eliminated. Worse, these unfortunate arguments are often repeated − mistake after mistake, detail for detail − one disputing side after another. Perhaps out of fear that there is no other for the salvation of wildlife, there is a tacit agreement among colleagues not to rock the boat of bad reasoning. Biased judgments are a natural tendency for a person to actively seek out and interpret information in a way that confirms deeply rooted beliefs, and the corresponding ability to ignore or underestimate everything that is contrary to this",

With regard to the unconditional priority of the postulate of biodiversity conservation, the only conclusion is follows. The normative assessment precedes, but does not follow empirical accuracy and theoretical reasoning. In other words, the need to preserve biodiversity does not follow from the laws of nature, but from the moral choice made by person, and the choice is determined by the dominant system of value priorities, and not by objective interests. It is a choice between conservation of biodiversity and existing eco-systems and development of technological schemes for their replacement as two scenarios of future evolution. The derivative parameter of biodiversity is not evolutionary efficiency, but evolutionary correctness. Initially and irretrievably, the concepts of post-academic science are loaded and intertwined with ideology, ethics and politics.

To be fair, it should be noted that other researchers came to the same conclusion a few decades earlier. For example, the Russian ecologist wrote (Gilyarov, 2001: 20)

> "The investigation undertaken by the author showed the unrestrained growth in the number of publications using (I want to say exploiters) term

"Biodiversity". It is not associated with any breakthrough in the relevant field of ecology. It is not a matter of science but politics".

In modern risk society, new attributes of science appear on the basis of these considerations, namely

- Ideologization (management of priority research tasks) that is direct and, often, decisive participation of political and business structures in the initiation of research projects;
- Commercialization of research that is the acquisition by scientific concepts of the attributes of a marketable commodity, and
- Politization (reporting) of science that is noticeable control by extra-scientific social structures and institutions of all aspects of the flow and, especially, the results of all stages of scientific research including subject, concept, methodology directly and openly (*de jure*), and not indirectly and implicitly (*de facto*); the result is
- Stratification of a single process of scientific cognition into two streams that are autonomous in terms of their social functions. Two streams represent a *dangerous (risk) science* as the transformation of the world according to the ideal image of a desirable future and *warning science* as identifying and calculating risks arising from scientific and technological development.

The importance of the latter factor is all the greater, since it acts as an agent that catalyzes and directs the course of the three previous ones, which in themselves look extremely alien to the classical concept of science of the 18th and 19th centuries.

CHAPTER 5.

EVOLUTIONARY SEMANTICS OF TECHNO-HUMANITARIAN BALANCE AND DEVELOPMENT OF RISKS (WEB-SOCIOLOGY OF *HUMAN ENHANCEMENT*)

Valentin T.Cheshko, Valery I.Glazko

The following postulates are derived from the conceptual model of post-academic science as a binary ligament of "risk science" and "warning science", which is set out in the previous section. (Cheshko, 2008).

There is triggering factor for the transformation of socio-cultural component of the adaptive strategy in the direction of the origin and formation of ligaments between "risk science" and "warning science". This is the approach of the evolutionary risk of scientific and technological development to the existential level and the emergence of High Hume technologies, in particular. The distinctive feature of High Hume is the development of effective control or manipulation schemes capable to creating the possibility of unauthorized random modification of the genetic, socio-cultural and cognitive codes of *Homo sapiens*. In relation to the link between bioethics and transhumanism, the role of this factor was played by individual existential risk from the use of the same technological complex.

The two components of scientific knowledge forms an asymmetric, uncompensated circuit (fig. 5.1) with positive and negative feedback (Cheshko, 2012: 179). An increase in "dangerous knowledge" is necessary for the development of "warning knowledge", but the latter cannot exist autonomously, because the partner provides the actual material for scientific progress in this area. "Dangerous knowledge" stands as auto-catalyst for own progress, and a catalyst for "warning of knowledge". Last inhibiting the ongoing development of "dangerous knowledge" deprives itself of own

base for the increment. Overcapacity of "dangerous knowledge" facing the crisis, and then the self-destruction of industrial civilization, excessive development of "warning of knowledge" will lead to a stagnation of industrial civilization, deprives it of adaptive plasticity.

A so-called Knobe effect is essential to establish parity between the two trends of post-academician science and to the formation of a temporary evolutionary trend of technological civilization in the future. According to J. Knobe, a higher status in consciousness manifests an emotional perception and a rational assessment of the potential negative effects of any innovation compared with positive consequences for the same innovation. (Knobe, 2003; Beebe, 2010). As a result, the initial social assessment of any technological innovation tends to overstate the level of risk from its implementation, especially if innovation is related to the substantiality or the self-identity of the human being. Obviously, this phenomenon is the mechanism for "future shock" (Toffler, 1970) and "future-phobia" (Bestuzhev-Lada, 2002), but on the other hand, it is included manipulation in factors set providing relative stability of SESH too.

These calculations have empirical confirmation in sociological studies of the perception of the benefits and risks of the latest biotechnologies of recent times (Connor, Siegrist, 2016). According to them, the perception of possible benefits is significantly more stable compared with the estimated risk values of the same technological schemes. The latter is much more subject to fluctuations. There is a coefficient of autocorrelation of the results of a series of consecutive public opinion polls. It serve as an indicator of stability. It is also symptomatic that the instability of the attitude to biotechnological innovations exceeds that of nuclear power and other similar technologies. Attitude towards the latter has already been formed and has become part of the mentality.

In such a system, there is no need to talk about the standard procedure of verification / falsification of the reliability of a scientific concept, adopted in classical science. Its place is taken by a more or less pronounced social verification.

In theory of socio-psychological mechanisms of manipulation by consciousness (Aronson, Pratkanis, 2003: 384), Elliot Aronson postulated the existence of the verbal-logical, emotional and associative socio-psychological mechanisms of perception, processing new information and decision-making as two alternative cognitive modes of cognition. The first mechanism involves a relatively lengthy analysis and the creation of an explanatory model, the second mechanism is the search for emotional association with pre-existing thought stereotypes. As recent empirical studies (Cacciatore, 2011: 385) suggest, risk perceptions of

nanotechnologies and other really depend from (1) the logical relationships between innovation and developing the social consequences of their implementation, and (2) from the emergence of various kinds of psychological associations between different concepts.

Based on these facts, we have assumed that there is socio-cultural landscape of evolution of rational-technological component SESH that includes the direction and strength of its reverse effect on the biological and socio-cultural components. It is determined by emotional reactions of mentality, above all. Only secondarily, this effect is determined by the by the direct result of rational study of the social consequences of technological innovation. In other words, modern, 4-th phase of SESH evolution characterized by a balance of internal, rational-deterministic and external, social and psychological factors of science and technological developments.

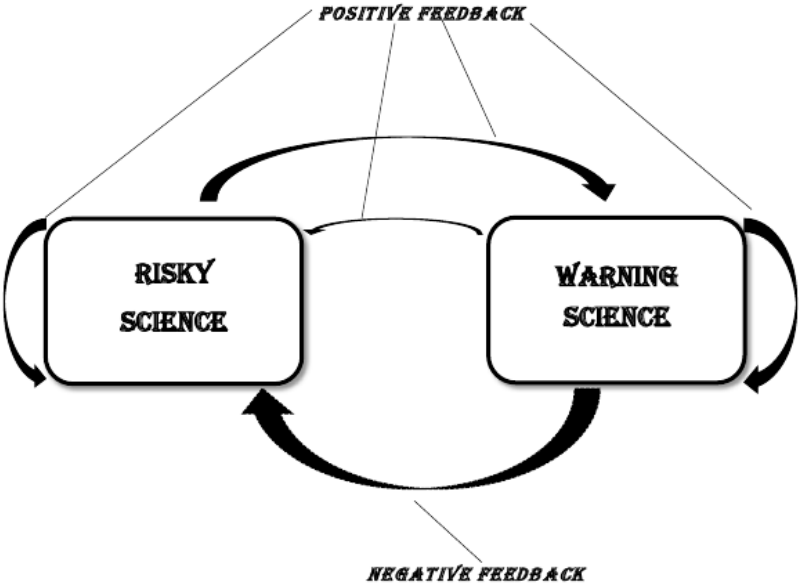

Fig. 5.1 Functional divergence risk and warning sciences

The task of forecasting the evolution of socio-anthropogenesis is to ascertain the specific magnitude of this balance in relation to the most risk-based technologies.

The second thesis lies in the possibility of determining the balance of the rational-technological and socio-cultural factors based on comparative content analysis of scientific research and mass-media communications. In other words, we assume the following initial postulates and principles.

1. There is a pronounced correlation between mental emotional images and verbal lexical elements associated with the impact of evolution based on technology;

2. In messages of key elements of the conceptual and terminological apparatus of two different concepts, the frequency of "lexical / semantic association" are comparable with the influence of one paradigm / research program on another research program and the influence of socio-cultural discourse on the evolution of the scientific theory in this model;

3. The higher semantic association of lexical units corresponds to a more pronounced personal and social group association between the value ratings of the concepts denoted by them.

First of all, we were interested in the terms of semantic association (keywords), somehow related to the lexical structures of the evolutionary paradigm, among themselves and with various aspects of its application[15]. The development of these fields of study and disciplines takes place in a social context and a certain evolutionary landscape. The exact path of this development is determined by a balance of perceptions of the potential benefits, risks and the possibility of monitoring and control in society. As we assume, the key elements of such a balance are the parameters of the frequency distribution of the terms "biological risk", "bio-security" and "biological safeguard" in associations with specific scientific developments and theoretical concepts.

In accordance with the initial working hypothesis, there is a structure and significance of semantic associations of basic constructs of separate concepts of post-academic science, which are formed as a network of nodes connecting specific pairs of lexical elements. The latter are represented by theoretical concepts. This system reflects the structure of the scientific paradigm.

Thus, "risk" and "safety" are transdisciplinary concepts, and contain elements of both natural scientific, nominative and socio-humanitarian, imperative and axiological knowledge. As a result, the matrix of semantic association can be considered as a kind of meta-construction of over-paradigm level of association.

[15] The source database in this topic, see (Chheshko et al., 2015; 2017: 242). The study was carried out in 2012-2014.

Let us denote this structural integrity, supported by elements of logical relations and semantic associations, as "biological and humanitarian-disciplinary-technological complex" (BHDTC or BHDT-complex). Its distinguishing features are a general natural-scientific paradigmatic core goes back to the theory of biological evolution (1) and similar technological applications (2). The subject of the latter serves the control and management of biological and mainly socio-humanitarian and socio-economic component of anthropogenesis. The complex consists of bioethics, biopolitics, bioeconomics and other transdisciplinary research areas. Their emergence has occurred in recent decades (from 1970). The number of publications in scientific journals and mass–media, can calculate their presence in the comparative research.

5.1 Basic settings, features, and limitations of theoretical model

Accordingly, content analysis (Shalak, 2006; Krippendorf, 2004) is the primary technique used for searching, collecting and interpreting data, including using Web-sources.

The number of semantic units are defined by the conjunctions equation N = "I" AND "J". Factor semantic association can serve as measure of the interconnectedness of the various areas of dangerous and warning sciences. It calculated by the equation $F_{ij}=N_{ij}/N_j$, where N_j is population number of publications containing semantic unit "J"; N_{ij} is populations containing semantic units "I" and "J" simultaneously. Thus, the value of F is not commutative, $F_{ij} \neq F_{ji}$ (Cheshko V.T., 2012: 215).

The level of sociopolitical pressure is determined by the dynamics and static differences between the corresponding representations (for example, "risk" *versus* "profit") in scientific publications and in the media on specific conceptual or research areas. Similarly, crisscross correlative influence of risk and warning science defined as the presence of lexical units (concepts) of "risk", "safety", "security" in the pools (populations) of publications in the field. A comparison of individual values F_{ij} was carried out too in populations of reports in the local segment of the Web, operated by the scientific community, or by groups of experts in the conceptual fields and in the global network as a whole. By this way, it will determine the possible coincidence or divergence of theoretical constructs, circulating within the scientific community, and of expectations of mass consciousness.

The coefficient of association is formed

- by the logical deducibility as the availability of the deductive or inductive links between the concepts, and
- by the actual semantic association, based on a holistic intuitive and emotional assessment.

The first component is dominant in the theoretical constructs of science, the second one is dominant in the stereotypes of culture and mentality. Accordingly, the first (logical) component is detected during the standard procedure of verification / falsification of scientific concepts; the second (emotional) component is implemented in the course of social verification amounting to integration / exclusion by mass consciousness.

A magnitude of $\Delta F_{ij}= F_{ij1}-F_{ij2}$ is recorded, where F_{ij1} and F_{ij2} are population ratios of semantic association in scientific publications and in a global search (by Google in our study), respectively. Therefore, positive values ΔF_{ij} correspond to higher association of terms in the communications world network. It according to the original working hypothesis reflect the general characteristics of the mentality of modern society compared with scientific publications.

Negative values ΔF_{ij} reflect the increased interest to the pairs of terms in the scientific community, compared with expectations of mass consciousness that is equivalent to "public opinion", and it is reflected in the composition of the relevant messages circulating on the Web. Mismatch association criterion

$$\Delta F_{ma}= (F_{ij1}-F_{ij2})/F_{ij1} \quad (5.1)$$

more sharply reveals the greatest possible external influence, which can provide a social and cultural context for the development of this concept.

In pool publications, negative values for this indicator, ΔF_{ma} show incentives for growth of association coefficient by second alternative pool and a deceleration of association coefficient growth in the second alternative pool by first member of the ligament. Thus, the value ΔF_{ma} = -4.919 for a lexical unit "talking" in a common pool of publications for cluster "human nature" corresponds to the similar parameters ΔF_{ma} = +0.831 for pool of scientific publications on this lexical unit.

Thus, we can talk about encouraging by scientific research of association "talking" and "human nature" in the mass consciousness and braking similar associations in topics of research pressure from the general cultural predisposition. The smaller the absolute value of ΔF_{ma}, the lower the external pressure experienced when developing the corresponding pool of online publications and the mental structure that it reflects.

Meta-description of these data leads us to the conclusion that the decline in the absolute value ΔF_{ma} diagnoses the decrease of conceptual overlap for imperatively-axiological and descriptive-epistemic (scientific) discourses.

The latter is a basic attribute of the classical scientific rationality as a "principle of ethical neutrality of scientific knowledge" and classical (industrial) phase of industrial civilization (Latour, 2006), that based on the Kantian-Hume methodological dichotomy "World of Proper" as subject of ethics and "World of Entity" as subject of science.

A resolution of the method is limited by "contextualization" of keywords search resulting from the features of the software related sites. A priory the effect of "contextualization" becoming a significant with the values of the association index approaches 1. In this case, the quantitative interpretation compared with lower values F_{ij} is difficult, although the increase in $F_{ij} > 1$ shows the integration of the respective semantic units in the wider cultural or general scientific conceptualization discourse

$$F_{gen=}\frac{|N_i-N_j|}{N_i+N_j}-F_{ij}, \tag{5.2}$$

F_{gen} magnitude equal to the difference between the highest possible relative amount of text fragments (messages), in which the terms "I" and "J" not occur together, and the relative amount of fragment, where they are in association. This value reduces the coefficient of association to $F_{ij} \leq 1$.

$F_{ij} > 1$ reflects the rating of involvement terms in general semantic structure of the test pool of publications. In other words, it corresponds to the rating of lexical structures (context) in which the studied pairs of terms can occur. Due to the uncertainty values F_{gen} is possible only qualitative interpretation.

Within the theoretical explanatory constructs of the modern transdisciplinary science, the structure of the transdisciplinary matrix of theory can be seen as the reason for exceeding the threshold Fij $\leq$1 by the semantic association coefficient. The transdisciplinary matrix includes the descriptive and normative cores, as we assume.

Within each paradigmatic core and between them, there is a system of deductive-inductive connections between descriptors, which includes semantic units coinciding in both cores. It contributes to "jump" of the search algorithm from one branch of the logical arguments to other branch with a similar semantic structure. These "jump" occur between axiological and descriptive constructs as well. As a result, recorded F_{ij} magnitude is overpriced.

On the other hand, the relationship between descriptive and imperative components of the transdisciplinary theory is actually an associative based

on partial overlapping of semantic fields of humanitarian and scientific conceptual nuclei. The result is a multiplication values F_{ij}.

Thus, the connections between the semantic units within each conceptual nucleus are deductive predominantly, and the connections between the cores are associative in general.

Another restriction is associated with semantic ambivalence results of content analysis. F_{ij}-index does not indicate a specific meaningful communication between members of the associative pairs. For example, the association of the terms "optics' on one side and "bioethics' and "bio-risk' on the other hand indicates only on the use of optical tools in biotechnological research, and does not indicate the existence of a logical links between theoretical concepts. Because, the results of content analysis must be constantly compared with the analysis of the semantic content of the texts. Especially, it concerns as the results, which are paradoxical or difficult explanation within the framework of a scientific theory or "common sense".

The mean square error is calculated by the equation of association for alternative sample

$$S_F = \frac{F_{ij}(1-F_{ij})}{\sqrt{N}} \tag{5.3}$$

5.2 Structure of BHDT-complex

Using the search engine of the Web portal ScienceDaily.com, a list of elements of the BHDT complex was ranked by frequency of occurrence. As already mentioned, the distinguishing feature of BHDTC is the integration of natural scientific, socio-economic and humanitarian elements. Based on these considerations, it is possible to attribute the BHDT-complex to the systems and constructs of the so-called post-academic science, more specifically, to its "warning" type (Cheshko, 2012).

The next step involved the detailed visualization of association schemes of individual elements of a complex with specific research themes and associated lexical units (keywords). A matches of keywords and topics of BGDTK informational messages were found on the ScienceDaily.com portal for this purpose. Common semantic constructs associated with specific elements of BHDT were then selected in publications in 2000 – 2012 in www.Nature.com and www.Sciencemag.org websites.

The structures of semantic associations on both sites are broadly similar. There are, however, significant differences in the social consequences of the use of BHDT technology. The index of semantic association in this case is

much higher at online publications populations at www.Nature.com. Three distinct clusters are formed by semantic associations of lexical units of the BGDT complex, in this case.

The first cluster includes terms related to the system conceptual framework of technological civilization and civil society, which is in a phase of risk society. This system is fundamental system of priorities for threat and risk control of modern civilization. Cluster make up terms on general problems of diagnostics and treatment of the most common, severe, and limiting the duration of life, first and foremost, oncological pathologies. F_{ij} in this case is in the range 0.2-0.5, but for some couples terms reaches extreme values ($15 \leq F_{ij}<66$), that are beyond the "physical sense" of this indicator.

Such high value index F_{ij} testifies to the integration of concepts cluster in the content of the basic philosophical and / or ideological systems of modern society. In other words, the concept BHDT develop within the of logical constructs, that are dominant in mentality and are not marginal for this type of society.

An indirect confirmation of this hypothesis is "exorbitant" value of semantic association index of "biodiversity" and "psychiatry" concepts (F_{ij} = 3747). This fact is likely to be interpreted in connection with the revision of the criteria for mental health and disease.

In mentality and worldview, these conceptual and methodological shifts is consistent psychologically and follows logically the doctrine of individualism and to the right of a person to self-determination that is mentality basis of the western type of technological civilization. In this context, an increasing number of pathologies of mild to moderate severity pass into the category of "individual existential projects".

In the same context can be interpreted revised attitude of society towards sexual minorities, suffering from the effects of chromosomal diseases (Down's syndrome, first of all), etc. too. Representatives of the anti-psychiatry movement from 1960-1970s. consider schizophrenia and related mental not as anomalies, but as an alternative basis for the substantial existential projects. Concepts of "mental norm" and "mental pathology" considered as a purely socio-culturally conditioned and equivalent to personal behavioral modes. The existential projects, in turn, determinate specific forms of an adequate interaction of the subject with the surrounding physical and socio-cultural reality.

There is a network of semantic and logical connections between the BHDT basic elements. This network determines internal organization of the complex. The central core of this organization is quaternary conjunction of (bio-) "risk" – (bio-) "safety"– (bio-) "safeguard" – "bioethics" concepts.

All these elements have almost identical composition of the first associative cluster, as well as similar values of the pairs of associations that it contains. The structure of the cluster includes associations with lexical units “Cancer”, “Disease and Treatment” (“Viruses”), “Stem Cells”, “Ecology” (“New species”, “Tropical forests”).

The second cluster of semantic associations brings together concepts that are regulators and descriptors of the basic directions of scientific and technological developments with the greatest significance. These include the terms “infectious diseases”, “public health”, “psychiatry” and “scientific behavior” in the case of the mentioned tetrad of basic concepts. Coefficient of association of “biological risk” concept with these terms is relatively stable and varies between 0.06-0.08. The composition of the second cluster is identical, and the F_{ij} magnitudes lie in the same range of values and concepts of biosafety and biosecurity.

According to the initial assumption on the distribution of functions among the members of the transdisciplinary core BHDT-complex, the above-mentioned four concepts are related to the provision of natural aspects risk-taking problems of scientific and technological development. The “bioethics” is central concept to understanding the socio-cultural and economic risks. It would expect the prevalence in the second part of the cluster of terms that reflect exactly the value-normative aspect of science and High Hume technology.

Indeed, in the second part of the cluster in conjunction with the “bioethics” presented

- A terms reflecting unfavorable development or degradation of the human environment and having a very high social status in the system of values of modern civilization such as “endangered animal”, “avian flu”, etc.;
- A terms associated with the development of acute social conflicts or perceived as acute ones such as “racial inequality”, “social problems”, etc.

It should be noted a higher ranking of social aspects in comparison with the natural science aspects of technological progress ($0.27 \leq F_{ij}<0.71$ and $0.06 \leq F_{ij}<0.08$, respectively). In our opinion, have a clear tendency to prevail over rationalist expectations of additional benefits and improve the quality of life due to the application of scientific knowledge in the mentality of modern human alarmist emotional responses.

Features of the structure of the second cluster of the concept of biopolitics, we have considered above. Second cluster “Biodiversity” concept was the most diverse. Judging from the data analysis, the highest priority are directions relating to the development environment, an

individually-oriented medical technology and space exploration. The degree of involvement of biological biodiversity in all of these areas of research is very large ($0.85 \leq F_{ij}<0.94$).

Finally, in relation to science components of the transdisciplinary matrix "risk"– "safety"– "safeguard", the third cluster reflects precisely crisscross association of these concepts with potential and current socio-political consequences of the implementation and use of BHDT-complex. The structure of the third cluster includes terms such as "consumer behavior", "education policy", "privacy issues", "endangered species" ($0.005 \leq F_{ij}<0.01$).

In the case of the concept of "bioethics", the same cluster includes extremely heterogeneous in content group term, Among them are such as "biochemical research" and "environmental research", "Diseases of malnutrition", but "transport" and "land policy or land managed" with a very low value of the coefficient of association ($0\ 01 \leq F_{ij}<0.05$). Rather, it demonstrates the incipient expansion of the associative field of bioethics at the new fields of knowledge and culture. As already mentioned, the concept of Bioethics was able to integration in the general mentality of technological civilization, especially its Western type.

Probably, structure a third cluster of associations of "biopolitics" can be interpreted by similar way. It consists of terms associated with acquiring or have already acquired the social importance of political issues as "infectious disease", "health", "depression", "conduct research". These terms are "attracted" to the biopolitical conceptual field and are perceived by the scientific community and society as the names of biopolitical issues that cannot be fully reduced to sections of traditional political science.

The third cluster of "biodiversity" concept practically includes "biochemical research", "developmental biology" only, with significant values of the coefficient of association, $F_{ij} = 0.06$. Obviously, this result reduces to the statement of the two most common methods of assessment of this indicator and the greatest importance of the individual parameters of biodiversity assessment.

As already mentioned, the composition and specific values of the association coefficients at different sites differ significantly when comparing a common 3-cluster scheme. This fact can be explained by a combination of individual differences in the policies of the site and regional differences in the social context. Further consideration should be given in light of these facts. This significantly reduces the reliability of the results. However, some conclusions can be made.

In particular, the concept of "biological risk" on the site www.Sciencemag.org detected predominate socio-political perspective in

the first cluster. The structure of the first cluster includes terms “Political Science”, “stem cells”, “child development”, “conduct research”, “rights of the individual” in decreasing order of magnitude F_{ij}. This feature characterizes the structure of the association to all the above concepts BHDT-complex on the site.

In this case, the cluster of the concepts of the BHDT-complex include terms relating to the field of population control, ensuring the rights of the individual and ensure individual freedoms, and political processes.

Magnitudes of F_{ij} reaches extreme values, beyond the “physical sense” of the indicator. Such high values of the F_{ij} show integration of these concepts in the content of the basic philosophical and ideological systems of modern society.

The second cluster combines the concepts that are regulators and descriptors of social conflicts and conflicts between different social communities, $10 \leq F_{ij} \leq 20$. Among them are racial differences, consumer behavior, political problems of education, etc.

Finally, the third cluster refers to the specific issues of the use of risk-taking technological innovations, $0 \leq F_{ij} < 1$. The concepts of “stem cells”, “child development”, and “health” are here. These lexical units represent topics with high conflict status as associated with acute ethical and legal dilemmas and alternative ideological and political interpretations.

The maximum values of the association observed for the first cluster “bioethics’ (over 200) and “biopolitics” (over 300 for the term “political science”). It can be said that in this case there is a marked politicization of the conceptual field of the BHDT-complex. More precisely, we should talk about larger conceptual overlapping of science and socio-humanitarian fields of transdisciplinary conceptual matrix of the BHDT-complex.

In other words, the concepts of BHDTC develop within the logical constructs that dominate the mentality, and they are not marginal for this type of society.

This conclusion takes into account the more pronounced orientation of the journal “Science” on the social aspects of the development of science and technology, the functions of the social institution of science in technological civilization and civil society. It is a powerful, although indirect evidence of the politicization and ideologization of the modern, post-academic stage of development of science. In turn, it confirms the transition of the social institution of science from Mode 1 to Mode 2. In these arguments, Mode 1 corresponds to the disciplinary-paradigm organization of science, and Mode 2 is a problem-transdisciplinary

organization in the terminology of H.Nowotny (see: Gibbons et al., 1994:90; Nowotny, 2003: 179).

It is interesting to note that there are three policy sections that have a basic meaning within the interdisciplinary matrix of the BHDT-complex, namely, "public health", "financing policy", and "environmental policy". The first two members of this set, "public health" and "financing policy" are in the second cluster of the "biopolitics" concept (F_{ij} <0.25). However, the political aspects of the environment are included in the third cluster of the "bioethics" concept (F_{ij} <0.1).

The last concept focuses primarily on the safeguard of individual rights and freedoms, while protecting the environment initially appealed to the needs and interests of society as a whole. In addition, a variety of environmental political issues historically had been much earlier. In the interaction of these two factors, you can find the cause of this phenomenon. Bioethical aspects of ecology seen as derivatives rather than underlying problems of bioethics. In other words, they have not as methodological as pragmatic meaning.

Next Research Series solves two main tasks:

- Firstly, identify differences between the structure of semantic associations of scientific discourse and mass consciousness and mentality;
- Secondly, clarification of the relative roles of the regional context, and other factors affecting the differences in the structure of the semantic associations of research topics related to the concept of BHDT-complex risk.

In general, the composition of the common Web-sector clusters was similar to those in the scientific discourse. The greatest similarity reaches first cluster "biological risk" concept. However, the "bioethics" and "biopolitics" are socio-humanitarian kernel of BHDT transdisciplinary matrix, and impression arises that its evolution is stimulated by extra-scientific factors of scientific theory development primarily. In other words, the proliferation of this topic to scientific discourse determined by external pressure of the dominant ideological and philosophical doctrines and systems value priorities.

This thesis does not contradict the active participation of members of the scientific community with a high scientific status at all stages of the genesis of bioethical and bio-political science concepts. The reason for the apparent discrepancy lies in the conflict of interests and the multiplicity of social roles of individuals at the same time and at modern society.

In support of the above considerations can lead structure of the first cluster of associations of “biopolitics” concept at general sector.

In the general sector of the Network, which is associated with the concept of biopolitics, the terms clearly affect specific social problems, which causes an increase in social resonance. There are “health”, “children's health”, “education”, “biology” and “developmental biology”. In contrast to the pool of scientific publications, there is a clear pragmatic shift towards everyday social specifics, rather than abstract models of the prospects for further social evolution.

The same can be said about the structure of the first cluster of “bioethics” concept in common sector. There are the associative connections with “social problems”, “developmental biology”, “psychology”, “health” here. The value of the coefficient of the association is in the range $0.53 \leq F_{ij} \leq 0.82$ for the bioethical issues, and $1.85 \leq F_{ij} \leq 2.0$ for the biopolitical problems.

If our baseline model representations are true, bioethics has already emerged in the segment mass consciousness that is the system of associative links with the problems of social life. At the same time similar connections of “biopolitics” currently has already won high-ranking public attention. However, the structure of semantic associations (“that we from this wait?”) still quite ambivalent and tends to be interpreted very broadly. If may so express, biopolitics has proved its value, but has not yet determined the boundaries of their applicability in the consciousness of society.

The next issue is the impact of mental and general cultural “landscape” on the configuration and growth rates of the individual components of theoretical and applied science.

We determined the coincidence or divergence of the theoretical structures circulating in the scientific community and the expectations of the mass consciousness by comparing the individual F_{ij} in the informational messages of the population in the information engines. The study was conducted using Nature, Science, Google portals.

Somewhat surprisingly, the structure of the semantic associations of biological risks concept differs very little between populations of scientific publications in the portal Nature and search engine Google as wide area network. The only statistically significant difference is due to a marked predominance of the semantic field of the term “health” in the global network as compared to the population of scientific publications (ΔF_{ij} = -0.92, ΔF_{ma} = -14.2). In a population of online publications of the journal “Science” the difference between them is even higher (ΔF_{ij} = -0.94, ΔF_{ma} <-

20), and it suggests the obvious socio-political orientation and, consequently, the financial pressure on the development of the subjects of scientific research.

Except for these data, socio-psychological and cultural-psychological factors have little impact on the development prospects of this theoretical concept. In other words, the associative structures of scientific and extra-scientific discourse within the semantic field of the concept bio-hazard / bio-risk practically coincide.

However, the same factors stimulate the study of biological safety associated with a very wide range of research topics ($\Delta F_{ij}<0$). The highest absolute values are achieved by ΔF_{ij} of the "biological safety" and "health", "public health" and related terms, "disease and treatment", "psychology", "conflicts", "scientific conduct" (latter concept is interpreted in context of "social responsibility").

In itself, there is increased public attention to the pragmatic topics of human health as well as social development of the appropriate determinate subjects of research that looks quite predictable, if not trivial. It reflected in the volumes of priority financing, obviously.

However, the last part of the list is very symptomatic. It includes concepts related to conflict resolution and the social responsibility of researchers. In our view, this fact demonstrates an integration by a public consciousness of security problems in the sphere of post-academician science, involving a joint view of the natural sciences and the humanitarian aspects of experimental sciences and theoretical constructs. It is obvious that security issues are integrated in popular culture as an unrecoverable essential attribute of modern scientific knowledge, rather than purely applied problem of safety due to implementation of new knowledge in a mentality and new technologies in social life.

Mismatch association criterion reveals a somewhat different picture, and allow to more accurately assessing of the possibility of social and cultural (extra-scientific) influences to the evolution of the theoretical concepts. A magnitude of the criterion for association between "biological safeguard" and "education policy" is the maximum absolute value in this set (ΔF_{ma} = -355). It suggests a very high degree of social determination of formation of educational programs in this area in comparison with the internal needs of the development of science. Magnitudes for "Land Management" (ΔF_{ma} = -271.9) and "pollution" (ΔF_{ma} = -262.7) are just below.

In the next place on these criteria are “psychology” and “confidentiality” ($-166<\Delta F_{ma}<-171$). It is followed by “consumer behavior” as a term referring to the regulation of the market and to ensure optimal conditions ($\Delta F_{ma} = 130$).

And only then in the ranked list follows the “health” ($\Delta F_{ma} = 100$).

However, a special group of semantic associations constitute the terms reflecting the extremely large absolute values of social pressure on research subjects ($\Delta F_{ma}<-900$). This group includes “political science”, “labor safeguard (safety)”, “environmental researches”, “nutritional diseases”. Obviously, these lexical items are the distinctive brands and areas with the highest social inquiry. As you can see, the conceptual field of the inquiry may be defined as the intersection of the political problems and quality of life.

On the subject of scientific publications, the range of social context effects is different in the journal “Science” in this regard. It have pragmatic orientation, so to speak. Here, the issues of political control of research activities are at the center of attention and can or should be taken into account by the scientific community.

Now we pass to “bioethics” and “biopolitics” as kernel elements of socio-humanitarian transdisciplinary matrix. The range of ΔF_{ij} lies mainly in the positive areas of magnitudes for “bioethics”, and the range is in the negative values for “biopolitics”. This is probably due to the more advanced stage of the institutionalization of bioethics as result of its consistency with verbal constructions and emotional intentions, which assumed the role of system-forming factors of public opinion.

In conjunction “Society – Science”, last member of binary bundles dictates the “rules of the game” in the formation of topics and areas of research, development, regulatory framework, etc in this case.

Moreover, there is a rather narrow range of variations in differences of association coefficient magnitudes in the scientific and general sectors of the global Web-sectors for bioethics concept. For any associated terms, ΔF_{ma} of this concept is approximately 0.8-0.9. A set of terms is very broad and heterogeneous. It seems that bioethics has become a powerful ideological element in the worldview of modern civilization. It affects most areas of mental, spiritual culture and public opinion in one way or another.

The concept of biopolitics is experiencing the greatest influence of “educational policy”, “social problems”, “labor safety”, which are included in the socio-humanitarian segment of public consciousness and “biology”,

which belongs to the natural sciences segment. In general, it was predictable.

5.3 Prospects and risks of controlled evolution of human: the intentional structure of post-academician science

At a pools of scientific publications and websites www.Nature.com and www.Sciencemag.org concepts "(bio)improvement of human" ("*Human Enhancement*" and "bioenhancement") are extremely rare. This construct, however, it is extremely clearly denotes a positive intention of technology-driven evolution application to human beings. (Social sciences and humanities in the same intention coded lexical construct "High Hume"). In this sense, construct united emotionally negativistic "biological risk" and neutrality or implicit positive "biosecurity", "biosecurity" allows you to define more clearly the mental and socio-cultural evolution of technology landscape of High Hume. In this regard, we searched the incidence of related terms on database www.Scopus.com.

As follows from the data, the frequency of the lexical unit "(bio) enhancement" significantly inferior to the absolute value of the rest of them, but is characterized by the highest growth rates. The greatest surge of interest in this subject is recorded in 2002-2008. The curve of occurrence of a lexical unit "biological risk" has a more dense form and is more extended in time. The growing number of publications has been celebrated since the 1994-1995.

In our view this reflects not only the surge of interest in the topic of driven human evolution, but also on projected (perhaps intuitively) the transition from its philosophical and theoretical considerations into practice. We emphasize, however,

- Firstly, the coefficients of lexical association of concept "human (bio) enhancement" and biotechnological terms can`t be determined due to their smallness;
- Secondly, the concept "human (bio) enhancement" is found almost exclusively in the socio-humanitarian, primarily medical ethical and bio-ethical periodicals.

Thus, of perspective of technologizing evolution within the scientific community discussed within the socio-humanitarian knowledge, without penetrating even into the theoretical and empirical discourse of sciences and technological advances. This concept "human (bio) enhancement" is

radically different from the "genetic engineering", to the extent the latter does not go beyond evolutionarily formed biological norm.

Therefore, as the totality of the available data suggests, the evolution of the SESH and its holders (*Homo sapiens* beings) is located near the evolutionary singularity, i.e., irreversible transition to phase 4 (directed evolution), but has not yet overcome the brink. With regard to the prospects of management, the system-forming role played by the humanitarian consequences of the use of the relevant expertise of technological schemes, rather than their fundamental technological feasibility. In other words, in the mentality, the absolute hegemony of technological imperative of modern civilization limited significantly in the of risk society (the 4th phase of SESH evolution).

It does not mean the loss by the technological imperative of its position as one of the most important intentions of socio-cultural adaptive complex of SESH in its Western kind of technological civilization. We are talking about comparative upgrading humanitarian components in the scale of values and priorities. Characteristically, described a surge of publications, including the concept of "bio-enhancement" explained the holding of two panel discussions. These topics concern

- firstly, the possibility of using the High Hume technologies to bring the moral and emotional aspects of human psyche (Persson I., 2013) in line with the realities of modern techno-cultural environment (i.e., on the admissibility of the regulatory process techno-humanitarian balance itself) and
- secondly, the "optimization" of emotional and rationalistic balance of mental processes, above all, reduces the proportion of uncontrolled by emotional and logical intellect mental states. (Such conditions are amorousness are related primarily with sexual and reproductive sphere of human behavior). This intention is concentrated thus in the correction of psychophysiological sexual dimorphism, in particular, a possible female embryos "bioenhancement" (because of the greater adequacy of the female psyche to the same civilizational realities) and the gradual elimination of sexual dimorphism of *Homo sapiens* (Sparrow, 2010; Casal, 2013; Douglas, 2014; Earp et al., 2013; Koch, 2010).

This observation is well illustrated and empirically proves the thesis of dissociation of individual elements of a biological adaptive module as a result of the influence of techno-rationalist module and under the control of the socio-cultural module. Within the framework of the concept of 3-modular SESH, there are an examples of formation of co-evolutionary techno-cultural ligament. A spread opinion about the possibility of controlled technology to overcome the sexual dimorphism is one of them.

The substrate basis of this phenomenon constitute the initial mental predisposition of Western civilization on the highest priority of individual freedom and, as a consequence of ideological pluralism of rights standard of different social communities; the formal teleological basis constitute the needs of progressive development of the technological module.

It has been said on amplifying permanently from the middle of the 20th century trend on providing semantic technology to overcome the biological conditionality of gender social roles. As a consequence there is a gradual replacement of biosocial adaptations of reproductive and (increasingly) ─ demographic features by techno-rationalist innovation. Limit point of this trend of *Homo sapiens* evolution is complete loss of functional dependencies between the two functions. Ability to save "sexual" (not reproductive function) component among anti-stress and maintaining of individual psycho-physiological norm mechanisms. Technologization of the sphere will then progressively increase. In our opinion, this assumption is fully justified, at least in relation to the Western (Atlantic) variant of technological civilization, and while preserving the development trends in relation to global civilization also..

Because of combining the technological imperative and individualistic humanism in the mentality of Western civilization, point of application of modern High Hume is the SESH as a whole, rather than individual modules. That humanism becomes technologized first and then actually technologized humanism will become a necessary and sufficient basis for practical transhumanism.

> "We claim that human beings now have at their disposal means of wiping out life on Earth and those traditional methods of moral education are probably insufficient to achieve the moral enhancement required to ensure that this will not happen. Hence, moral bioenhancement should be sought and applied",

Ingmar Persson and Julian Savulescu (Persson, Savulescu, 2013: 124) suggest this thesis. In this example, it is obvious, there are two parameters, and these parameters of human evolution are irreducible to each other – at least phenomenologically as two system-forming evolutionary factors.

Accordingly, the magnitude of the risk of evolution will be determined by the ratio of the evolutionary correctness and evolutionary efficiency under the leadership of the first of them. Recall that in accordance with our ideas trend correctness of evolutionary divergence diagnosed by the

structure of associative links between theoretical science and popular culture. To this question we now turn.

5.4 The thematic structure of theoretical science and the predisposition of mass culture on technology-driven evolution

Most pronounced association observed in relation to "genomics", followed by "GMOs" and "genetic engineering" at spectrum of research preferences (set by coefficients of direct associations of the title term) of biotech online publications at www.Nature.com. "Gene engineering" and "GMOs" is leading a similar range of site www.Sciencemag.org.

The spectrum of genetic engineering research associations demonstrates leadership topics "GMOs" (in the natural high coefficient of association with the term "biotechnology") at site www.Sciencemag.org.

Scopus database has lower coefficients of semantic association. Rating associated terms of a sequence of "genome", "biotechnology", "genetic engineering", "GMO".

In general, patterns of association coefficients are clearly site-specific, which obviously reflect differences in the structure pool of publications.

There has been a steady increase in the number of publications related to "biosafety", launched a little later, from the beginning of the 2000s. This difference seems to reflect a different emotional meaning of the terms "risk" and "safety", and demonstrates a certain parity of risk-taking and warning science, translated into the plane of practical measures to ensure the effective use of biotechnological innovation.

Note also that the starting positions of concepts "Bio-risk" and "bio-security" also vary greatly: in the latter case, the increase in the number of publications started from scratch, whereas the "risk" (probably due to ambiguity of the term biological risk) occurs in appreciable number of publications already in the early 1960s.

We noted the magnitudes of coefficient of association (F_{ij}) of the concept of "biological risk" to the concept of "biotechnology", "genetic engineering" and "GMO". These parameters reflect the representation of relevant areas of research in the warning science and, consequently, the value priorities of the scientific community with regard to the subject matter. (In this context the term "concept" and "semantic unit" are regarded as identical.) According to our data, for 2000-2013 the F_{ij} is 0.48 (complex and lexical units "benefit" and "products" ("goods") is quite comparable with the value for the terms "Biorisk" and "biosecurity". This is particularly

evident for the pool of publications database Scopus. In this case, the value is in the range 0.9-0.95 for Nature.com site. For Scopus measure F_{ij} for the term "benefit" is somewhat lower and varies between 0.25 ("GMO") – 0.16 ("biotechnology").

This applies to all terms associated with positive perception of economic predispositions of all aspects of the development of NBIC-complex. This fact demonstrates the positive economic intention of such subjects, stimulation of the evolution of the business area (and, consequently, the scope of policy and law) in the triple helix of evolution of technological civilization. We can assume that the described pattern has a basic attribute of technological civilization. (For comparison, the same indicator of the involvement of the relevant terms in the interpretation of risk-taking, for the site Nature.com 0.32-0.10 and 0.13-0.03 for Scopus).

Of course, there is reason to link the activity of the total publications containing the results of research in this area, with a set of subjective and objective factors characterizing the research activity. These include, first of all, the system predisposition, i.e. epistemological value and priorities of the thematic structure of the social inquiry and the commercial demand for the results of relevant studies, the structure of the disciplinary matrix, and so on.

All of this requires further analysis. Nevertheless, the theme of "risk science" covers just under 50% of general pool of scientific publications in relation to the biotechnology sector of NBIC-technological complex, and this fact is eloquent enough. Obviously, the attention of researchers expressed reorienting to the study of side effects of scientific and technological development, forecasting and risk analysis and fight against them. In other words, the future path of scientific progress is largely determined by risk than it was during the period of the classical type of scientific rationality and the corresponding social status of science.

It should be noted, in the public mind and in the media attention given to the problem is much higher, making the fields more vulnerable to biopolitical and ideological pressure.

According to the conclusions of a meta-analysis (Frewera et al., 2013: 142) of scientific publications in the Western sources 1990-2010th, rating perceptions of risk of genetic engineering research is slightly higher than the rating of perception of the benefits and advantages derived from their use (46 points against 30). At the same time trend found in the regression coefficients for this indicator shows a marked increase in the attention of society to the risk-taking components of genetic engineering (0.45) at a relatively constant level, focusing on the benefits of the same technology (-0.08). For twenty years, we have formed a clear geographic differentiation

of the adaptive landscape, which takes place the formation of the biotechnology segment of the SESH technological component. Risk perception of biotechnology is more pronounced in the EU and elsewhere in Europe than North America.

This fact is confirmed not only by almost all studies (The Role of Biotechnology, 2012: 17), including our own. It has become trivial to stating, politicians and business scope to be reckoned it. This is stipulated in the legal field of the respective regions and geopolitical configuration. Several European experts led by Oliver Sanvido indifferently stated that although the European Commission intends to extend the schema of the risk assessment of GMOs, the decisions is currently focused on the risk assessment. Estimates of the potential benefits explicitly not taken into account in the implementation of GMOs in Europe in accordance with the EU Directive 2001/18/EC. In other legal acts of the decisions on the use of GMOs could take into account both the potential benefits of growing GM crops, as risks associated to technology alternatives (Evaluating environmental, 2012: 84). Another researcher also notes the tightening of the regulatory and restrictive measures are no noticeable effect on the overall negative predisposition Western European mentality with respect to genetically engineered foods (Einsele, 2007).

Dominic Brassard (Einsele, 2007: 17) made a very important observation. The positions of the supporters and opponents of this confrontation are initially antinomic in the Kantian sense of the word, since the outcome of mutually exclusive initial settings – "GM technology are the good" *versus* "GM technology lead to danger". The arguments of the other side are not considered because they are outside of their own conceptual field. In other words, there is a formation of two alternative mental and socio-cultural types and each has a center of crystallization estimate evolutionary consequences of technology-driven evolution. As part of the mentality and ethos of the scientific community there is a predictable result of delay on the internal dichotomy and the community into two priority system associated with the "risk-taking and "warning" science.

The latter conclusion is confirmed by the case study of social history dynamics of biotechnology, in particular genetically modified organisms of the last decade. An example is the reaction of public opinion and, therefore, the political elite at a contradictory in methodical outline studies of I.V.Ermakova (Russia, 2009) and Seralini (France, 2012) of the biological risk of long-term effects of genetically modified food products. As authors believed, they have received credible evidence of high-risk GMOs-products (GM soybeans,2007; EFSA, 2012).

These publications have generated enough contradictory and bordering the unequivocal rejection reaction from the scientific community, and order more business whose interests were associated to GMOs. The answer of social movements and many political figures was certainly negative about the prospects of further practical use of GMOs and other genetically engineered innovation. In principle, this distribution of opinions and assessments could be predicted based on the already quoted Knobe effect.

So, a sharp reaction of public opinion arose in connection with the biopolitical significance not only of the scientific results themselves, but of the prospects of their use as a tool of political technology for reformatting the electoral structure and mentality of society. As a result, these publications were consistently brought highly rigid scientific expertise. In particular, the results of the group of Seralini tested were experts of six European countries and have been collected and compiled in a special report European Food Safety Authority, totaling 157 pages (EFSA, 2012: 1).

The experts concluded that the scheme of experiments and statistical processing technique of the results contain a sufficiently large number of errors. As a result, the conclusions are not based on reliable empirical basis and are, if we may say so, to a much greater degree of "politically motivated". Political motivation here refers to the predominant influence of the initial ethical and social (extra-scientific) value priorities, and not the internal scientific criteria adopted by the scientific community.

Earlier equally close police subjected the Ermakova data.

However, political and commercial components are inevitable and, if desired, can be applied to the cited documents. It is interesting to note that further discourse was translated in the judicial field, in particular, and not verification and analysis of the findings of scientific research. At least this applies to the media and alarmist public organizations. So, there are materials from the site "GMO Review"[16], the content and conclusions are clearly negative in relation to their topic (GMO). From the report on the outcome of the trial in the Philippine court on the termination of field tests of GMO varieties of eggplant states, it follows:

> "Seven experts in the last trial really tried, but were unable to refute the study of Seralini (2012) in respect of serious effects in rats fed a long time GM maize NK603 and a small amount of the herbicide Roundup". The court's decision, according to the same report, said that

[16] https://gmoobzor.com/stati/popytka-oprovergnut-issledovanie-seralini-terpit-neudachu-v-sude.html

> "the testing or introduction of Bt-eggplant in the Philippines by the nature and intentions of a serious and direct threat to a balanced ecology because no single document nor what criteria it is not an environmentally friendly event".

In the absence of the original, we continue to rely on the same electronic publication. Output in the title, gives the impression that it is the court proved the accuracy of the data Seralini:

> "The attempt to refute studies Seralini fails in court".

Meanwhile, even in the above quotation it comes to social and environmental risks and not about the reliability of the scientific concept. The same decision focuses on the social and political aspects of the implementation of the results of genetic engineering research:

> "There is no scientific consensus on the safety and effects of Bt-eggplant;
> there is no law passed by Congress that regulates the Bt-eggplant as the GMOs;
> the precautionary principle is applicable in the light of uncertainty and failure (ineffectiveness) of the current system of regulation;
> Bt-eggplant with its social, economic and environmental impacts on the surrounding environment not may charging only scientists who adhere to the interests of the parties concerned".

The conclusion of the intensification of the process of combining scientific and social discourse became particularly evident after the "withdrawal" by the magazine of the fact of publication of the article of Seralini group. The cases of disavowal from published article content by scientific journal are not rare in modern science and, as a rule, only increase the politization of evaluating the reliability of previously published data.

There is combination of strictly scientific, moral, political and legal conceptual fields, and this complex becomes unavoidable (by virtue of the ambiguities of individual social roles and conflict of interest) common place of postacademician scientific discourse and practice of the research process.

Judging by the reaction of the scientific community, the next similar investigation (Carman et al., 2013) equally contributed to a negative perception of the prospects of genetic engineering and caused an equally acute socio-political resonance. However, this report was more substantiated from the point of view of the canons of classical epistemology, and its conclusions were more balanced.

Subsequently, there were reports about the initiation by the National Russian genetic association so-called "Rat reality Show", in which different groups of laboratory rats will get or not containing GMO diet (Johnaton,

2013).They shall be checked by using different methods, and video protocols are broadcast on television. Thus the (quasi-) scientific experiment is translated into show business and manipulation technologies, and the conclusion of data accuracy and validity of the findings will be made not by the scientific community, and social and political movements based on considerations of the ethical choices and political correctness.

The other dominant motive of discussion linked to sociological and socio-psychological predispositions of adhering to alternative interpretations of experimental data participants. The main factor here is a conflict of interest related to the polysemy of social roles of modern researchers. At the same time, each researcher is interested in improving his status in the scientific community, as well as in securing financing, implementing business plans for technological innovations, etc. At the same time, the basic elements of the study and its theoretical interpretation remain relatively constant. These include substantive arguments of the parties regarding the methodology and interpretation of empirical data, the validity of the experimental design and theoretical conclusions. Actually, the scientific arguments of the discourse participants currently have weaknesses both among supporters and opponents of genetic engineering and biotechnological innovations. F.W.Engdahl article (2012 et al.) is most striking example of this "sociological" bias of modern biotechnology.

General methodological problem of post-academician science is a key term "long-term consequences". Scientific publications to justify the original risk GMOs have a characteristic detail of the planning and research methodology. For example, Seralini group used genetic line rats, originally created for cancer research and, in particular, modeling oncological diseases. This line is used in the standardized three-month study of possible carcinogenic effects of GM foods. However, during the implementation of the research program has been revised. The probable cause could serve as the inability to clearly negative interpretation of the results.

Expanding beyond the observation period, the original terms of the limited makes methodological diagram Seralini experiments not justified in terms of reliability and validity of the results. Research group of Seralini and arguments of his critics both contain propositions and facts that are open to subsequent revision or refutation of both the logical and empirical aspects. The position of Seralini's and Ermakova's opponents is more reasoned. However, the decisive factor becomes the lack of absolute reliability to any scientific-theoretical construct.

If the risk level reaches the existential level, and in the structure of risk evolutionary component dominates, the classical methodology of scientific research and the generation of technological innovation itself becomes a

source of risk. The classical scheme of the cycle of generation of scientific concept and its subsequent verification provides the adaptation of new knowledge to new data made by falsifiers as new scientific paradigm.

In this scheme, each discovered error even inaccuracy of the scientific concept turns into a generator of new scientific knowledge. This is the essence of Karl Popper's evolutionary epistemological scheme.

However, the features of the existential risks have asymptotic approximation of the probability (P) of its realization (actualization) to the unit over time: $dP(R)/dt \rightarrow 1$. Translated into the language of the socio-political pragmatists, this means that the researcher loses the right to make a mistake. Long-term consequences of imprecise objective scientific knowledge and, accordingly, created on its basis technologies, cannot always be predicted, eliminated or neutralized.

A striking example of the potential of such a scenario is the story of the now banned to use of the pesticide DDT (dichlorodiphenyltrichloroethane). The discoverer of its insecticide activity, Swiss chemist Paul Muller got in 1948 Nobel Prize "for the discovery of the high efficiency of DDT as a contact poison". It is known that DDT was widely used as a pesticide, but was almost universally banned for use in the early 1970s due to the long-term consequences of its harmful effects.

However, the immediate aim of the use of DDT was the fight against insect-vectors of infectious diseases, primarily malaria, and it has been achieved by this time in the United States and other countries. According to some estimates, the technology the use of DDT has prevented about 500 million deaths from malaria. Currently, DDT is recommended by the World Health Organization, among others, the use of insecticides, although not on such a scale (Bouwman et al., 2013:272; Zubrin, 2012; Tren, 2001).

Such ambiguity of results of the use of technological innovations can be considered a general law of development of industrial civilization and all mechanisms of adaption genesis by SESH. With the approach of the evolutionary risk to the existential threshold risk itself becomes dominant component of adaptability. The effectiveness of management for achieving evolutionary existential threshold risk is system-forming parameter at adaptive landscape of *Homo sapiens*.

As a general conclusion, we observe distinct adaptive reconstruction of components of SESH that is initiated by culture. An adaptive reconstruction of techno-rationalist module is in the deployment of the so-called "warning science" ("warning scientific knowledge"); and in contrast to the classical ("dangerously", "risk") science, "warning science" is oriented on the self-reflective analysis of the consequences of scientific and technological development.

There are additional arguments to socio-evolutionary value of the studies and an extremely high spike in attention not only outside, but also within the science community. For classical science and purely descriptive empirical research, such a stir would seem strange to the extent that it does not affect the own structure of the disciplinary matrix. For modern postacademic science, that is oriented toward solving social problems, rather than solving logical puzzles (Thomas Kun), this reaction is quite natural and explainable.

However, in accordance with the scheme of functioning of co-evolutionary binary links between the elements of SASN (Fig. 1.2), the adaptive reaction of the slower component to the innovation of the faster component is initially phase-lagging. Thus, the reaction of the spontaneous cultural component to technological innovation "focuses" on those risk elements that coincide with the already established phase of technogenesis. In the examples described, public attention was focuses on the possible negative effects of genetic engineering techniques that are common to chemical, breeding, pharmaceutical innovation at mid-twentieth century (allergies, oncology, various remote physiological pathology, etc.).

However, the modern stage of SESH evolution is characterized by the ability to deconstruction or erosion of genomic and cultural component. As results, the most serious and difficult to calculate risks of the existential level of significance remains out of sight of socio-cultural adaptation at this stage. Only after the formation of the "inhibition effect" of technogenesis, will those areas of warning scientific knowledge be activated that actually allow us to identify, evaluate and predict the objective distribution of risk factors; and only then comes the turn to develop a system of risk neutralization measures that are adequate to this distribution. In other words, we really are dealing with an adaptive reaction of culture and society, which reformats the evolutionary landscape of the science development, and inhibit the rate of scientific and technological development of certain areas and speeding up the progress of others.

Let's also assume that, in relation to the scientific community, this finding would have been not quite correct. The value system within the scientific community is much more focused on the features of the organization of disciplinary matrix ("objectively verifiable") than on mentality of society as a whole. Typically, "risk" and "safety" appear together in most publications. The first of these focuses on the perception of the danger of scientific and technological developments, and the second one focuses on the development of innovations to overcome risk. It is clear, at least at level of interpretation of empirical data and theoretical concepts,

potentials of risk science and warning science in scientific research are relative balanced in the professional mentality of the scientific community.

Reciprocal association coefficient (F_{ji}), reflecting the representation of the theme of risk and, consequently, the level of proliferation of warning science in the relevant research areas, giving significantly different results. In this case, the leaders are genome (0.306-0.312), biotechnology (0.20-0.22) and genetic engineering (0.10-0.11). Surprisingly few publications where association are formed by the lexical units "risk", "security" on one side and "GMO" on the other.

A comparison of data from different servers allows for several different interpretations, since it depends on some not related factors (the composition of the population of publications, software search engine server, guidelines for the selection of material, and so on.).

Yet we note one indisputable fact. We determined the correlation coefficient for the term "biological risk" with various lexical units of the conceptual field of biotechnology and genetic engineering from the technology-based evolution sector, and the parameter is greater for the Google search engine than for Scopus.com and Nature. com. This is especially true for the term "biosecurity". The value F_{ij} in this case is much higher than that for the other terms.

For the terms "benefit" and "profit" such pattern not detected. The values of lexical association for all three servers are quite close, if not identical to each other. Any of these terms in a pool of mass publications associated, primarily, with the concept of "security". Of special note is a lexical unit "goods" / "products". It is specifically pragmatic (obviously positive) shade of perception (as opposed to ethically-oriented perception of the terms "benefit" and "profit"). In addition, it is in this case that the intention to connect the term "biosafety" and "biorisk" is much less expressed in public consciousness. On the contrary, the possibility is more powerful in transforming the achievements of genomics and biotechnology into goods.

In the Russian-speaking (and other Cyrillic languages) sector of the Web, require the most attention in relation to biosecurity measures is research topics in which there are terms (in order of decreasing coefficient of association), "biotechnology", "gene(tic) engineering" and "genome". Note parallel to the association biorisk and biosafety is extremely high. Its particular value in this case goes beyond the resolution of the technique used ($F_{ij} \geq 3.0$). In the sector of professional publications, this association several orders of magnitude lower.

In our opinion, this is a very interesting observation, because the more frequent use of the term "risk" and "safety", respectively can be a direct

indicator of the orientation of the individual researcher to risk or warning science.

The direct F_{ij}, reflecting the perceptions of the negative aspects of this type of scientific and technological developments, in the mass consciousness, are very high. In the Russian-speaking sector of the Web, almost every publication refers to security issues in the field of biotechnology and genome research ($F_{ij} \approx 1$). For publications dealing with GMOs, the parameter is ¼, and for genetic engineering – almost 40%.

Thus, the risk assessment of the evolution the society exceeds that of the scientific community, although it is possible to note a clear difference between F_{ij}, registered in the pool of North American and Western European scientific publications.

There is a very strict opposite examples when high levels of the evolutionary risks associated with technological activity, meets with a very low level of anxiety of public opinion.

For example, among experts there is almost complete unanimity regarding the causes of the phenomenon of global warming as a result of the process of human activity. This is what the results of a survey and content analysis of scientific publications say (11 944 articles from 29 083 authors in 1980 scientific journals for the period 1991-2011). 97.2% of publications and authors support the anthropogenic origin of this phenomenon in one way or another. At the same time, the respondents-laypersons showed striking immunity to this type of information. How to write the authors of the cited study, there is a bottomless chasm between the actual consensus of experts and public perception. It is striking, especially given the evidence of the expert consensus that just less than half of the US population believes that scientists agree with the statement that it is people who are responsible for global warming (Cook et al., 2013:6; EEA, 2002).

This happens not only because of the nature of the human psyche and the mass perception. Global changes in the environment are regarded as independent kind of human reality, perhaps as a product design activities of transcendental (personalized or impersonal) subjects. This subconscious intention is complemented by another one – about the dangers of direct (not mediated by-objectives) human intrusion into the sphere of influence of these forces. The role of such subjects is not necessarily initially playing transcendent beings (gods, spirits, and so on). Perhaps the source of the formation of such psyche stereotypes could be linked to contacts with competitors on general ecological niche.

Equally, if not more important is another factor that is auto programmable technogenesis effect, i.e., separation technology component of the co-evolutionary cycle from other two components of SESH and the

subordination of bio- and cultural evolution to technologies development. This mechanism is realized through the implementation of the technology by the mind control those systems of perception and behavior that are adaptive within a proper technological (but not humanitarian) evolution.

The research team cited here states (Maran, Kleisner, 2010:6-7): a clear image is formed in the mass consciousness through advertising technologies and taking into account the prevailing value priorities and norms. The core element of the image is the "loss of confidence" in the validity of the concept of anthropogenic and technogenic origin of global climate change in the scientific community.

These data, in our view, show:

- Firstly, the fact of a significant divergence of priorities in risk assessment between the intentions of the mass consciousness (culture) and those within the scientific community. This fact reflecting internal trends of development of science in general and of warning knowledge in particular;
- Secondly, the obvious and a proportional to divergence of mass mentality and scientific knowledge techno-humanitarian imbalance. This imbalance in itself represents a significant threat to the subsequent evolution of adaptive technological innovations.

As J.Ziman wrote (Ziman, 2004: 84),

> "What might be called "post-industrial science" differs from the earlier stereotype of industrial science by substituting "market" competition (of conceptual populations and research schools of their carriers – Auth.) for "command" management".

Research groups are working, carrying out commands like a small company that produces a competitive product on the market.

Commercial enterprise and personal mobility replaces the professional responsibility and career stability as principles of research and development activities. Further, Ziman not without justification declares that the survival of academic, fundamental science in a new social context is very "nice". The transition from classical to post-academician science is coherent transformation of industrial civilization to a phase of information culture, and transformation of the market economy in the knowledge economy. It is accompanied by the appearance in semantic code of the scientific community brands (management, contract administration and control, responsibility, training, employment), unknown here, borrowed from the outside – from a culture of civil society that emerged in the West in the last few centuries (Cheshko, 2012: 329).

Thus, the perception of the potential and actual possibilities of transformation of reality through technology-driven evolution is generally

positive. While ensuring an adequate level of safety, reducing the evolutionary and other forms of social risk of technological innovation has an absolute priority in the value system. In other words, the question of the benefits and improving the quality of life is important, but it takes only second place in the list of values. The first is the problem of eliminating the risk.

So, the first important conclusion from the data is as follows. Socio-cultural adaptation of the Industrial Form of Technological Civilization is consisted in the absolute dominance of the representation of the technological module in the cultural module of SESH, but it is no longer an absolute attribute of mentality of Information Society.

The second conclusion follows from the parity of the positive ("profit", "benefits", etc.) and negative ("risk") intentions of perception of technological module. There was also a return to the value system of the so-called traditional society, based on the priority of stability and emphasis on the dangers and the undesirability of any technological innovation. Socio-cultural SESH module is currently undergoing bifurcation zone and its condition upon completion of this process, hardly predictable, at least for now.

5.5 Mental predisposition of perception of attributes of humanization and dehumanization as an evolutionary risk factor of gene technologies

The next series of studies was devoted to the study of the influence of the socio-cultural evolutionary landscape on the perception of risks to human self-identification. The described techniques were used.

The totality of the studied terms was divided into 6 groups involved in the formation of associative links that were taken in account. In accordance with the Wilson-Haslam conceptual model of the psychological predispositions (Wilson, Haslam, 2013), the basis for including in group was the functional adaptive significance of the trait that is denoted by the term for the formation of clusters "HUMAN NATURE" and "HUMANITY". In accordance with the mentality of modern civilization, a sets of traits / signs of each cluster are the criteria for identifying a particular person to "humanity". Conventionally, these groups can be described as follows:

1. Language and thought.

2. Social characteristics I (means of providing communication within the family and with close members of the social environment).

3. Social characteristics II (a means of maintaining the hierarchical structure and activity relationship).

4. Manipulation by fragments of the physical and social environment.

5. Social characteristics III (means of symbolic communication and coordination of actions of individuals).

6. Antisocial symptoms (causing harm to themselves and to other members of the social group).

As we assume, there are relatively stable patterns of semantic associations in the populations of scientific online publications and general online publications. Respectively, the patterns reflect the characteristics of the scientific paradigm and mass consciousness. If this premise is true, then the specified pattern can be described in two ways:

- In terms of the internal structure of verbal and logical relations and socio-cultural and psychological predisposition within the common and scientific pools that is estimated by F_{ij};
- In terms of mutual connotations between members of different scientific sub-populations and common mega-population, i.e. as the mutual influences of socio-cultural and psychological predisposition and verbal and logical constructs of the scientific disciplinary matrix. These influences are measured by the relative magnitude of difference association coefficient F_{ma} and correlation r between populations.

There are terms with a great frequency that serve to designate mainly human characters and relationships in the pool of Web publications, where there is an association of semantic units “gene technologies” and “humanity”. This applies to both the mass mentality, and theoretical constructs of modern disciplinary matrix of anthropology. However, the greatest interest is the rating of the symptoms of affiliation to the humankind.

In accordance with our model, it would be expected that the cluster of the “humanity” reflects the deterministic by culture changes only.

In this case, the source of the existential evolutionary risk is gene engineered interventions into the substrate basis of the traits included in this cluster. Such interventions may destroy the integrity of the epigenetic processes of providing co-evolutionary bundles of elements of the biological and socio-cultural modules. In addition, gene-technological manipulations with such signs are equivalent to the transfer of the functions of determination and control of their development from the socio-cultural to the biological module.

On the contrary, regulation or maintenance within the normal range is desirable and justified in relation to attributes associated with the "human nature". Unconditional demand is the constant composition and frequency distribution of elements within "humanity" cluster in the course of such manipulations. The modern mentality considers attributes that are part of "human nature" cluster as determined by biological heredity only.

"In this regard, the frequency distribution of semantic associations is interesting. In the cluster of "humanity", the highest rating are characteristic terms referring to the groups to ensure social structure (the 3rd group of attributes), means of communication and coordination (5th group) and means of rational thinking (1st group). There are "Helping strangers", "Working", "Serving others", "Making things", "Reading", "Writing", "Studying" among them.

Their changes have to be considered as the main members of the diagnostic complex of signs of the humanization / dehumanization process controlled by the socio-cultural module of SESH under the influence of technology-driven evolution. Technological manipulation that affecting their material and the substrate, genetic basis should be considered at the mentality of Western civilization as extremely risk.

Thus, the absolute priority of maintaining the attributes of the human self-identity have different parameters of social behavior, mainly, and social intelligence, to a lesser extent.

Further in this list, as the strength of association with the concept of humanity decreases, there are physiological, morphological features and means of social survival / viability (2nd group) and manipulation with ecological and socio-cultural environment (4th group).

Finally, the list closes the signs relating or contributing to antisocial manifestations of behavior, that are destructive for social organization (6th and partially 4th groups).

This shift of the spectrum of semantic association represents of particular interest. The sequence of this fragment of the frequency spectrum as follows: "grasping", "drinking", "negotiating", "suicide", "non-vocal communication", "torturing".

Immediately struck by several circumstances. Lexical unit "Grasp ing" is multi-valued metaphor. Its contents can be interpreted in three ways.

1. In the term of a morphology and motility, there is the appearance of grasping hand.
2. In the term of a sensorics, there is understanding difficult to interpret the facts or their complexes by separating the essential parameters of the object that in this context can be neglected.

3. In the term of a cognitivistics, there is the development of abstract thinking.

In modern psychology, the term “Grasping” is defined as the ability to move together two or more facing each other surfaces in three-dimensional space while maintaining the possibility of free movement of the remaining fragments of held surfaces. The acquisition of this ability stimulated transformations in the sensorimotor system that made possible the development of abstract thinking. Therefore, among the other attributes of human, the highest rating of this trait is quite understandable. The same applies to the ability to achieve a compromise of conflicting interests and the ability to understand and manage their neighbors without the aid of verbal communication. Thus, the grasping term is a member of the group 4 of features, which includes the manipulation by external funds of natural and socio-cultural environment.

But it is equally interesting that the other attributes of humanity in this part of the frequency spectrum are more negative than positive emotional, and belong to a group of 6 of self-identification attributes. Moreover, among the terms of this cluster there are few terms related to the provision of basic factors of sapientation in accordance with modern theories of anthropogenesis.

We proceed from the assumption that the initial working hypotheses are correct, and the composition and characteristics of the information fragments populations of the Web are really connected with the structure of mental predispositions. Moreover, in the mentality, the unique attributes of the identity of *Homo sapiens* are associated primarily with the signs that are able to go beyond adaptive norm and detected just by its extreme manifestations. The paradox is that these characteristics are determined by evolutionary semantics of culture, and their optimization by means of gene technology on the same concepts should not be admissible and effective.

The shape of the frequency distribution of lexical associations generally monotonic, and shows no abrupt fracture. As we can assume, a structure and composition of mental complex “humanity” not strictly differentiated and its reconstruction in the future is possible.

There is a number of concepts associated with “humanity” pool in mentality, and they overlaps with the identical constructs in “human nature” pool. These facts are an additional argument in favor of the high ductility of socio-psychological predisposition on the basis of “humanity”.

The lexical associations nomogram of the concept “human nature” have a turning point that can be easily detected even visually. It separates the 5 features with the highest rating values from the rest of them.

The strongest association found for semantic concepts “Studying”, “Sex”, “Carrying”, “Helping family members”, “Solving problems”. This set of concepts and designated by them attributes is a mixture of members of the 1st, 2nd and 4th attribute groups. In totality, they provide cognitive processes, and the abilities to reconstruct the habitat and to organize the closest social relations. As to be expected, it is the improvement of cognitive abilities and the reconstruction of sexual behavior that are the most desirable for the objects of technological manipulation in the modern mentality.

There are “carrying”, “greeting gestures”, “impulsive aggression”, “numerical reasoning”, “paternal care of young” among the attributes of weakly associated with the “humanity” and genetic engineering. Obviously, these signs are not considered as significant in terms of the uniqueness of the human being. Does this mean that these signs of the modern mentality refer to those features of *Homo sapiens*, which have an animal origin?

Let's turn to the cluster of “human nature”. Composition of constructs with the lowest frequency of occurrence of the cluster does not coincide with the composition of the previous cluster, in general.

So, there are a “gray” area of the frequency spectrum as a set of signs with intermediate frequencies in cluster “humanity”, and the area is a wide. Perhaps the possibility of genetically engineering optimization in strong measure will depend on the efficiency of use of the social engineering technology. (Another name is mind control technology.) For the controlled evolution of these traits, the balance of influences of competing influence groups on public opinion will be a significant factor. At least, this thesis is valid for the initial stage of implementation of the relevant technological protocols.

Among the semantic constructs with the greatest frequency in both clusters, there are a significant number of names negatively perceived traits. This fact may indicate a significant attention of public opinion to the possibility of technological correction of negative deviations from the norm already established during anthropogenesis, although it does not allow us to reveal the exact dominant attitude towards this possibility. First of all, the mentality fixes the possibility of technological intervention with the aim of maintaining the already established norm, but not with the goal of optimizing the norm as going beyond the already established limits. Even the use of technology to improve the attributes of humanity in the direction of the mental ideal is considered doubtful.

It can be expected that the value of this factor will be more significant for concepts with a larger value of association.

The mentality more preferably perceived optimization “humanity” attributes through socio-cultural engineering, instead of using the gene and

biotechnologies. In other words, the maintenance of human uniqueness should be provided subject to the constancy of the human genome, or that part of the genome that is responsible for these traits. It concerns, first of all, the complex providing individual behavioral adaptation and reconstruction of the socio-cultural environment. Therefore, such optimization should be carried out by individual behavioral and social adaptation and reconstruction of the social and cultural environment, but does not by improve the genome. At least, this thesis is corresponds to a system of value priorities of the modern West (Atlantic) variant of technological civilization.

An example of such a reconstruction and its ideological base can serve paradigms of "valeology" in the former Soviet Union and the anti-psychiatry at the West.

However, this trend weakens or fluctuates over time. As the semantic association of these attributes decreases with the humanity cluster and the association with the human nature cluster increases, the possibilities of using genetic engineering will meet an increasingly favorable social context. The system-forming factor here is the accumulation of relevant scientific data and their proliferation into the mentality of modern society.

It is possible to make clearer conclusions by using the relative rather than absolute meanings of the semantic association of the concepts "humanity" and "human nature" in combination with the term "genetic technology".

The total frequency distribution pattern of associative links preserved. However, it becomes possible to take into account the significant differences in the frequency of use in the pool of on-line publications these concepts and, accordingly, the size of "humanity" ($N_{ij} = 18.3 \cdot 10^3$) and "human nature" ($N_{ij} = 6.42 \cdot 10^6$) associative clusters. At least partially, such a significant difference can be explained by the natural focus of this sector of the NBIC-technological complex on the manipulations with the genetic code, not cognitive and sociocultural codes.

First, it should note that between the volume of "humanity" and "human nature" clusters and the value of the semantic associations of their constituent terms there is an inverse relationship. At the more numerous cluster value of the coefficient of association is much lower as compared to the alternative ones as in the whole group, and on separate lexical units. Probably, the topics of messages related to global ethical and social problems dissolve here among the mass of technical and pragmatic details.

In other words, according to our interpretation, the mentality of modern civilization does not attach great importance to the problem of the evolutionary risk of gene technologies, if the latter do not relate to personal

uniqueness. (Uniqueness, we recall, is associated with “humanity”, not with “human nature”.) In general, this indicates a more favorable perception of the process modifications of genetic and biological module compared with the development of technology control and individual choice as “free will”. Mind control of the individual and the social group is filled with more negative attention than the reconstruction of the body organization .

A second series of studies was carried out on the pool of scientific publications at site scholar.google.com. In accordance with the initial working hypothesis, it should reflect the structure of the predispositions with respect to the socio-cultural and biological components of the anthropological status of *Homo sapiens* that actually or potentially subjected to *Human Enhancement* interventions. In other words, the results should reflect the circulating within the scientific community representation of the relationship between biological and socio-cultural inheritance in the definition of specific traits.

Naturally, some differences were between frequency spectra of this indicator in the overall pool of online publications that reflects “public opinion” in general, and a pool of scientific publications that reflects the structure of the disciplinary matrix and predisposition of specialists.

The pool of scientific publications, most associated with the concept of “humanity” that reflecting the uniqueness of *Homo sapiens*, and is provided by socio-cultural module of SESH, proved to the terms “Studying”; “Making things”; “Serving others”; “Helping strangers”; “Speaking”; “Working”; “Practicing” in descending order of frequency values and coefficient of association.

At the cluster of “human nature”, there is a similar sequence of frequently used terms, and, accordingly, there exist a sequence of most strongly associated with the same concept terms.

At the pool of scientific publications, there is a large numbers of lexical units represent sequence with a very near and close to 1 value of semantic of association coefficient (F_{ij}) and some lexical units substantially exceed this value.

These points note output of analyzed reports from the area mainly associative links between semantic units in the sphere of primarily verbal and logical links. The latter, in turn, reflect the causal relationship between the designated objects. Thus, the using of a of semantic association criterion becomes incorrect in this case.

The most striking example is the frequency of lexical unit “Playing thinking games” of cluster of “human nature” in a pool of scientific publications online. Frequency of the concept are outside the range of values of other concepts (N_{ij} = 4730000; F_{ij} = 268.75). So, this attribute and

denoting concept is key parameter of the anthropological characteristics of *Homo sapiens*, and it is biologically determined ones, in the framework of the existing disciplinary matrix.

Note, in the same way, this parameter changed in the case of associations with the concept of "human nature" in the total pool of publications. However, the values of this indicator is lower in the total pool of publications by several orders of magnitude than this parameter in pool of scientific publications. As it should be taken into account, there are substantial, verbal-logical connections established in abstract theoretical structures of the disciplinary matrix, and these connections are more stable and powerful in comparison with associative links.

On the other hand, as the same data show the distribution of mental association currently represents a fuzzy projection of scientific and theoretical logical connections within a single logical structure.

Thus, according to our researchcomplex the disciplinary matrix of gene-technological complex is focused on the specific features of biological module of SESH. These signs serve as anthropological attributes obviously related to the genome, and the mechanisms of their formation are common in *Homo sapiens* and other biological organisms. Therefore, quantitative modification of this cluster bears little evidence of an evolutionary risk correlates with the loss of self-identity of culture and media intelligence.

The main sources of risk from technological interventions are,

- Firstly, the directly humanitarian technological schemes for modifying the axiological component of a sociocultural module; and,
- Secondly, the disintegration of bio-semantic coevolutionary links between the elements of the biological and socio-cultural modules.

In both cases, technological interventions violate the integrity of the socio-cultural module.

In contrast, according to the same data, the mass consciousness emphasizes precisely those signs that are formed by socio-cultural module of SESH, and reflect the features of the biological module not directly, but as a result of co-evolutionary interaction with biological module or through an additional circuits with the participation of a techno-rationalistic module. Thus, their modification is associated with the higher evolutionary risk of loss of self-identity by *Homo sapiens*. If there is a discrepancy between the cultural prerequisites and the real organization of "humanity" and "human nature" clusters, the technology can provide ways to actualization of the culture-drived evolutionary scenario. Prerequisites are the availability of technical means for the implementation of such a scenario of the future, powerful pressure of extra-scientific factors on the development of

scientific research and the incompleteness of scientific knowledge of the consequences.

Thus, the achievement of an existential level of technological risk may arise as a result of both a civilizational crisis and the possibility of extinction or evolutionary divergence of our biological species. In both cases, the reasons are related to interventions in the system of attributes of humanity, determined by biological or socio-cultural inheritance. There are:

1. A direct action of the technological module, which is associated with an increase in the value of evolutionary risk as a result of civilization crisis induced by the destruction of the system of universal human values, induced by the destruction of the system of universal human values;
2. An indirect action of technological module that mediated by the system of mental predispositions, which is associated with an increase in the magnitude of evolutionary risk as a consequence of the deviation of the system of biological species determinants of *Homo sapiens.*

This discrepancy between the socio-cultural and techno-rationalistic spheres of adaptive socio-culture-anthropogenesis fraught with serious conflicts in the future. However, now the intensity of internal conflicts in mentality of modern civilization have not yet reached the threshold of the hard social conflict between its socio-humanitarian, scientific and technological sectors. As already mentioned, evidence of this is insignificant coefficient semantic association of public and scientific research sectors online publications.

At the same time, there are sufficiently high coefficients of semantic association of the cluster of "humanity" that suggests considerable research activity of so-called humanitarian technologies that can significantly effect on the associative structure of mentality in the future.

So, the result of the implementation of combined social and biotechnological innovations have to extend and improve the quality of life and physical organization of *Homo sapiens*, and will be determined by the resultant of HN/HU. The current configuration of the Western mentality is characterized by prevalence of HU-component of the Western mentality (from the 1950s) with the continuous growing specific weight of HN-component as a reaction to the development of medical biotechnology and genomics.

Next, we investigated the structure of semantic associations equivalent forms of East Slavic sector of online publications related to the use of gene technology. In accordance with the initial hypothesis, common pool of Web publications should reflect the characteristics of the mass consciousness and mentality, with their inherent system of evaluation priorities for the various aspects of the topics associated to a particular lexical units (concepts).

For this purpose, the matrix was composed of semantic associations studied concepts and terms in the Cyrillic, Russian / Ukrainian, par excellence sector of Google search engines.

First of all, we note that the trend to strengthen the association of categorical terminological apparatus of biotechnology with the process of humanization / dehumanization traced here too. The number of references to the concepts of "humanity" and "human nature" is quite significant and increasing over the past 10-15 years here. This trend applies to all considered in this study terms of the conceptual field of biotechnology and genetic engineering.

At the same time, both in the scientific online publications, as well as in the total pool, the association of genetic engineering technologies with the concept "humanity" (N_{ij} = 95.000) is much lower in absolute and relative terms compared with the concept of "human nature" (N_{ij} = 248.700).

In the English-language sector as we can remember, such frequency distribution is characteristic only for scientific publications.

Concept "humanity" most strongly associated with the semantic units of "biological safety" (F_{ij} = 0.255), "genome" (F_{ij} = 0.145), "biological risk" (F_{ij} = 0.127) in the total pool of Web publications. In the pool of scientific research publications there is somewhat different rating the most powerful semantic associations: "biological safety" (F_{ij} = 0.315), "biological risk" (F_{ij} = 0.233), "genome" (F_{ij} = 0.164).

There are the coefficient of association magnitudes (F_{ij}) of "human nature" with the "biosecurity" and "bio-risk" terms in the total pool of publications that show a sharp jump to 1.91 and 1.141, respectively. So, the magnitudes are beyond the "physical sense". The third and fourth place in the ranking is occupied by a "genome" (F_{ij} = 0.71) and "GMOs" (F_{ij} = 0.85).

In the East Slavic sector, there is no two-cluster associative structure of the totality of symptoms, which must be taken into account when assessing the consequences of introducing genetic technologies. Unlike the English-language sector of the Network, this model did not work or could not be detected by content analysis methods.

Indeed, there is the ranking of semantic units most associated with the concept of humanity in the general pool of web publications on gene technologies[17]: "Fighting" (N_{ij} = 1620); "Game" (N_{ij} = 1370); "Speaking, Talking" (N_{ij}=1210); "Eating" (N_{ij} = 1110); "Writing" (N_{ij} = 974); "Killing" (N_{ij} = 915); "Making Rules"(N_{ij} = 910); "Triumph" (N_{ij} = 795).

[17] The English equivalents of the corresponding Eastern Slavonic lexical units are given

A similar sequence for the “human nature” is “Fighting” (N_{ij} = 19300); “Game” (N_{ij} = 17500); “Eating” (N_{ij} = 17400); “Making Rules” (N_{ij} = 16800); “Killing” (N_{ij} = 14900); “Speaking, Talking” (N_{ij} = 13300); “Writing” (N_{ij} = 11100); “Triumph” (N_{ij} = 8300)

The composition of the two sequences is the same at 87%, and in 3 symptoms (“Fighting”, “Game”, and “Triumph”) their positions in are the same in the frequency spectrum too. Such a coincidence indicates ambivalence attributing most symptoms as belonging to one of the two clusters, and, therefore, and the lack of a clear differentiation between “humanity” and “human nature” in East Slavic Web Sector. In turn, it could be evidence of geopolitical differentiation of Western and Eastern Slavic (post-Soviet) mentality on the impact of modern genetic technologies in the process of humanization / dehumanization of humankind. More precise, we should speak about targeting Latin and Cyrillic cultures.

There are noticeable differences between the structure of associative connections, the total volume of “human nature” or “humanity” in the East Slavic sector of the Network. These facts indirectly cast doubt on the hypothesis of the shortcomings of the method as an alternative explanation of the above results. Our methodology made it possible to reveal that the value of F_{ij} in the “humanity” cluster is lower in the general pool of publications, and exceeds it in the pool of scientific publications compared to the “human nature” cluster. For the English-speaking sector, there are reverse relations.

The average values of the association coefficient, F_{ij} are ranked sequences in each group of characters. This series can be presented in **the general pool of publications as follows**.

Cluster “humanity”:

1. Group 4 – The manipulation by fragments of the physical and social environment, $F_{ij} = 0.00245 \pm 0.0029$.
2. Group 1 – Language and thought, $F_{ij} = 0.00240 \pm 0.0025$.
3. Group 6 – Antisocial symptoms (causing harm to themselves and to other members of the social group), $F_{ij} = 0.0017 \pm 0.0017$.
4. Group 3 – Social signs II (a means of maintaining the hierarchical structure and activity relationship), $F_{ij} = 0.00106 \pm 0.0014$.
5. Group 2 – Social characteristics I (means of providing communication within the family and with close members of the social environment), $F_{ij} = 0.0007 \pm 0.00084$.
6. Group 5 – Social characteristics III (means of symbolic communication and coordination of actions of individuals), $F_{ij} = 0.00048 \pm 0.00041$.

A cluster “human nature”:

1. Group 4 – The manipulation by fragments of the physical and social environment, $F_{ij} = 0.155 \pm 0.186$.

2. Group 1 – Language and thought, $F_{ij} = 0.146 \pm 0.168$.

3. Group 3 – Social characteristics II (a means of maintaining the hierarchical structure and activity relationship), $F_{ij} = 0.062 \pm 0.126$.

4. Group 6 – Antisocial symptoms (causing harm to themselves and to other members of the social group) $F_{ij} = 0.0523 \pm 0.0622$.

5. Group 2 – Social characteristics I (means of providing communication within the family and with close members of the social environment), $F_{ij} = 0.049 \pm 0.053$.

6. Group 5 – Social characteristics III (means of symbolic communication and coordination of actions of individuals), $F_{ij} = 0.0196 \pm 0.0178$.

The pool of scientific publications ranked similar sequence as follows.

Cluster "humanity:

1. Group 1 – Language and thought, $F_{ij} = 0.229 \pm 0.204$.

2. Group 4 – The manipulation by fragments of the physical and social environment, $F_{ij} = 0.220 \pm 0.234$.

3. Group 3 – Social characteristics II (a means of maintaining the hierarchical structure and activity relationship), $F_{ij} = 0.159 \pm 0.224$.

4. Group 6 – Antisocial symptoms (causing harm to themselves and to other members of the social group), $F_{ij} = 0.158 \pm 0.146$.

5. Group 2 – Social characteristics I (means of providing communication within the family and with close members of the social environment), $F_{ij} = 0.076 \pm 0.075$.

6. Group 5 – Social characteristics III (means of symbolic communication and coordination of actions of individuals), $F_{ij} = 0.067 \pm 0.045$.

A cluster of "human nature":

1. Group 1 – Language and thought, $F_{ij} = 0.171 \pm 0.163$.

2. Group 4 – The manipulation by fragments of the physical and social environment, $F_{ij} = 0.165 \pm 0.191$.

3. Group 3 – Social characteristics II (a means of maintaining the hierarchical structure and activity relationship), $F_{ij} = 0.110 \pm 0.18$.

4. Group 6 – Antisocial symptoms (causing harm to themselves and to other members of the social group), $F_{ij} = 0.080 \pm 0.085$.

5. Group 2 – Social characteristics I (means of providing communication within the family and with close members of the social environment), $F_{ij} = 0.059 \pm 0.059$.

6. Group 5 – Social characteristics III (means of symbolic communication and coordination of actions of individuals), $F_{ij} = 0.039 \pm 0.026$.

This data can be compared with earlier English-language sector of the Network.

The total pool of English sector of the Web publication of the average value of each group of signs F_{ij} has following ranked order.

Cluster "humanity":

1. Group 1 – Language and thought, $F_{ij} = 0.285 \pm 0.171$.
2. Group 5 – Social signs III (means of symbolic communication and coordination of actions of individuals), $F_{ij} = 0.246 \pm 0.00137$.
3. Group 2 – Social characteristics I (means of providing communication within the family and with close members of the social environment), $F_{ij} = 0.211 \pm 0.0012$.
4. Group 6 – Antisocial symptoms (causing harm to themselves and to other members of the social group), $F_{ij} = 0.143 \pm 0.159$.
5. Group 4 – The manipulation by fragments of the physical and social environment, $F_{ij} = 0.128 \pm 0.0002$.
6. Group 3 – Social signs II (a means of maintaining the hierarchical structures and activity relationships), $F_{ij} = 0.0232 \pm 0.00017$.

A cluster of "human nature":

1. Group 1 – Language and thought, $F_{ij} = 0.0008 \pm 0.00049$.
2. Group 2 – Social characteristics I (means of providing communication within the family and with close members of the social environment), $F_{ij} = 0.0006 \pm 0.00000024$.
3. Group 5 – Social characteristics III (means of symbolic communication and coordination of actions of individuals), $F_{ij} = 0.00056 \pm 0.00000022$.
4. Group 6 – Antisocial symptoms (causing harm to themselves and to other members of the social group), $F_{ij} = 0.00041 \pm 0.00045$.
5. Group 4 – The manipulation by fragments of the physical and social environment, $F_{ij} = 0.00037 \pm 0.00000014$.
6. Group 3 – Social characteristics II (a means of maintaining the hierarchical structure and activity relationship), $F_{ij} = 0.000066 \pm 0.000000026$.

The pool of scientific publications of English sector of the Web publication. These sequences are as follows.

Cluster "humanity":

1. Group 1 – Language and thought, $F_{ij} = 0.713 \pm 0.365$.

2. Group 3 – Social signs II (a means of maintaining the hierarchical structure and activity relationship), $F_{ij} = 0.712 \pm 0.261$.

3. Group 4 – The manipulation by fragments of the physical and social environment, $F_{ij} = 0.541 \pm 0.0029$.

4. Group 5 – Social characteristics III (means of symbolic communication and coordination of actions of individuals), $F_{ij} = 0.485 \pm 0.329$.

5. Group 2 – Social characteristics I (means of providing communication within the family and with close members of the social environment), $F_{ij} = 0.448 \pm 0.305$.

6. Group 6 – Antisocial symptoms (causing harm to themselves and to other members of the social group), $F_{ij} = 0.314 \pm 0.304$.

A cluster of “human nature”:

1. Group 4 – The manipulation by fragments of the physical and social environment, $F_{ij} = 1.142 \pm 0.0012$.

2. Group 6 – Antisocial symptoms (causing harm to themselves and to other members of the social group), $F_{ij} = 1.0625 \pm 0.0005006$.

3. Group 3 – Social signs II (a means of maintaining the hierarchical structure and activity relationship), $F_{ij} = 1.051 \pm 0.067$.

4. Group 5 – Social signs III (means of symbolic communication and coordination of actions of individuals), $F_{ij} = 1.036 \pm 0.0003$.

5. Group 1 – Language and thought, $F_{ij} = 1.029 \pm 0.042$.

6. Group 2 – Social characteristics I (means of providing communication within the family and with close members of the social environment), $F_{ij} = 1.016 \pm 0.338$.

The sequence of the ranks of the attributes of "humanity" in a cluster can be clearly presented as follows.

GENERAL (TOTAL) POOL

4	1	6	3	2	5 (Cyrillic)
1	5	2	6	4	3 (Latin)

POOL OF SCIENTIFIC PUBLICATIONS

1	3	4	5	2	6 (Cyrillic)
1	5	2	6	4	3 (Latin)

in a cluster of “human nature” the same scheme is follows

GENERAL (TOTAL) POOL

4	1	3	6	2	5(Cyrillic)
1	2	5	6	4	3 (Latin)

POOL OF SCIENTIFIC PUBLICATIONS

1	4	3	6	2	5(Cyrillic)
4	6	3	5	1	2 (Latin)

There are obvious difference in the structure of semantic associations of text fragments in the English- and Russian-Ukrainian segment of the Network. The same can be said of the relationship between sectorial structures of common pool of publications and a pool of scientific publications.

At the Cyrillic sector of the Network, there are the most significant associations between attributes of humanity and the attributes of human as a biosocial being that marked according to ability to abstract thinking, language and purposeful reconstruction of material and spiritual reality.

It appears necessary to use a fuzzy expression, perhaps even a metaphor, "affiliation to humankind" in view of the lack of a clear differentiation of mental predisposition to "human nature" that is provided by the biological inheritance, and to the "humanity" that is provided by socio-cultural inheritance.

However, even more important is another circumstance. 2rd and 3rd positions in the ranked list of signs of humanity and human nature take indications of the ability to maintain a hierarchical social organization, and a social behavior.

Characteristically, the largest association coefficient (F_{ij} = 0.6795 ± 0.0123 for the first cluster and F_{ij} = 0.5791 ± 0.00366 for the second ones) has a lexical unit "Fighting" (group 4) among scientific publications. This lexical design has a constructive / destructive emotion coloring. High values F_{ij} are also lexical units "Bullying others, Rape" (F_{ij} = 0.385 ± 0.0134 for the 1st cluster) and "Torturing" (F_{ij} = 0.3077 ± 0.0120 and F_{ij} = 0.1414 ± 0.00182 for the 11st and 2nd clusters, respectively), "Drinking" (F_{ij} = 0.221 ± 0.0097 and F_{ij} = 0.1549 ± 0.00196), "Killing" (F_{ij} = 0.28525 ± 0.0115 and F_{ij} = 0.1418 ± 0.00183). In the 3th group, there are the "Following Rules" (F_{ij} = 0.7404 ± 0.0108 and F_{ij} = 0.6221 ± 0.00353), "Organizing" (F_{ij} = 0.4615 ± 0.0140 and F_{ij} = 0.276 ± 0.003), "Working" (F_{ij} = 0.157 ± 0.0074 and F_{ij} = 0.1371 ± 0.00177), " Helping strangers" (F_{ij} = 0.128 ± 0.0063 and F_{ij} = 0.0466 ± 0.00066), " Compassion, Empathy" (F_{ij} = 0.138 ± 0.0067 and F_{ij} = 0, 0585 ± 0.00082), " Criticism, Judging others" (F_{ij} = 0.186 ± 0.0085 and F_{ij} = 0.1214 ± 0.0016). They are a lexical structure with high values F_{ij} too.

The lowest rank in the sequence have symptoms related to the provision of basic communication links within the social group and ensuring coordinated the activities of individuals, primarily with the use of various forms of symbolic communication.

We can come to the following conclusion as it reflects the above results content analysis of Web publications. The structure of the East Slavic mentality is characterized by elements with a higher association of technological transformation possibilities in relation to

• Ability to strengthen the vertical of social communication in society (i.e. proto-power); and

• The ability of some people to resist the norms of social behavior, even if it implies the destruction of society and the self-destruction of the individual (that is, incompatibility, rebellion, revolutionism).

These predisposition contradictory mental prepositions exist in the evolving post-Soviet mentality in parallel. Is this trend invariant socio-cultural type; or it is the result of stochastic fluctuations of the last few decades or centuries of historical development? It can be found only as a result of further study of the system.

Unlike, a higher association observed for the attributes of linguistics and thinking, symbolic communication and maintenance of structures in small social groups as family, closest social environment at the English Web-sector. Along with this, the high rank has an association of gene technologies with asocial behavior in the pool of scientific online publications.

As can be assumed too, cross-sectorial differences reflect specificities of the correlative value priorities of individualistic and communitarian intentions. In this case, the content analysis revealed a specific orientation towards a high positive or negative priority of technological modifications of the micro-social environment in the Western mentality. In parallel, this reflected a specific focus on changing the macro-parameters of the social system in the East Slavic mentality.

Finally, there is an obvious similarity between the patterns of the associative structure of the general and scientific pools of publications in the English-speaking sector of the Network, in contrast to the East Slavic sector. It is also an essential factor for calculating the possible civilizational and anthropological stability of evolutionary trends. The high association coefficients in the pool of scientific publications speak of an adequate conceptualization of the elements of clusters of high humanity and human nature in the general transdisciplinary paradigm of the biomedical and genetic technologies of the high hume segment.

There is a power of the mutual influence of the mental context and theoretical constructs of modern biotechnology paradigm that we evaluated by the ratio of the correlation coefficient of associative complexes and the mismatch association criterion (ΔF_{ma}).

Both the English- and in the Eastern Slavic Web-sector correlation coefficient of associative structures of scientific and mass media publications is much higher than in the cluster of "humanity", reaching a value of r = +0.791. Range of values of the correlation coefficient in the interval from 0.636 to 0.929. There are high positive values of the correlation coefficient in the express negative values of ΔF_{ma} for the general pool publications and positive values of the same indicator in the pool of scientific Web-publications. This indicates a significant influence of scientific and theoretical structures on the formation of mass consciousness.

In general, average ΔF_{ma} are not extremely high in absolute value. Alternative pattern would indicate strong instability of techno-humanitarian balance and, accordingly, confirm the significant magnitude of the socio-cultural and technological components of the evolutionary risk.

In fact, the value of ΔF_{ma} at different groups of signs is concentrated in -2.0 to -2.8 to a common pool of publications and + 0.6 to +0.7 at scientific publications. There are only three points a high risk value, at least in the future. This is diagnosed by the magnitude of the divergence of associative patterns in the general and scientific pools of the Network.

These points are the differences in the assessment of the significance of "non-voice communications" (ΔF_{ma} = 0.986 for the general pool, and ΔF_{ma} = -68.31 for the pool of scientific publications) "self-harm" (ΔF_{ma} = 0.95 and ΔF_{ma} = -19.0) and "Carrying" (ΔF_{ma} = -1679 and ΔF_{ma} = 0.92). The combination of indicators F_{ij} and ΔF_{ma} suggests a stimulation of interest to scientific research by the social and cultural context, in the first case and deceleration in the rest. The relatively low values of the association coefficients do not allow us to conclude that the evolutionary risk is critical in terms of its technical and humanitarian components.

In the general pool of publications of the English sector, there are third group of attributes (a means of maintaining the hierarchical social communication and activity) and fourth group of attributes (manipulation by fragments of the physical and social environment) that falls out from the total series of publications (r = 0.645 and r = 0.636 respectively).

In a "human nature" cluster, there are correlations of associative patterns of the general pool of Web publications and pool of scientific publications significantly that are lower and in some cases has the opposite orientation (r = 0.002 with a range of -0.387 to +0.393).

Negative correlation of associative patterns observed in third group (r = -0.387) and sixth group (r = -0.165). The last group represents various manifestations of antisocial behavior. Therefore, contradictory picture of the techno-humanitarian balance develops in a "human nature" cluster of English Web sector of publications. This conclusion is supported by prominent negative average magnitude of the difference of semantic associations between pools of publications (ΔF_{ma}). The range of values is between -3.2 ± 0.07 (group 1 – the attributes of language and thought) to -178.9 ± 167.1 (Group 6 – antisocial features).

Within the group, values of ΔF_{ma} change from negative to positive magnitudes. In accordance to the working model, it corresponds to the predominance of scientific discourse to mass consciousness at techno-humanitarian balance formation.

The highest positive correlations observed at 4th group (r = + 0.387) of this cluster. It can be explained by of detection of contradictions between the scientific paradigm and system of social and psychological predisposition about the environmental prospects of technological transformation. In other words, co-evolutionary bunch of opposing elements (interests and values) is formed. Superposed conceptual fields of axiological and epistemological discourses is the reason for this. In the classical phase of industrial civilization, these forms of discourse do not overlap.

In our opinion, the scan results are even more interesting in the East Slavic sector of the network based on Cyrillic. There are the extremely high values of ΔF_{ma} at associative patterns of "humanity" cluster; the correlation is also extremely high, r = 0.927; and, in the group, the range of r magnitudes is not lower 0,877.

In a cluster of "human nature", a magnitudes of these parameters are much lower. General correlation between pools of mass media and scientific publications is absent almost, and mean group values are in the negative side of the scale and fluctuate from 0 to -0.539 of this index.

In other words, this area has currently the most potential and actual available for technological manipulation; and mentalities of the population and the scientific community are evolving in almost opposite directions. Most likely, the associative structure of scientific communications determined by the actual verbal and logical connections within the scientific paradigm to a much greater extent than by the scale of value priorities of post-Soviet society. (A paradigmatic matrix, of course, is the same in English and Cyrillic sectors of network.)

In the Cyrillic sector, there is a predominance of elements of scientific (descriptive), rather than social and ethical (imperative) discourses in the formation of the techno-humanitarian balance on the following points:

1. “Suicide” (ΔF_{ma} = 1591.6 and ΔFma = -1.57 respectively; 6th Group).

2. “Fighting” (ΔF_{ma} = -95.52 in a scientific pool, the ΔF_{ma} value is not statistically significant in the total pool; 4th group), “Navigating obstacles” (ΔF_{ma} = -86.47; 4th group) “Following Rules” (ΔF_{ma} = -84.219 and ΔF_{ma} = -3.158; 3rd group).

3. “Triumph” (ΔF_{ma} = -75.83; 4th group), “Judging others” (ΔF_{ma} = -36.938; 3rd group), “Acting Pretending” (ΔFma = -18.381; 5th Group), “Forming social groups” (ΔF_{ma} = -16.44 and ΔF_{ma} = -11.07; 2nd group).

4. “Scanning and Exploring the environment” (ΔF_{ma} = -10.35 and ΔF_{ma} = -15.85; 2nd group), “intellectual plays” (ΔF_{ma} = -8.769; 1st group).

5. “Torturing” (ΔF_{ma} = -7.034; 6th Group).

6. “Ingenuity” (ΔF_{ma} = -5.833; 1st group), “Maternal care for young” (ΔF_{ma} = -4.14; 2nd Group).

7. “Working” (ΔF_{ma} = -3.663; 3rd group), “ Playing physical games” (ΔF_{ma} = -2.117; 4th group), “Practicing” (ΔF_{ma} = -1.571; 3rd group).

(Lexical units are listed in the English translation.)

In this rating, the first place of suicidal behavior is probably explained by the following way. At a low magnitude of semantic association in the public mind ($5{,}4 \cdot 10^{-5}$), suicide is considers a consequence of personal choices and social conditions. The genetic background of this phenomenon have been identified and the possibility of its modifications by genetic engineering technology has been widely discussed in science.

There are the following members of this series, which are defined by or related to social status. The specificity of these features consists in the inseparability of anthropological (substantive) and social (functional) semantic connotations. However, this disadvantage cannot be eliminated using the content analysis methodology. The prevalence of the problems of social and legal regulation is quite understandable in the problems of scientific publications on medical and technological innovations

There is a correlation of these social behavioral traits with genetic and epigenetic factors that have been discovered in the past decade. It creates a rather noticeable trend for reductionist scientific publications. The socio-psychological predisposition of West civilization is quite strongly opposed to this process due to cognitive dissonance with basic mental predispositions.

Manifestations of antisocial behavior are the next part of the sequence of attributes. They are represented by symptoms that in different degrees characterize various signs of a person’s mental and physical condition.

These attributes are distributed across all six groups, and the average group parameters is as follows in the total pool of “human nature” of East Slavic sector.

Group 1 – ΔF_{ma} = -3.2 ± 0.07 r = -0.07
Group 2 – ΔF_{ma} = -4.7 ± 0.14 r = -0.539
Group 3 – ΔF_{ma} = -10.7 ± 0.65 r = -0.240
Group 4 – ΔF_{ma} = 0.155 ± 0.186 r = -0.340
Group 5 – ΔF_{ma} = -5.1 ± 0.16 r = -0.358

The pool of scientific publications has its own outsiders. Possibility of technological reconstruction of these features attracted much less attention of professionals compared to the total pool of publication. (The latter reflect the structure of preferences of the mass consciousness.)

The set of these signs include: "Making art" (ΔF_{ma} = -85.85), "Impulsive aggression" (-35.844), "Sex" (-20.30), "Eating" (-17.36), "Manipulating objects" (-11.224), "Performing calculations", (-5.12), "Negotiating" (-4.72), "Verbal communication" (-4.136) and "Performing repetitive tasks" (-3.424). For these attributes, there are significantly higher expectations and assessments of the technological manipulation possibilities within the framework of predisposition and intentions of the mass consciousness in comparison with the scientific community.

Obviously, the sociocultural psychological predispositions of the East Slavic mentality expect that gene technology has already gone out or will soon go beyond the scope of methods for correcting purely biologically determined pathological behavior. At the same time, the significance of the biological factor is considered in the East Slavic mentality somewhat higher than is allowed by scientific theories with regard to the abilities of artistic creativity, sexual behavior and irrational social behavior.

In this connection, the high mismatch association index of impulsive aggression is particularly interesting (ΔF_{ma} = -35.844). On the contrary, calculated, deliberate aggression or hostility is evaluated equally, the association coefficients are very close in both pools.

Obviously, instrumentalism may be a key differentiator to unequal perception of the importance of changes in the process of humanization / dehumanization of aggressiveness, and the same applies to the prospects of technological control of aggressiveness. Rational forms of aggressiveness are instrumentalistic by definition, since they imply intellectual modeling of the situation and the calculation of the effectiveness of possible ways to achieve the goals. Presumably, that confidence in the high specific gravity of irrational, "animal" motivation in the origin and development of social conflicts is the dominant psychological and socio-cultural predisposition here.

Based on the comparison of characterize our model parameters of potential (ΔF_{ma}) and current (r) violations of techno-humanitarian balance,

the conflicts are detected in a large number of points of associative structures patterns.

However, the critical (existential) level was achieved in no item by the imbalance of scientific and theoretical constructions and the predisposition of the East Slavic mentality. Moreover, the magnitude of the imbalance is essential to verify the results of the concepts of social studies in no item. The exceptions are 2nd Group and 6th Group , perhaps. (In the latter case, it concerns the individual socially important features.)

Such a big difference patterns of semantic association of English and Eastern Slavic sectors of Network is reflected in the magnitude of the correlation between clusters and between pools publications. Eastern Slavic and English sectors demonstrate significant correlation only in the "humanity" cluster of scientific publications pool ($r = 0.67$). In all other cases, it varies between 0.02 – 0.03 in magnitude. It seems that the structure of associative and logical connections in comparable sectors in clusters of "humanity" and "human nature" based on a completely different system of values and priorities and predispositions on the possibilities of technological reconstruction.

Most likely, two conclusions can be made from the data of the East Slavic Web sector and, in particular, on the low coefficients of correlation of parameters of the general and scientific pools of online publications:

- There is a more stable balance between the components of techno-humanitarian balance and, consequently,
- There is a smaller relative importance of extra-scientific factors of gene technology developments in the West, compared to the post-Soviet geopolitical space.

These conclusions may seem paradoxical, given the intensity and scope of the various alarmist movements opposing gene technologies in the West. The contradiction is resolved by taking into account

1. An extensive and influential system of social, judicial and administrative control over the implementation of new technologies through bioethics committees, government bodies, etc. and

2. A relatively high level of development of the associative structure of the predispositions of mass consciousness and mentality.

At the same time, the balance between the public and the administrative control is clearly shifted toward administrative control measures, and as follows from extremely low values of F_{ij}, public opinion is potentially capable to sharp fluctuations in the post-Soviet geopolitical space. In a political and social crisis, such instability could potentially lead to significant pressure on the implementation of technological innovations in the field of controlled evolution.

However, it is necessary to take into account the priority of maintaining macro-social stability inherent in the post-Soviet mentality, which was also revealed according to our analysis. In this case, the administrative control is able to provide the high level of stability of the evolutionary trend of techno-humanitarian and techno-biological ligaments of SESH. As the necessary conditions of stability, there are

• Low magnitudes of the association of basic values and gene technological topics in the general system of mentality that manifested as "public opinion";

• Consistently high magnitudes of this parameter in the scientific community;

• The coincidence of the original predispositions of the scientific community and the political elite.

Based on our data, the first two conditions are present, and the third one is in an uncertain state. With regard to the thesis sustained high values F_{ij} within the scientific community, we note that F_{ij} in Cyrillic sector inferior to these parameters in the English sector. In the English sector, the average group values of the association coefficient are higher than 1 for the first members of the ranked sequence in the "human nature" cluster. Given the nature of the search engine, this means that the attributes of the cluster integrated into the logical-semantic structure of the text.

Thus, there are leaders of "human nature" cluster, and these attributes have already been identified as the most promising objects for gene manipulation technology of *Human Enhancement*. This conclusion relates primarily to adjustment of pathological (antisocial) attributes: a 6^{th} group in a cluster of "human nature" is ranked second in the order of English scientific publications.

In the sector of scientific publications based on the Cyrillic alphabet, these values are lower by several orders of magnitude and patterns rated sequences differ significantly from the English pool. A 6^{th} Group is shifted significantly towards the end of the scale. Perhaps, biomedical technologies evaluate the idea of genetic correction of social pathologies with greater caution in the post-Soviet geopolitical space at the present time.

So, the impact east-Slavic historical experience of the twentieth century is obvious in our view. Over the past 100 years the thesis of social conditioning of human nature was in the mentality of the Russian Empire and the Soviet Union part of the official or semi-official ideological doctrine. The history of "racial hygiene" in Nazi Germany and the "genetic discussions" in the former Soviet Union had a strong influence on the predispositions structure of intellectual and scientific elites in post-Soviet

countries in contradiction to the influence of the latest scientific research and technological innovations.

CHAPTER 6.

CONCLUSION. EVOLUTION AS THE TECHNOLOGICAL REALIZATION OF REASONABLE CREATION

Valentin T.Cheshko

In the study, the organization of SESH has consistently been considered from three perspectives. There are:

1. The nature of the carrier as the substrate of adaptive information in biological, socio-cultural and techno-rationalistic SESH modules. This aspect turns out to be equivalent to different ways of replication of adaptive information as genetic, socio-cultural and symbolic inheritance;

2. The nature of the connection between generation and adaptivity of the information as the Darwin-Weisman mode and the Lamarck mode;

3. The nature of communication of various adaptations, the result of which is their integration into a single stable evolutionary strategy as co-evolutionary informatics and co-evolutionary semantics. This aspect turns out to be equivalent to the mechanism of repayment of evolutionary conflicts between different adaptations.

So, the stable adaptive strategy of *Homo sapiens* is a superposition of three different adaptive information arrays or modules that are biological, socio-cultural and techno-rationalistic ones. They are based on three autonomous processes of generation, replication and implementation of adaptive information. In this case, the third component of SESH is

directed equally to the adaptive transformation of the habitat and the carrier itself that are a hominines. This aspect of the SESH implementation can thus be called an informational one.

As another aspect of implementing SESH functions, a co-evolutionary semantics is a time-varying code of correspondence between members of pair wise co-evolutionary connectives. Some researchers use the term semiotic co-optation to refer to this phenomenon (Maran, 2010) that is equivalent to the "co-evolutionary semantics used in our study. Accordingly, we consider that the terms coevolutionary informatics and semiotic selection are equal, since the correspondence of biological and sociocultural modules is achieved by means of mutual selective pressure in the latter case.

Thus, there should be an operator defining the rules of pairwise comparison of information arrays of the three modules, and this comparison is carried out either by the system of objectified interests as praxeologically oriented knowledge, or by a system of subjective values as psychological predispositions.

Replication of interests is carried out within the rational-technological module by mechanisms of symbolic inheritance. Replication of value priorities is carried out within the framework of the socio-cultural module and, accordingly, by socio-cultural inheritance (i.e. cultural tradition). If the main "purpose" of interests is evolutionary efficiency as the material survival of SESH carriers, then the content of evolutionary correctness as a similar parameter to values is determined by their ability to ensure the maintenance of self-identity.

There are an influences of culture and the pool of technological schemes of the High Hume class on the structure and composition of *Homo sapiens* populations that can be divided into two separate types in accordance with the selection / semantics dichotomy of the mechanisms of inter-modular co-evolution by phenomenologically. The first type is changes in the frequencies of individual genes and the prevalence of specific technologies and their applications. It is an information co-evolution. The second type is increase in the level of genetic and technological polymorphism because of the complexity of the network structure of links between elements of different modules. It is a semantic co-evolution.

Note, the semantic mechanism of communication between modules proceeds very quickly and immediately affects a complex of biological features in the biological time scale. As result, the change in the structure

of communicative-co-evolutionary links can be considered as discrete phenomena, i.e. genetic-cultural co-evolution and techno-humanitarian balance.

For example, the genetic polymorphism of a specific nucleotide DNA sequence is preserved even after the elimination of the selective pressure of the corresponding socio-cultural type. With the change of one set of sociocultural predispositions by others, the total variability of the genome should accumulate. Indeed, if the examples of fixation or elimination of certain structural genes are relatively few in a population under the influence of socio-cultural factors, the correlation between the levels and structure of genetic polymorphism and socio-cultural types will not be questioned (Borinskaya, 2015).

Even more interestingly, the latest pattern of cultural influence on the organization of the genome extends from the human genome itself to the genomes of "cultivated" biological species, whose existence and evolution now depend on humans. In the genome of such species is formed by the sub-genome, which ensures the communication of biological evolution with the evolving system of socio-cultural predispositions (Glazko, 2014: 30).

Thus, the comparison of the results of the definition of adaptability by the methods of biological and cultural anthropology can serve as another empirical counterfeiter of the SESH concept presented. The evolutionary correctness is a main parameter connecting the two data sets.

Like the system of value-semantic priorities and predispositions, evolutionary correctness is capable to discrete fluctuations in the biological time scale in the instrumental plane. Thus, the evolutionary risk may increase abruptly to the existential level not only as a result of anthropogenic catastrophe, but also because of changes in the system of value priorities and semantic connotations associated with technological progress.

On the other hand, such organization is capable to a spontaneous increase of systemic complexity, and its various components assume the role of leader at different stages of socio-anthropogenesis. Approximately 350-400 years ago, a technological civilization emerged, and its feature is the permanent expansion of the "socio-environment niche" as sphere of control by *Homo sapiens* and in parallel to escalation of the risks of anthropogenic impact.

It seems quite logical to make two clarifications.

The adaptability of SESH as a whole is determined not only by the reproduction of the corresponding information arrays, but also by the corresponding semantics of co-evolutionary inter-modular relations. For this reason, the spread of new systemic socio-cultural innovations cannot be carried out as simple contact infection or diffusion. It requires the inflow of biological carriers of the corresponding co-evolutionary semantics.

This conclusion was confirmed by empirical observations of the relationship between the spread of dairy cattle and the invasion of ethnic groups that were carriers of the gene for the constant activity of lactase. Previously it was believed that this process was of the type of simple technological borrowing and socio-cultural imitation (Allentoft et al., 2014).

Obviously, there is some consistency between periods of a sharp increase in the magnitude of evolutionary risk with periods of the "scientific and technological revolution" and periods of radical reconstructions of the dominant value systems in society. As a result, there are destabilization and potential unpredictable stochastic fluctuations of the structure of co-evolutionary connections between the elementary adaptations of different modules and of actual adaptive meaning of each element.

The system of prevailing in society value priorities has a structure including several levels. There are personal unconditional interests, group conventional standards, abstract and theoretical universal values (Kohlberg, 1969; Prehn et al., 2015)[18]. Above all, there is possibility of relatively rapid reconstruction, that radically changing the semantics of the cultural module and biological or techno-rationalistic ones in the area of group norms and predispositions on specific attributes humanization / dehumanization.

As a result, the adaptive landscape may be reformatted quickly. An example is a radical revision of value priorities with respect to traditional and non-traditional sexual orientation in the Western mentality from 1970 to 2015. Universal values are practically unrelated to the transformation of sociocultural and psychological predisposition, and the results of these

[18]Two publications cited; first item is classical publication on social ethics of Lawrence Kohlberg, the second ones is study on experimental neuroscience that after half-century by neuro-morphology methods empirically substantiated biological substrate base of L.Kolberg philosophical constructs.

changes are interpretative in relation to the scope of the right of individual choice and, accordingly, the diagnosis of norms and deviations. This process is not completed now. However, the result will be of systemic importance for the trends of the future human development.

As it can be concluded, group standards are most subject to evolutionary transformations in three levels of value priorities and corresponding sociocultural predispositions. A more stable elements of this set are individual interests as most closely associated with the living requirements of biological module and universal values as the most abstract, distant from the objective reality and close to rationalistic module.

However, the perturbations effect of group relations and attributes of humanization / dehumanization, in particular, is extended by means of evolutionary-semantic transmission to the biological module and, in turn, destroys the rules of semantic matching of a module with the two remaining modules. By virtue of this secondary impact, the elements of the SESH biological module are extended to a system of objective "interests", and then to the remaining levels of the socio-cultural module. There is a fixation of a certain set of group norms and, therefore, there is a revision of universal values, since the latter are a reflection of projective group norms and individual interests.

Therefore, a certain part of biological adaptations in the new socio-cultural context becomes elements of the genetic load, i.e. they are either adaptive or selectively neutral. On the contrary, part of the selectively harmful or neutral components of the genome acquire adaptive meaning. With regard to technological innovation, in their totality, they are clearly aimed at fragmentation of biological adaptive complex and separation of its constituent interlocking adaptations such as sexual and reproductive functions on independent cultivated patterns.

Thomas Kuhn explored scientific and technological revolutions as a paradigm shift some time ago in the classic monograph of 1962, but the evolutionary significance of sociocultural transformations is beginning to become clear only now. Meanwhile, socio-cultural inheritance is also capable to a radical overhaul of its structure and composition.

An additional complicating circumstance is the relative independence of each module. For example, the "macro-mutation" of cultural and psychological predispositions is aimed, first of all, at preserving the structural distribution of subcultures within this type of civilization. Only

later can it spread to the composition of elements of the biological module of SESH.

However, in the relative balance of gene-cultural and techno-cultural co-evolutionary semantics, the configuration of the entire system does not allow an uncontrolled transition to an existential risk level. A prerequisite is the absence of a direct impact of the SESH techno-rationalistic module on biological and sociocultural modules.

Earlier, we formulated the conditions for such semantic stability from the point of view of social and humanitarian knowledge. The basic mentality of the West serves a person's desire to achieve the ultimate ideal or as metaphor,

"Per aspera ad astra – Through thorns to the stars".

It is complemented by the second intention of the sacred and at the same time, putting limits to this ideal,

"Ad imaginem suam ad imaginem Dei –The image and likeness of God";

And by the third intention that emphasis on the absolute priority of the uniqueness of the human person,

"Unus ex nobis – One of Us", God says about Adam.

Thus, the actualization of the desire to bring together the "World of Entity" and the "World of Proper" receive the nature of the movement to the Absolute, ultimate goal or "Omega Point", as Teilhard de Chardin called it (Cheshko, 2012:11, 506).

In an objectified, freed from metaphor form, the same thesis is reduced to the statement, that one of the basic predispositions of the mentality of technological civilization is the trend towards the liberation of the social role and social status of the individual from the conditioning by biological substrate (by genome, especially) as the criterion of social and evolutionary progress.

In the semantic theory of the culture genesis by the Russian investigator Andrei Pelipenko (2016), human civilization passes through two macro-stages of evolution. The time line between them takes place in the 5th century BC. We will call them mythological or traditional and technological civilizations.

In turn, the evolution of the technological macro-stage has one more point of divergence. At this point, two cultural formations diverge to

1. The so-called logocentric phase of the evolutionary stage of the technological civilization that is characterized by axiological interpretation of objective reality and by value priority of the transformation of the external habitat in accordance with some ideal image; and
2. The personal phase that is characterized by the realization of personified existential projects and by the value priority of self-expression, not only in the spiritual and in the bodily meaning.

The author of this concept believes that the personal phase is more progressive, which displaces the logoocentric socio-cultural type.

Following the logic of this model, the trajectory of cultural evolution is a combination of two evolutionary trends. These are macro-cultural transformations leading to the expansion of socio-cultural habitat as a vertical trend and local adaptation to the conditions of existence as horizontal trend.

However, identification of the personal phase is difficult. The technological realization of individual existential projects implies the local adaptation of the individual to a personal socio-cultural niche based on free choice, and the disintegration of humanity into biologically different communities.

This trend, in turn, is balanced by an irrational fear of a possible intervention in the human psyche from the outside, violating the free will of the individual and causes him to act contrary to his "human nature". It can be traced at least since biblical times and legends about werewolves and vampires, through gothic novels of 18th century to modern thrillers and science fiction at most recent years.

The system of socio-cultural balances to ensure the identity of *Homo sapiens* has been very stable, but only until the birth of technology-driven evolution. At this point, the ontological antinomy of evolution *versus* intelligent design has been completely overcome by West civilization. As a result, there were restrictions due to limited technical means of transforming reality, but they are surmountable, at least *in potentio*. The semantic code of humanization / dehumanization remains the only stabilizer of the current SESH configuration in the global evolutionary process. However, in itself, it is subject to significant stochastic oscillations and is open to technological interventions and, therefore, requires permanent monitoring.

With the advent of High Hume technology, the risk level approached the existential level of significance. At the existential level of

technological risk is an evolutionary risk since leads to the genesis of disappearance of humanity as a species, by definition, but leads to disappearance of intelligent life and the techno-sphere not necessarily.

Now the actual evolution is the object of the rationalistic management and / or manipulation, and it becomes necessary to calculate the features of the social reaction to scientific and technological development in compiling a forecast and determining the magnitude of innovative risk. These factors stem from the substantial foundations of human consciousness and culture, and are the result of the previous biosocial evolution.

This change in the techno-cultural balance was an adaptive response of the SESH socio-cultural component to the above processes, and it led to the transformation of classical science into a post-academic science. The emergence of bioethics has to consider as a form of modern transdisciplinary scientific concept humanities, classical scientific theory and social utopia. It is a part of the same global-evolutionary transformation that caused by development of technology of controlled evolution.

Not so long ago E.Coonin diagnosed curious feature of explanatory models of modern evolutionary biology very observant. These concepts are narratives with more or less teleological component. Consciously or not, logical constructs "arise for ..." are present in them, either explicitly or implicitly. A language of these narratives is best suited to describe the evolutionary processes and phenomena, and to create verifiable hypotheses, although it is contrary to the classical methodology of science and not is contrary to modern, transdisciplinary theories (Cheshko, Glazko, 2009:273).

This is even truer for that phase of the human evolution and evolution of mind, which we called "phase IV of SESH evolution". In our investigation, the phase IV is characterized as a universal rationalization and technologization of evolutionary process. An example of such explanatory model is an evolutionary model of risk genesis that proposed here. It is combined in accordance with the principle of complementarity of objective-scientific and subjective humanitarian criteria for the magnitude of evolutionary risk. The names for these criteria are evolutionary efficiency or inqlusive adaptivity and evolutionary correctness, we proposed.

The proposed concept is largely methodological. In other words, it is a meta-theory. We hope that it will become a heuristic stimulus for the

formation of specific scientific hypotheses that will be available for empirical and social verification.

This total consideration determines the civilizational and evolutionary function of bioethics, in turn. As *a priori* it is clear, the each of the three modules of SESH should to have its own system of self-maintenance. In the biological module it is the most well studied and is referred to as immunity. In techno-rationalistic module such system is the concept of verification and falsification of reliability of scientific knowledge. At socio-cultural module the system of pre-dispositions regulate human identity in the global-evolutionary transformation and performs the function of self-maintenance.

There is an asymmetry of semantic communication between the designated object and the designating symbol. This feature determines the disparity of the composition of the socio-cultural module. It is due to the process of socio-cultural self-identification and implies the relation to each other causal (cause - effect) and semantic (object - sign) binary oppositions.

In this case, there are elements that have intracultural determination. In total, they are called "humanity", which is the object of socio-cultural self-identification of *Homo sapiens* and, as such, is protected by ethical and legal norms. On the contrary, there are elements that are basically culturally-stimulated developments of the biological elements of SESH. They can be considered symbols of human attributes that are open to technological manipulation and control. The totality of such elements is called "human nature".

Naturally, the most stable and evolutionarily plastic organization of the human evolutionary strategy will be the option when the system of self-identification of a sociocultural module basically coincides with objective knowledge about the essence of anthropogenesis and the structure of the biological module. This knowledge generated by techno-rationalistic module.

At the highest level of analysis, the problem of evolutionary risk and its components come into conceptual field of the anthropic principle. There is "Doomsday equation" as the mathematical model of population growth. One of the parameters of this equation is identical to the universal constant of human genesis in the Universe, which is determined by the characteristics of sociocultural and biological evolution. Brandon Carter, one of the pioneers of the anthropic principle, drew attention to this (Carter, 2012). Let us analyze the interpretation and arguments linking the

epistemological and axiological aspects of the technologies of guided evolution and the metaphysical anthropic principle.

In 1960, the Heinz von Foerster articulated the law of hyperbolic demographic growth of *Homo sapiens*, also known as non-academic title "Equation of the Doomsday" (Von Foerster, 1960)

$$\frac{dN}{N}dt = \frac{n}{T^*} \quad (6.1)$$

where N is volume of *Homo sapiens* population on Earth, t is time, T* is constant, which is, probably, species-specific. Its physical meaning of will be discussed below.

In accordance with the Foerster's equation, population growth governed by the equation hyperbole in the last 10 thousand years. In other words, volume of global human population growing with the increasing acceleration and about 2025 will become infinite, and lose the physical meaning. This will mean the end of the evolutionary history of *Homo sapiens*, although it does not necessarily mean the death of intelligent life in general. Rather, it involves the passage of a certain evolutionary singularity point, that is the achievement of the magnitude of the evolutionary risk of a value close to 1.

In Foerster's equation present parameter T*, which the author has been calculated empirically that, in his estimation, is $2{\cdot}10^{11}$ approximately. Brandon Carter considers this option as a member of a pool of world constants. This constant determines the appearance of the humans and the formation of their capacity for reflection of natural laws and civilization development. In his interpretation, the T* value is a function of the amount of information contained in the human genome (10^{10} bits) and the length of a generation (20 years). The transition from the biological to the socio-cultural, and then technological phases of anthropogenesis (Phase II-III in our model of the evolution of SESH) becomes impossible by reducing this parameter is below this threshold $T^*=2{\cdot}10^{11}$.

Both phenomenological interpretation and explanatory model of Foerster's "equation of Doomsday "are in full agreement with the views of the organization and formation evolutionary risk of SESH in our study.

On the one hand, population growth increases the frequency of techno-rationalistic and sociocultural innovations / adaptations and the speed of their spread in the population, which proceeds by the contagious mechanism in accordance with the Lamarck module. As a result, the conditions are created to further accelerate the demographic growth and

ecological niche of Homo sapiens is expanding (Korotaev, 2005; Kapitza, 2005).

On the other hand, the integrity of the structure of the three-modal SESH implies co-evolutionary semantics as some kind of inter-module communication correspondence between the elements of the biological and socio-cultural modules. The effectiveness of adaptive evolution drops sharply after exceeding a certain threshold of the number of adaptive socio-cultural elements as compared with the pool associated with them biologically determined traits. (This conclusion is still valid even under condition ambiguity of semantic connections between the modules).

It is manifested in the accumulation of genetic and cultural imbalances and inconsistencies in the sociocultural environment and psychophysiological characteristics of the organism, that is, in increasing evolutionary load. With the growth of the volume of adaptive information replicated by cultural inheritance, there comes a time when this value becomes equal to the amount of genetic information contained in the genome, and then exceeds it. It is this moment that serves as an indicator of reaching the threshold value, after which the rate of adaptive evolution of culture drops sharply. This situation has two fundamental, but alternative evolutionary solutions.

The first, "hard" solution means technologization of biological human evolution, i.e., "enhancement" of *Homo sapiens* using genetic engineering, etc. technology. As already mentioned, this decision is fraught with the completion of the evolutionary history of mankind, which is equivalent to the loss of self-identification by the next generations of mind carriers.

"Soft" solution involves creating a radically transformed version of evolutionary semantics for regulating gene-cultural co-evolution and techno-humanitarian balance. The future co-evolutionary semantics will have to ensure a better fit of the biological and techno-rational modules to the so-called universal human value priorities that preserve the self-identity of the carriers of the mind.

Let us summarize our excursion into the study of the evolutionary-natural philosophical transdisciplinary paradigm of biotechnology and synthetic biology.

Unlike the classical, disciplinary matrix, this paradigm represents a binary bundle of the descriptive and axiological nuclei as a result of the intersection of epistemological (scientific) and axiological (public) discourses.

The descriptive abstract-theoretical core is the three-modular model of the stable evolutionary strategy of *Homo sapiens*. A distinctive feature of this model is the thesis of the rationalization of the global evolutionary process and the generation of an increasing evolutionary risk as the main attributes of SESH.

Bioethics is largely a methodological concept. In other words, it is a meta-theory, which, we hope, can serve as a stabilizer of the system of attributes-identifiers of human self-identification, as well as systems of cultural-mental predispositions that are formed on their basis. Such a system ensures the maintenance of the current version of the evolutionary semantics of the NBIC-technological complex within the "universal human values". It ensures the maintenance of humankind in the process of permanent development of technologies facing the subject of the evolutionary process. Thus, bioethics serves as the axiological core of the transdisciplinary matrix of synthetic biology and biotechnology.

The essence of the unique phenomenon of a stable evolutionary strategy of our biological species, evidently, most adequately expressed by Elena Knyazeva (Knyazeva, 2014:16) a phrase put forward by us in the epigraph to the monograph:

> "The constructing person and the world he constructs constitute a procedural unity".

The logical connection between the two paradigm nuclei of bioethics and biotechnology simultaneously implements the anthropic principle on the expression J. A. Wheeler, which is most adequate to the problem of technology-driven evolution:

> **"**Observers are necessary to bring the Universe into being" (Wheeler, 1977).

Taking into account the realities created by nano-bio-technologies, the anthropic principle should be expressed as follows (Cheshko et al., 2017, 264):

> *Only that Universe acquires the status of Reality, in which there is an active agent endowed with the mind.*

A person turns from a subject and an observer, knowing the laws of nature, into a subject of activity, an accomplice and co-creator of reality; and, as a result, Nature and God become an identity in the process of evolution.

In philosophy, “Human nature” is the essence of the carrier of the rational principle in the Universe. As result of its cosmological-existential content, the participatory anthropic principle of Wheeler is the central initial principle of any ontology of human nature in the philosophical meaning of this word.

The second metaphysical principle throws a bridge to the anthropology of the genes and other technologies of controlled evolution. It affirms the three-module organization of the evolutionary strategy of *Homo sapiens* as the carrier of Reason and the cause and mechanism for the realization of the anthropic principle of participation.

There is a direct consequence of the anthropic principle of participation in conjunction with the three-module organization of SESH. It is the adaptive evolutionary inversion inherent in the Mind, i.e. a trend to rational reorganization of reality in accordance with some intellectual design. This is what makes the splitting of reality into World of Entity and the World of Proper. At the same time, this makes rational and purposeful, and not spontaneous as it was before the appearance of hominines the construction of an ecological niche in the dominant trend of the evolutionary process and the expansion of our ecological niche to indefinite limits. These limits are established by somatic adaptive capabilities of *Homo sapiens* (Human Nature) and compatibility with the socio-cultural system of universal human values (Humanity) only; and both of these parameters cease to be world constants as the techno-rationalistic module unfolds. The above metaphysical reasoning serves as a meta-theoretical justification for the conclusion that

> “Our species has developed a new ecological niche, that of the 'generalist specialist'. Not only did it occupy and utilize a variety of environments, but also in its adaptation to some of these environmental extremes” (Roberts, Stewart, 2018).

This thesis is still speculative, but already belongs to the sphere of scientific theoretical hypotheses, accessible to empirical verification in the future.

So, there are of discrepancies in the speed of biological, socio-cultural and techno-rationalist evolution and the presence of co-evolutionary relations between them. As result, evolution process splits into an objectively spontaneous and subjective-teleological components. For the same reasons, periods of relatively quiet development are replaced by

evolutionary crises in due to the accumulation of conflicts between sets of elements of the biological, socio-cultural and techno-rationalist modules. The solution of these conflicts is achieved either through the fixation of biological mutations, or by reformatting the socio-cultural niche, or through technological interventions in the psychosomatic constitution and cultural stereotypes of human.

Using both of these principles as premises of deductive conclusion, we get the thesis about the global evolution of the systems with human dimension as a sequence of recursive adaptive inversions, during which the object and subject of reality transformations change their places. In this case, each subsequent projectively-activity inversion does not cancel the previous one, but embed into it. It imparts nonlinear and open character of the evolutionary trajectory.

From this metaphysical triad, as you can see, it is possible to construct an ontological conceptual-terminological framework at the output of which we obtain logically consistent theories of constructing a socio-environment niche, multi-level selection and the concept of evolutionary technogenic risk, evolutionary efficiency, evolutionary correctness and quality of life. With the help of these logical constructs, it becomes possible to create verifiable explanatory models of socio-cultural anthropogenesis and, in particular, a description of the evolutionary consequences of scientific and technological development.

Concept of evolution means an objective and spontaneous separation of reality into a retrospective realm of the current values of the adaptability of each evolving object and the prospective realm of the maximum possible values of adaptability in evolutionary metaphysical interpretation. The common trend of this binary opposition is the constant movement of adaptivity in the direction of maximum values, in accordance with Fisher's theorem. With the appearance of man, this dichotomy and this trend become a rational antinomy of the World of Entity and the World of Proper, being in constant interaction and mutual transformations with each other. There are means of pull-up an objectively existing reality to its ideal image. They are a technology, and the means of transforming the system of value priorities as a phenomenological expression of the World of the Due, according to the current state of the World of Entity are a biopolitics and biopower.

The evolutionary process turns out to be a double epicycle, and each of its components continuously finds expression in the resulting vectors of development of axiological discourse (bioethics) and descriptive-technological ones (biotechnology). Evolution and intelligent design are integrated into one construct, and the Intelligent Design ceases to be a world constant in the metaphysical meaning of the category. As recently wrote by A. Kaczmarczyk (2018: 125),

> "The Creator [God or Human Technologist, indefinitely now - *Auth.*] carries out the work of creation using intelligenttools with built-in self-organization processes and with feedbacksas teleological mechanisms enabling purposiveness… Creation is accomplished according to the laws of creation expressing meta-rules of the technology of our Universe".

The co-evolutionary interpretation of the anthropic principle becomes apparent whenthe second branch of a Subject-Subject transformations, appears. Thus, a kind of evolutionary hypercycle arises, where a purposeful transformation of the World is realized in parallel and interdependent with self-construction and self-manipulation by a rationally operating Subject. This double hypercycle is the phenomenological description of the current Reality as such. Equally, one can use the expression self-description, since the objective hypostasis of reality is the emergence of NBIC, which is also a consequence of the anthropic principle.

From this point of view, the global evolutionary process acquires a humanistic meaning, implying the risk generated by man as an inevitable attribute of reality. Risk monotonously approaches unit in magnitude and becomes an evolutionary risk in form. Science and technology are not only means of surviving of humanity and a source of power over the "raging" reality, but lead to the deviations that violate the anthropic principle as the correspondence of the parameters of the socio-natural habitat to the necessary and sufficient conditions for the existence of intelligent life in the Universe. This operator of human duty and responsibility in the face of reality logically follows from Wheeler's equation. It cannot be traced explicitly in the canonical, "strong" and "weak: variants of B.Carter.

From the anthropic principle of participation the need follows for a transdisciplinary review of the three aspects of the problem of reality:

1. Ontological aspect that is the reconstruction of the categorical apparatus by means of which the cognitive-projective image (Design) of the Reality is formed;

2. Epistemological aspect that is creation of the conceptual field of the problem of communication Macro- (”object”) and Microcosm (“subject”) as two attributes of reality, mutually conditioning and mutually determining each other;

3. Anthropological aspect that is disclosure of internal nature and temporal trends of the genesis of binary communication of Micro- and Macrocosm.

In the process of transition from ontology to anthropology and further to the actual scientific theories, we move from the philosophical world-view level through evolutionary anthropology (meta-theoretical level) into the sphere of specifically scientific theoretical studies.

So, there are ontological enactivism, evolutionary epistemology and the theory of co-evolution as the “three whales” of the new, transdisciplinary theory of scientific knowledge.

In their totality, they all proceed from the intention of overcoming Cartesian dualism (more precisely, Cartesian antinomy) of the object and subject of cognitive activity.

As enactivism claims (Varela et al., 1992 (2017): 185; Knyazeva, 2014: 5, 53), the process of cognition is not a process of forming an objectified reflection of material reality in the human mind, but represents the creation of reality due to the co-evolutionary interaction of the organism with their habitat. Accordingly, the object and the subject are an inseparable whole, the product of knowledge is mutual adaptation of the world and the organism to each other.

In other words, a cycle of information and communication links is established in the course of cognition, and a bilateral correspondence of the corporeal organization and environment is established during its implementation.

In this interpretation, firstly, “knowledge” and “activity” correspond to two aspects of adaptation genesis. Secondly, the mind is somatically determined; its form follows from the body organization. In addition, thirdly, there are differences between the physical (the “world as it is”) and the virtual (“the world of it must be” and the “world of the possible”) realities, and they are imaginary, i.e. a set of scenarios of global evolution.

Similarly, evolutionary epistemology (Popper, 1972: 121 et al; Popper, 2002; Campbel, 1974: 141; Thomson, 1995: 165 concludes that

the process of adaptive evolution and cognition is identical. The homology between them follows from the same functional scheme:

$$TT_{i-1} \rightarrow EE_i \rightarrow PP_i \rightarrow HH_i \rightarrow FF_i \rightarrow TT_i \rightarrow EE_{i+1} \rightarrow PP_{i+1,} -$$

Falsification test / Selection

where EE_i is data obtained empirically;
PP_i is problem situations, i.e. discrepancy between existing data and its theoretical explanation (TT_{i-1});
HH_i is suggested explanatory models;
FF_i is falsifiers, they deductively predict consequences which give possibility for empirical verification;
TT_i is hypotheses that passed the falsification test and obtained the status of reliable theories;
EE_{i+1}, and PP_{i+1} is new data and new problem situations, discovered as a result of development of TT_i.

There is analogy between the process of cognition and adaptive evolution, and it becomes apparent as a result of the comparison of (1) sets of data and gene collections, (2) a multitude of hypotheses and a multitude of mutations, (3) problematic situations and transformations of the ecological environment, (4) theories and biological populations / species, (5) procedures of falsification and natural selection. Thus, the identification of evolutionary adaptation and reliable knowledge seems logical. The growth of knowledge and the growth of adaptive complexity turn out to be entirely equivalent and stemming from the evolutionary strategy of *Homo sapiens*.

Two conceptual constructs are “nominees" for the paradigm status of modern evolutionary theory in analyzing the evolutionary aspects of social verification of the implementation of all varieties of NBIC technologies, namely, “Constructing a Socio-Ecological Niche” and “Triple Helix”. The first model regards an evolutionary process with an emphasis a static organization, the second regards an dynamic trends in the formation of the adaptive complexity of self-organizing systems.

The concept of extended evolution represents the attempt of a metaphysical generalization of evolutionary theory by extending the classical Darwinian triad “heredity − variability − selection” (Pigliucci, Muller, 2010). Thus, a conceptual field is created. The homologous

methods of research and the conceptual apparatus are created too. They can be taken simultaneously and with the same efficiency not only in the theory of biological evolution and evolutionary epistemology, but also in socio-humanitarian knowledge in general, because the object of research is complex adaptive systems as regulatory network structures capable to self-learning in all these cases (Renn, Laubichler, 2017:109).

This philosophical idea is concretized in several directions and in two, already verified concepts, above all.

According to the conceptual model of "niche construction" (Odling-Smee et al., 2003: 246; Laland et al., 2016: 191-202), living organisms change not only their own somatic and behavioral organization, but conditions of its own existence spontaneously or, in the case of *Homo sapiens* purposefully in the process of adaptation to the environmental conditions. Thus, evolutionary process is considered within the framework of this explanatory model as co-evolution of living organisms and socio-ecological niche. It is resulted in mutual adaptation, "fitting-in" of the niche conditions and the population of organisms that exploit the niche.

The consequence is the famous competitive exclusion principle (other name is "Law of Gause"). According to the principle, the same ecological niche occupies by no more than one ecological species. In the alternative, we can observe either the extinction of other species or the division of the niche into several ones. A special feature of anthropogenesis is two branches co-evolutionary cycle, and the ascending branch, organism → habitat in its rationalistic form prevails over the specific gravity of the spontaneous-descending branch, habitat → organism. The general vector and specific trajectory of socio-cultural anthropogenesis in less degree are determined by environmental dynamics and becomes increasingly spontaneous and intentional. In our works this feature is called the "evolutionary adaptive inversion" (Zubov, 2011). As a result, the ecological niche itself as applied to man turns into a cultural-ecological niche, and its borders are constantly expanding to the borders of the biosphere. The next phase of expansion of the socio-ecological niche is "the invasion" of artificial, including humans, micro-techno-ecological systems into the near-Earth space.

The next concept explores the mechanisms of this co-evolutionary interaction. It is the so-called "triple helix" concept (Lewontin, 2002; Leydesdorff, Franse, 2009: 109). According to the logical organization, it is a post-Hegelian and post-Marxist interpretation of dialectics. As was

shown at the beginning of the 20th century, binary Hegelian scheme cannot explain the phenomenon of increasing adaptive complexity with respect to co-evolutionary systems. As an example of "Struggle of opposites", the evolution of "predator-prey" system ends with the formation of a stable binary opposition oscillating around an equilibrium position for indefinitely long period of time according to the Volterra-Lotka model.

Before the emergence of humans, systemic complexity was formed because of the functioning of the co-evolving triad genotype-phenotype-environment. The totality of the elements of the genome undergoes epigenetic modifications in the process of realization of genetic information and produces the phenotype of organisms. In turn, the survival of organisms is determined by their adaptation to the biotic conditions and abiotic parameters of the ecological niche and to the transformations of the same parameters that are determined by the vital activity of living beings. All three elements of the triad are interdependent and connected by a complex network of direct and inverse influences, and an essential role is played by informational communication between individuals (sociality) in these links.

There are a fundamentally important conclusions from conjunction of the anthropic principle and the three-module model of the stable evolutionary strategy of *Homo sapiens* into a single deductive logical construction.

- First, in the implementation of technologies of controlled evolution, the most potentially beneficial effect ("Benefit") will be observed in the area of non-intersecting action of evolutionary efficiency and evolutionary correctness. In other words, the greatest benefit of *Human Enhancement* can come from technological manipulations with the attributes of human somatic and psychophysiological organization associated with the highest positions in a the system of human values priorities and "not noticed" by the biological adaptive evolution. These priorities correspond to the "ethics of the *Homo* species" of Habermas. The second condition implies the presence in the genome of genetic determinants of such features and the lack of selective pressure on the determinants in the conditions of modern civilization. For example, this area includesall gerontological problems caused by the specific features of the ontogenetic development of the human body after 30-40 years. Phenotypic manifestations of age-related problems and senescence,

especially, go beyond genetically determined reproductive period. Therefore, these problems are not “visible” for selection.

- Secondly, the greatest technogenic evolutionary risk is formed in the areas of overlapping of the evolutionary correctness and evolutionary efficiency competencies. Here, the attributes of the human self-identification form a complex network of co-evolutionary semantic nodes of biologically and socio-culturally determined features; and the magnitude of the nonlinear evolutionary risk of technological intervention is approaching the existential level. It is determinates particularly great importance of bioethics as mechanism, process and social institution to control technological risk for the future evolutionary fate of civilization.

Not fully aware of the fruits of the knowledge of good and evil, we have already turned to the branches of the tree of life if we use the biblical metaphor. Most likely, it is a standard and unavoidable situation of the advanced development of the cognitive function of a technological civilization in comparison with its humanitarian normative analogue. But it depends on us whether our descendants will approach the ideal of divine omnipotence and goodness, or will lose the right to be called people. In accordance with the anthropic principle, the latter will mean the death of reality that the creator and guarantors is *Homo sapiens* as the carrier of a Ratio first principle in our Universe.

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