LIFE'S MEANING AS A GLOBAL PROBLEM OF MODERNITY: A VIEW FROM BIG HISTORY AND COMPLEXITY STUDIES PERSPECTIVE

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Throughout human history, in-group solidarity has been achieved at the price of confrontation with out-group individuals ('them vs. us'); this has been guaranteed by religious or quasi-religious ideologies. However, in compliance with some basic evolutionary patterns inferred from Big History and complexity studies (synergetics), the traditional mechanism of social aggression-regulation is actually becoming counter-productive and threatens to destroy planetary civilization during the next decades. The author argues that the perspectives of global viability essentially depend on whether or not the human mind develops new mechanisms of strategic meaning-construction and solidarity regardless of large-group (confessional, national or class) mythologies.

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Discussions related to the perspectives of global civilization show a growing agreement about at least one point. Namely, the kernel of global problems is a complex mixture of cultural and psychological factors, such as worldviews, thought processes, and dominant value systems. This consensus is supported by historical experience, which discovers numerous examples of crises caused by human activity. A survey of such precedents helps us to highlight the essence of the troubles humanity is experiencing at the current historically conclusive stage of globalization.

The subject-matter of this paper has been taking shape simultaneously with evolutionary mechanisms discovered by interdisciplinary researches coming into focus as a result of two complementary paradigms: Big (Universal) History and complexity studies (synergetics; chaos theory).[1] To substantiate the final arguments, the first six sections of the article briefly present the identified patterns and mechanisms (for further illustration of these and a detailed bibliography see Nazaretyan 1991, 2004, 2005b, 2008, 2009b).

The Concept of Crisis. The Law of Delayed Dysfunction and the Rule of Redundant Variety

From a complexity studies perspective, a living organism is a system of *sustainable non-equilibrium*, *i.e.* the one that needs the continuous work aimed against the equilibrating (destructive) pressure of the environment to sustain its integrity. Anti-entropy work – vital activities – requires regular energy income from outside, and energy is released in

the process of other systems' destruction. The competition for free energy is the premise for the formation of multistage and multidimensional natural symbioses, which maintain the global energy circulation.

This dialectic of construction and destruction is what makes linear processes in non-equilibrium systems impossible. New external or internal conditions develop, which results in anti-entropy activity turning into increasing entropic effects. These transitional phases are called *crises*. A crisis is followed either by a catastrophic phase (system destruction), or by change of the habitat, or by updating the system's anti-entropy mechanisms.

There are multiple criteria for the classification of crises. Local, regional, and global crises can be distinguished by their scale, although in some cases, a regional crisis can become global because of its role in the evolution. Similarly, a crisis can be ecological or geopolitical (in social systems) while they are often complex and interrelated. Therefore, we mostly distinguish crises by sequences of events.

As to their genesis, we distinguish between exogenous, endogenous and endo-exogenous crises. Exogenous crises are due to relatively accidental changes in the habitat, regardless of the system's activity. These can include fluctuations in solar or geological activity, spontaneous climatic changes, cosmic cataclysms, or emergence of new warrior nomads. Endogenous crises result from transitions in the stages of the genetic program or its exhaustion (like aging of a multicellular organism). Crises of the third (mixed) type are consequences of *the unfavorable habitat transformations which have been provoked by the system's own activity*.

Endo-exogenous crises are the ones that have played the most essential and creative role in the evolution of nature and society, and they are of special interest both for the complexity theory and for the world's current situation. Gradual increase of anti-entropy activities (for instance, growing biological population and resource consumption) accumulates destructive effects in the system's environment, resulting in former mechanisms of life sustenance becoming counter-productive. *The Law of delayed dysfunction* states that such a phase is inevitable, and further survival of the non-equilibrium system depends on its ability to transform. If it has no opportunity to change its habitat, it will either collapse or develop new anti-entropy mechanisms that furnish higher specific productivity (the ratio of the useful product to the volume of destruction). This scenario always requires radical increase in organizational complexity and 'intelligence'.

The chance to constructively overcome a crisis is related to the amount of *redundant variety* that the system may have accumulated in relatively secure earlier stages. If the selective process has not been rigid enough to discard what geneticists call *slightly deleterious mutations*, then marginal elements that have earlier been actually useless and played a peripheral role might provide the system with the internal resources of diversity to develop new survival patterns. This obviously particularizes the Law of requisite variety formulated by W. R. Ashby (1964) (see Section 3).

> To illustrate the two propositions – the Law of delayed dysfunction and the Rule of redundant variety – I would mention, by way of example, an episode from the early history of the biosphere.
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> Over a period of billions of years, early life on the Earth existed mostly as cyanobacteriae (blue-green algae). Their waste product – oxygen – accumulated in the atmosphere and changed its chemical composition. As a result, the atmosphere was strongly oxidized, which in turn led to a mass extinction of the cyanobacteriae.

Meanwhile, by that time, a new kind of protozoa had emerged through the process of mutations – those that consumed oxygen and produced carbon dioxide. Under the new atmospheric conditions, these organisms started to breed extensively and got the leading role in the evolution of life. In turn, the biosphere became radically more complex, which resulted in higher dynamic sustainability.

Five global breakthroughs, following similar scenarios, have been described by paleontologists in the biological history of the Phanerozoic Eon (although the factors are not so clearly revealed in each case). Historical sociologists, for their part, have described at least seven such breakthroughs in social prehistory and history. To understand the latest ones, we need to add another essential concept, which I will cover in the next section.

Anthropogenic Crises. The Law of Techno-humanitarian Balance

Endo-exogenous crises became anthropogenic at the pre-social stage of evolution. As far as this aspect of the issue has been in many details described in English (Nazaretyan 2005a, 2009b), here I will just dot down its points.

There are strong reasons to suggest that the first pebble tools (choppers) were used by their makers – *Homo habilis* of the Olduvai Gorge – besides other functions as a weapon in the intra-species conflicts. Thus *the Rule of ethological balance* (a balance between natural weapons of a species and its instinctive inhibition against intra-species aggression, which sustains viability of animal populations), has been broken once and for all at an early stage of *Homo* genus formation (Lorenz 1981). *Habilis* lacked natural weapons and, therefore, their instinctive aggression-inhibition was not adequate to the new instruments for killing. The combination of psychology of an armless animal with dangerous artificial weapons doomed them to self-destruction. This collision in human prehistory has been called *the existential crisis of anthropogenesis*.

Yet, at least one *habilis* population did survive and started a new spire of evolution on the Earth. The most developed hypothesis to explain how the first *Homo* managed this feat attributes it to the emergence of an extra-natural aggression-inhibitor conditioned by necrophobia. The neurotic fear replaced the insufficient instinct in its balancing function and eventually became ferment for spiritual culture.

Since that time, viability of pre-human and human communities has depended on the parity between instrumental[2] and self-controlling attributes of their cultures. The analysis of many anthropogenic crises and catastrophes in various historical epochs and in various continents has discovered a systemic correlation between three variables: technological potential, quality of cultural regulation and internal sustainability of the society. *The Law of techno-humanitarian balance* claims that *the higher the power of production and war technologies are the more advanced behavior-restraint is required to ensure the self-preservation of society.*

A growing technological potential increases society's *external sustainability* (its independence from spontaneous natural or geopolitical cataclysms). At the same time, the system becomes more vulnerable to mass emotional fluctuations, to impulsive decisions of authoritarian leaders, *etc*. In other words, a society's *internal sustainability* decreases if its strength is not compensated by adequate development of values and norms.

In fact, new technologies have usually entailed a specific sense of omnipotence that provoked the splashes of aggression against nature or neighboring societies. Sooner or

later, the society infected with euphoria has destroyed the natural and/or organizational bases of its existence. Many oases of civilization in different continents of the Earth fell victim to their own imbalanced might: flourishing societies experienced 'fracture and breakup', often happening unexpectedly for their contemporaries, as well as for later historians.

Fortunately, however, we see alternative scenarios occur in history as well. The one eventually essential for understanding the evolutionary mechanisms is related to the episodes of 'progressively' surmounted man-made crises. When a particular crisis involved a vast region that was highly saturated with diverse cultures (the redundant variety rule), its inhabitants sometimes managed to find a radical way out of the deadlock. At those stages, selection of societies and value-norm systems compatible with grown technological power was intensified, which went together with dramatically discarding the ones unable to provide a cultural and psychological balancer for new technological might. (Actually, in some cases the catastrophic effects were moderated by cross-cultural assimilation.)

As noted earlier, no less than seven breakthroughs of global importance have taken place in the 2.5 million years of human history and prehistory. Each of them followed a large-scale conflict between technological might and social self-control, and in each case the crisis was overcome by transformations in both society-nature and intra-social relations. The breakthroughs resulted in many new developments, from growth in productivity of new economic activities to an increase in the volume of information (both collective and individual knowledge) and the development of organizational complexity. The overarching result has been the development of new levels in inter-group and in-group regulation. In fact, these stages have led to society continually *digressing from its natural (wild) condition*. Thus natural ecosystems have been turned into anthropocenoses and – thanks to this – the ecological niche of humans has been broadening and deepening. After that, however, new technologies, population growth, and the expansion of collective and individual needs have led to new anthropogenic crises.

The link between technological potential, quality of cultural regulation and society's internal sustainability (the Law of techno-humanitarian balance) relies on evidence of case studies, and it may be considered as an empirical generalization. It implies that because of the selective mechanism, throughout history, the quality of cultural aggression-restraint have been nonlinearly (mediated by the anthropogenic crises) but progressively following the technological development. To verify this non-trivial corollary, we used a distinctive cross-cultural index – *Bloodshed Ratio,* which is the ratio of the average number of killings per unit of time (including wars, political repressions, and everyday violence) to a population size during a given period.

Calculations show that the rate of human death from violence has been irregularly decreasing over the course of millennia, while both technological potential for mutual destruction and population densities have been successively increasing. Since the downward trend is highly nonlinear (splashes of violence correspond to the sharpening of crises) it is clearly seen only as long-time distances are considered; we may add that the decrease is mostly due to the restraint of everyday violence. This is not 'decreasing aggressiveness': a reasonable explanation is that the crucible of anthropogenic crises has made cultures multiply and perfect the procedures for aggression-sublimation into physically non-violent social activities.

When studying the psychological aspect of this historical trend, we distinguish between the concepts of *menace* and *danger*. Menace is any factor that can damage

the interests of a subject (including his physical state), while danger is the variable that reflects the relation of the menace to the subject's readiness to withstand it.

> For instance, there are many more menaces in the street, in transport, at work or in public places than inside one's own flat; however, policemen, ambulance crews, and sociologists know that accidents, injuries and murders happen more frequently at home. An adult understands the menaces outside his (her) flat; therefore one is alert, concentrated and attentive. At home, one erroneously estimates relatively small menaces of being alone or among one's family or friends as lacking at all, totally relaxes, and this raises a real danger of unpleasant happenings.

Each new technology, both military and production ones, has usually carried the menace of growing destruction to geopolitical and/or natural habitat, and – after a period of euphoria – has caused social troubles. Nevertheless, these dangers remained until a cultural and psychological adjustment *(fitting)* occurred. During this fitting process, people used to develop a proportionate appraisal of the menace. After all, norms of activity came into line with the grown instrumental potential by specific psychological mechanisms.

As a result of this process, danger decreased to an 'acceptable' level, and the tamed technologies, including military ones, became a life-protecting factor. *As soon as the phase of cultural and psychological fitting was completed* (only after that!), the more potentially destructive a weapon was the less murderous effect it really caused. This has been shown by special calculations related to both military weapons (Nazaretyan 2008) and non-combat technologies (Rabotnov 1992).

Retrospective empirical data show the mainstreams of consecutive universal transformations, which can be traced in a kaleidoscope of cyclical processes on local, regional and global scales. One of such mainstreams is the succession in the development of cultural regulation, without which neither successive increase (respective concentration) of population nor growth in technological might and organizational complexities would be possible. With certain reservations, all of those historical vectors may be designated as *progress*. However, the complexity-studies version frees this classical idea from two ancestral vices: linearity (usually with strong overtones of Eurocentrism) and teleology. Progress is no longer interpreted as the aim or as movement toward the aim but as *a means of self-preservation*, with which the complex non-equilibrium system (society) responds to the challenges of declining sustainability.

Growth and Limitation of Variety: The Law of Hierarchical Compensations

As noted earlier, the fact that one of the critical conditions for overcoming a crisis is the resource of variety accumulated by (natural or social) system at a relatively quiet stage, may be considered as a manifestation of Ashby's law. Here, however, we will call attention to its specification, which is important for our further conclusions.

The Law of requisite variety and its derivatives helps to explain many cases of increase and decrease in systems' competitiveness in the nonlinear world. Therewith, its one-sided interpretation has often led to misunderstanding.

The uncontrolled increase in variety beyond a certain optimum point lowers a dynamic system's control and thus decreases its effectiveness. For example, if variety were an unconditional value (as Ashby's law is sometimes interpreted), a language would not

need a single grammar, the school would not need teachers of philology, and publishing houses could do without editors and proof-readers, as well as society could do without morals, penal code, traffic rules, and so on.

In fact, formal and informal regulations and negative sanctions, which take place in almost any aspect of social interaction, are aimed at the restriction of varieties in behavior and even in thinking; without them any society (including criminal communities) is likely to lose its viability. Nature has also produced its complex mechanisms to prevent boundless increase in the variety of species and behaviors.

Facts of this kind are hardly reconciled with Ashby's law if one sees it exclusively as the demonstration of the success of variety. We studied this question in the 1980s together with the specialist in Information theory E. Sedov: we tried to work out correlations in the amount of variety for systems of any kind – from cosmo-physical to cognitive ones – and to evaluate the dynamic of those correlations in the evolutionary processes. After the untimely death of Evgeniy Sedov (in the last weeks of his life he developed a mathematical model to describe these correlations) in the editorial preface to his posthumous publication (Sedov 1993) I suggested giving the pattern his name – *Sedov's Law,* or *the Law of hierarchical compensations*. My general formulation is as follows: *the increase in variety on the upper level of a hierarchical organization results from the restriction of variety on the lower levels, and inversely – increase in variety on the lower level, destroys the upper level of an organization*.

The Law of hierarchical compensations is congruent in both subject and volume with the Law of requisite variety and is an indispensable complement to it. Illustrations abound in all spheres of objective and mental realities. Let us consider a few examples.

> A hypothesis in Cosmology claims that there was a phase transition from multidimensional space to four-dimensional spatiotemporal continuum at the early stage in the evolution of the Universe; historically, this was perhaps the first act of restriction, which made possible the increasing variety of structures. Such transitions then multiplied at the rate of acceleration and branching of the evolutionary processes. On the Earth, restriction of the varieties on the subcellular and molecular levels of living matter entailed the multiplication of forms on the supra-cellular level. The eukaryotes' increasing variety was furnished by the unification of their forms of metabolism as opposed to those of the prokaryotes. A general premise for the increasing biodiversity has been the relative unification of physical conditions on the Earth under the influence of living matter; subsequently, restraints on biodiversity became a necessary condition for social and cultural diversifications.
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> Similar dependence is manifested in all spheres of social activity. For example, a restriction of phonemic combinations in any language is necessary for the construction of words, restraint of the syntactic combinations is necessary for the construction of phrases, *etc.;* this has historically led to the generalization of linguistic rules. Market development was brought about by the use of the generally accepted commodity equivalent of gold, which was subsequently replaced by still more abstract equivalent, the paper banknotes secured by gold, and actually by credit cards to substitute the banknotes. The development of science also employs such simplifying generalizations, which implicitly contain a great number of recorded facts, causal links, reliable judgments and forecasts, as well as guidelines that may be deduced from them. And these, in turn, exclude many other facts and hypotheses. The complication in social or-

ganizations has been each time attended by new moral, legal and other restriction: all kinds of laws, directions, and rules.

Inversely, as soon as the grammatical regulation is abolished, a language degrades, impeding mutual understanding, dismembering linguistic community and interrupting collective activities: see the Bible story about the Tower of Babel. Cancellation of traffic rules amplifies the individual choices (*i.e.* variety), almost automatically augments accident rate and finally destroys the entire traffic system. In paleontology, one of the 'phylogenetic rules' formulated by E. D. Cope (1904) states that any biological group has usually increased its taxonomic diversity just before extinction…

The Law of hierarchical compensations helps in a thorough treatment of some practical problems of modernity regarding globalization, global ecology and cultural policy.

The Specificity of Modern Crisis: 'Knowledge-Enabled Destruction'

Half a century ago many people did not believe that the 21st century would come, and there were strong reasons to doubt. The proliferation of nuclear weapons and missiles made the menace of global catastrophe very real, particularly by the 1960s. Besides the threat of a direct nuclear war, there were military load trials, which contaminated the atmosphere, soil and hydrosphere, collateral effects of the peaceful nuclear power engineering, destruction of nature through industrial pollution by the developed nations, and demographic explosion in the Third World.

After hard diplomatic battles, the Partial Test Ban Treaty (1963) became a landmark in the development of world ecological consciousness. Even those nations that rejected the Treaty (France and China) had to gradually reduce their nuclear weapons testing under the pressure of world public opinion. Subsequently, the naïve belief in the unquestioned safety of nuclear power plants was replaced by recognition of their menace, and resulting safeguards have radically lowered the danger of unpremeditated (without terrorist provocation) accidents. Local, regional, and global arrangements related to ecological problems have had impressive effects. Inter-state coalitions, not aimed against any outside enemy, have become a sign of our epoch. Energy-saving psychological attitudes have involved many spheres of production and everyday activity while giving additional impulse to the development of new information technologies.

Breakthrough in the political consciousness occurred after the compromise solutions to the Caribbean, the Berlin and the Middle East crises. People saw evidence to the politicians' capacity to abstain from using the most destructive weapons, and this abated the catastrophic expectations. There are obvious signs that global society's cultural and psychological fitting to atomic power had been successfully completed by the end of the 20th century, and after that 'classical' nuclear weapons finally transformed from the tool of aggression into the tool of deterrence. Humans learned to coexist with ballistic missiles as well as they had tamed (in chronologically descending order) firearms, steel, bronze and distant (bows and the like) weapons.

Nevertheless, we should also consider the other side of the coin. Mankind managed to escape a nuclear catastrophe at the price of channeling the global contradictions into the riverbed of almost continuous local wars. Up to 50 million people perished in the total sum of those wars (1946–1991); yet, this period of world policy is usually referred

to as the Cold War in the context of expected (in the worse scenario) billions of victims and also thanks to the fact that the real victims were dispersed in space and time. Unfortunately, people had not yet learned to live without 'hot' wars.

The situation had rapidly changed by the beginning of the 21st century. Today, although the global danger of 'classical' nuclear weapons has lowered (thanks to the fitting effect), the real danger has shifted to another sphere.

As technologies develop, social internal sustainability depends more and more on individual actions: this is a direct corollary of the techno-humanitarian balance model. It seemed, fifty years ago, that humankind had reached the peak of this historically increasing link, as its existence depended on several hundred persons with access to nuclear 'buttons'. Now we can see that it was not yet the height.

At the turn of the 21st century the US computer engineer B. Joy (2000) suggested that the epoch of weapons of mass destruction was changing into the epoch of *knowledge-enabled destruction*. On the one hand, advanced technologies like mini-bombs, nanotechnology, robotics, and genetic engineering (which have their far-reaching destructive options), are becoming cheaper. On the other hand, mass access to education and information is penetrating nations, classes and religions, and practices of terrorism are becoming highly sophisticated. As a result, more and more available weaponry is slipping out of the control of nation-states and their responsible governments and falling into the hands of particular corporations, groups and 'brilliant' individuals.

Under such conditions, local conflicts no longer serve as an escape value for global catastrophe. Calculations demonstrate that the level of physical violence in the modern world has fallen to an unprecedented level: for example, according to the data from the World Health Organization, the number of murders in the year 2000 (this includes political repressions, armed and everyday conflicts) was about half a million (Krug *et al*. 2002). The figure is monstrous by itself. However, it makes up 0.008 % of 6 billion population (the same publication informs us that even more people, 815 000, fell victim to the suicides). To be compared: in our calculations, average annual violent death rate in the 20th century was 0.15 %; in the Paleolithic tribes it was about 5 %.

At the same time modern individuals' *sensitivity* to violence has grown significantly, which creates a popular illusion of growing violence; what is still more important, its *social price* has grown as well. The multiplying technologies of terror are 'delocalizing' war conflicts and making each one fraught with global after-effects as never before.

Up to the present day the perfection of cultural self-regulation has been accompanied by dramatic elimination of social systems that have been unable to restore the broken balance. The Law of techno-humanitarian balance also admits the possibility of the crash of our planet's civilization under the weight of its own technological might. Today, we see an unparalleled rate of sharpening global problems on the one hand, while on the other, there is an unexampled velocity of information diffusion and processing, that is increasing societies' ability to undergo dynamic transformations. Accordingly, the key question of the modern epoch is whether or not our planet's civilization remains capable to continue improving its external and internal control as a reliable counterbalance to the accelerating growth of technologies.

Cosmic Perspectives of Intelligence and Universal Natural Selection

Theoretically, in the phase of instability, there are more than two (usually about seven) scenarios *(attractors)* of a complex system's further development; this is called *bifurcation* or more accurately, *polyfurcation,* in non-linear dynamics. As to the actual global

situation, it is easy to describe a set of scenarios that lead to the crash of world society and the end of evolutionary processes on the Earth. It is more important to outline the scenario that entails a new sustainability. Here, ignoring many details, we will consider the universal aspect of the issue.

In the 19th and early 20th centuries, 'cosmist' philosophers (G. Fichte, N. Fedorov, K. Tsiolkovsky) saw a universal perspective of civilization in boundless diffusion of the 'shock wave of intelligence' outside our cradle planet. Those prospects sharply conflicted with the naturalist worldview, and their authors were subject to mockery. However, our generation of the late 20th century witnessed the human flight into space. What is still more significant, the post-classical methodology unlike the classical natural science admits the possibility in principle that intelligence can become a factor in cosmic development.

As a psychologist, I have written on this subject, arriving at my conclusions by extrapolating data about the evolution of intelligence, as well as heuristics and gestalt theory. In the new constructive paradigm we find out that boundaries imposed on engineering by physical laws are surmountable by a change of the cognitive meta-system. Specifically, those constructs of the problem situation, which were uncontrollable constants inside one model, become manageable variables within a more complex meta-model (Nazaretyan 1991, 2004, 2005b). Therefore, there are no absolute limits for intelligence-induced management of mass-energy processes, and a potential perspective of intelligence is linked to its expanding influence upon cosmic evolution.

US physicist D. Deutsch (1997) substantiated similar conclusion from the point of view of modern natural science. 'Neither our theory of stellar evolution nor any other physics we know' gives any reason to restrict the potential influence of life on the cosmic processes, Deutsch writes.

> Throughout our Galaxy and the multiverse, stellar evolution depends on whether and where intelligent life has evolved. <…> The future history of the Universe depends on the future history of knowledge. <…> When we apply our best theories to the future of the stars, and of the galaxies and the universe, we find plenty of scope for life to affect and, in the long run, to dominate everything that happens, just as it now dominates the Earth's biosphere (Deutsch 1997: 183–186).
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> Deutsch also appeals to the 'Turing principle': there is no upper limit to the virtual-reality generators that will actually be built somewhere in the multiverse; in other words, opportunities for intellectual control are boundless. Therefore, if the intelligence descending to the Earth's civilization does not achieve control over Metagalaxy processes (possibly, because of our self-destruction), someone else will do it – 'presumably some extraterrestrial intelligence' (*Ibid.:* 353).

The Turing principle in Deutsch's version develops the well-known system theory principle of realization of all the possibilities: any event that *can* occur in the system *does* occur. The Mendeleev Table is based on this principle, and the physicists proceed from the same principle in their search for the theoretically possible particles, *etc*.

Having acknowledged as possible and therefore liable to realization both cosmic development of intelligence and its self-elimination, we see an obvious paradox. To solve the paradox, we must assume multiple hotbeds of evolution in the Universe, in which all

the evolutionary scenarios are embodied, including collapse of biospheres and civilizations at each of the crucial phases. This, in turn, logically implies a surmise of the *universal natural selection*. Evolving life systems on various planets that cannot cope with crises at one or another phase become waste products of universal evolution. Only those few that do survive reach the cosmic stage and continue the process of Big History.[3]

There are indirect reasons (see below) to suggest that only one of many planetary civilizations is able to develop into a factor essential on the Metagalaxy scale, and that it has not yet occurred. There are also reasons to suggest that the next polyfurcation, which leads the Earth's civilization either to collapse or transition to a cosmic stage, is not a matter of fantastic futuristic thinking: this will probably happen during the lifetime of the next generation.

Snooks – Panov Vertical

In 1996 the Australian global historian G. D. Snooks published calculations that showed acceleration in evolutionary processes from the origin of life to postindustrial civilization. He discovered that over the course of 4 billion years, the time between global phase transitions in biological, pre-social and social history have been sequentially shortening in compliance with a single logarithmic equation, namely that each major biological/technological transformation took only one-third of the time of its predecessor (Snooks 1996).

The Russian physicist A. Panov (2005), who did not know about Snooks's work, deduced a similar equation. He followed a different cultural and disciplinary tradition, used different sources (among them, the first [2001] edition of a book of mine [Nazaretyan 2004]), and employed an alternative and more precise mathematics. Moreover, a particular speculative assumption allowed tracing the period of logarithmic acceleration back to 10 billion years ago: to the moment of emergence of heavy elements in the Universe (inside first generation stars), which began a new mechanism of self-organization. As light elements fuse, a quantum of energy is thrown out, while to synthesize a complex molecule, energy from outside is required. Thus, competition for free energy has launched development toward organic compounds; subsequently, the accelerating process of structural complexity has localized on the Earth and perhaps at other points in the Metagalaxy.

The empirical formula has demonstrated the unity and continuity of universal evolution. Of still more significance, an extrapolation of the hyperbolic graph-line gives a most striking result: in the near future, it becomes vertical! This mysterious formal result has been designated as the *Snooks – Panov Vertical*.

From the merely mathematical point of view, this means that the formula describing the course of events over a period of billions of years becomes senseless several decades from now! The velocity of evolutionary transformations goes to infinity, and the intervals between phase transitions vanish. What kind of objective reality can be revealed by this formal extrapolation?

The two authors' interpretations are diametrically opposed. In Snooks's (2005) view, the line of acceleration will reach an asymptotic direction: the disproportions in social development will be overcome, and humankind will progress rapidly toward a perfect state, but never achieve it. In other words, material transformation, or economic revolution, will become continuous but stable. Although Panov (2005, 2007) has modified his suggestions, his general idea is that the line is to acquire a logistic form and the vertical

will change into a horizontal: historical development will achieve its plateau and all of the traditional phenomena like policy, wars, scientific and technological progress will be left in the past.

In my view, so far as the equation reflects a huge fragment of Big History, its 'singularity point' must prospectively mark events of universal (not just planetary) importance. In other words, either the collapse of the Earth's civilization or a phase transition, perhaps congruent, because of its evolutionary impact, with the emergence of living matter, will have occurred by the middle of the 21st century. Probably, the second or 'progressive' scenario implies the next spire of 'digressing from the natural state' as a condition for sustainable preservation of our planetary system, penetration into super-minute and super-dimensioned spaces, so that intellectual activity, which has actually become a geological factor, is likely to reach the cosmic scale.

Just in this point, trying to see the details of the two scenarios, we are facing the problem of meaning-formation.

Viability and the Worldview Paradigms: Ideology *vs*. Civilization?

In history we can find very few cases of a society restoring techno-humanitarian balance by rejecting new technologies. This way of escaping from crises could only be local and temporary, however, because it made the societies defenseless against external menaces. *From a strategic perspective, it is only the elevation of humanitarian intelligence (i.e. socio-cultural regulation) to the level of technological might that has maintained civilizations' sustainability*. Humans have learned to live with new technologies by accumulating the experience of anthropogenic catastrophes and perfecting their cultural and psychological behavior regulation and thus abridging the menaces that technological growth inevitably carries.

At present the campaigns for nuclear and other disarmament are of tactical importance as they promote mass recognition of the menaces. But the dividing line between military and non-military technologies is diffusing, and mankind cannot cope with the sharpening crises (from resource deficits to genetic degeneration) without increasingly newer technologies. As it has ever been before, the strategic perspective is related to cultural and psychological adjustment and, accordingly, to radical perfections in mass consciousness.

The challenges of modern technological development have resulted in a qualitatively new problem for humanity. From the Paleolithic time to our days, the problem of internal sustainability has been related to *structuring* social violence and preventing its most arbitrary and chaotic forms. Actual problem is *to remove* physical violence from social life, and it is unsolvable by the habitual means. Advanced communication technologies contribute to solving this problem by virtualization of violent actions (Nazaretyan 2009a), but ultimately, nothing short of radical global conscience can succeed.

Violence structuring has been essentially achieved by transferring in-group aggression outwards. For this purpose, culture has been producing *ideologies*, which competed among themselves, replaced one another and so ensured group consolidation by creating 'us' *versus* 'them' discrimination.

> The term 'ideology' in the new European tradition descends to the late 18th century: the French evolutionist P. Cabanis invented it for a specific scientific research into the biological grounds of thinking. His effort to develop such a discipline failed, and subsequently, Napoleon Bonaparte used this word as a cliché to qualify infertile political speculations.

> After that, false social theories that defended particular interests of a particular large group (before all, the nations) opposed to the interests of the other groups were called ideologies. After the class struggle in Europe sharpened, a new concept of 'class ideologies' appeared. The Communists introduced a paradoxical collocation 'scientific ideology' implying that the proletarian ideology was based on the 'objective truth'.
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> Since the expression 'scientific (or truthful) ideology' is actually out of use, the traditional understanding of ideology as a rationalization of a group political interest has been reinstated. It is in this sense that we use the term here.

Ideology is an anti-entropy mechanism for people's consolidation in large groups by their contraposition to other people on the basis of adherence to a particular set of sacral symbols. These discriminating symbols are constructed by mythologizing some real or fictitious events, persons, figures of speech and visual images saddled with mystical qualities and senses. The practices of the latest centuries have shown that, given a psychological disposition, any constructs may become subject to a procedure of mythologization. In this way, nation, class, materialism, atheism, democracy or market may serve as sacral symbols, as well as god, faith or king. What is inherent in any ideology is a more or less accentuated religious (or quasi-religious) kernel: consolidation of the 'co-religionists' in joint rejection of the 'infidels'; accordingly, real or potential war remains the immutable companion of the ideological worldview.

The perfection of cultural regulation for restoring techno-humanitarian balance at the crucial phases of history has usually included amplification of group identities. Thus inter-tribal hostility in the Paleolithic gave way to multi-tribe consolidation (chiefdoms) of the Neolithic, as people learned 'for the first time in history how to encounter strangers regularly without attempting to kill them' (Diamond 1999: 273). In the Bronze Age, by further military conquests some of the chiefdoms consolidated into the first multi-ethnic city-states, which viewed other city-states and chiefdoms as enemies: 'all humanity remained in the condition of perpetual and most frequently armed opposition between the societies' (Diakonov 1994: 29).

As steel weapons were considerably cheaper, lighter, and more durable than the ones made of bronze, they radically aggravated the bloodshed, and to maintain viability of the leading societies, the Axial Revolt (800–200 BC) transformed the system of political values over an immense geographical area from Judea, Persia and Greece to India and China. Enemies learned to see each other as human beings, understand, and sympathize and no longer evaluated their generals' prowess by the number of killings and destructions. *Mythological thinking* oriented towards the idea of heavenly penalties for violation of social norms partly made room for *critical thinking* and moral of individual responsibility. Therewith, formation of the first empires stimulated the next amplification of the community scale that one could identify as 'mine' *versus* 'hostile'.

The ideas of collective humanity started to take shape in the Axial Age. But those ideas proved to be too refined for the slaves and barbarians who overflowed the historical scene centuries later on the wane of the first wave of the Axial Age and who could not conceive the world without Lord or Chief. Those philosophies that rejected both human's submission to the man-like heavenly power and group confrontations were dislodged to the periphery of spiritual culture as 'redundant varieties'. The World religions, which appealed to blind faith, mystical fear and hope proved to be much more consonant with the times. Instead of the tribal and state demarcations, humans were divided by

confessional affiliation. 'He who is not with Me is against Me'; 'I came to bring not peace but a sword', Jesus Christ said (Math., 12:34, 12:30). Muhammad developed the idea: 'When ye meet the Unbelievers, smite at their necks' (The Quran, Sura 47, 4). In India, Krishna worship and Buddhism with their humanist-like orientation were ejected by the eclectic and confrontational Hindu ideology (Kanevsky 1998; Alaev 2007).

The spread of the World religions enlarged the scale of group identifications again, even compared to the imperial communities. At the same time, the tolerance for adherents of different faiths 'completely remained in the past' (Diakonov 1994: 70) and 'fanaticism in war, of the type [that] drove recorded Christian and Islamic conquests, was probably unknown on Earth until chiefdoms and especially states emerged' (Diamond 1999: 282).

The fanaticism of religious wars became indeed a whip for the Europeans in the Late Middle Ages because of the development of firearms. During the Thirty Years' War up to 80–90 % of adult male population perished in some parts of Central Europe. The Westphalian Peace Treaty (1648) and its resulting political system saved Europe from the most destructive religious (or quasi-religious) wars for the next 266 years. However, weakening religious delimitations were being replaced by the ones based on nation or class: ideology remained an attribute of the social mind, and wars remained an attribute of social existence.

Both war and production technologies of the second half of the 20th century extremely uncovered the menace of global catastrophe and required non-confrontational interstate and interclass coalitions to save our civilization. However, the conception of 'universal values' has also accreted with ideological accents becoming in certain cases an instrument for economic, political and military pressure. As a protest against Westernization, multiple theories of 'regional civilizations' have developed on the opposite flank, and here we find masked national and religious fundamentalism.

It is important to note that until recently both ideologies and wars have been not only immutable but also indispensable factors in social existence and development. It is no mere chance that only those religious doctrines were really in demand which provided politicians with ideological motivation of inter-group hostility. Early Christians hated 'pagans', destroyed antique temples, broke statues with stones, killed philosophers and looted marketplaces before they got political power (Gaev 1986), but considered the usage of combat weapons sinful. Still, once power was in their hands, they developed the conception of 'sacred' wars, for which St. Augustine found plenty of authority in the Bible.

Since that time, the mainstream Christian churches have never condemned war as such as a sinful action (Contamine 1980), but more than once has censured pacifists for their 'heretical' appeals. Logically, in 'them *versus* us' matrix, the only effective technique to prevent or suppress a particular war is the transfer of aggression onto a common enemy; this technique has been widely exploited by religious authorities. Therewith, if the influence of a certain (religious or quasi-religious) ideology enveloped vast territories, it soon divided into hostile heresies and sects full of ever more spiteful mutual hatred.

We should also keep in mind that both ideologies and wars respond not only to social needs but also to intrinsic functional needs of individuals, so that the emotional factor has encouraged their regular reproduction as well. Psychologists who investigate

the opportunities to remove violence from social life have repeatedly demonstrated that spiritual needs are more easily satisfied within a religious or quasi-religious context, especially in case of intensified inter-group conflicts, than in a secular and peaceful context (Lorenz 1981; Rapoport 1993; May 1972; Audergon 2005; Nazaretyan 2008). Affiliation and a sense of security, sympathy and self-sacrifice, thirst for immortality and for the meaning of life often move the masses to support the most aggressive ideologists and politicians. The unconscious drive to tap strong and ambivalent affective experiences, which are excited by an armed conflict, is so deeply interwoven in the human emotional fabric that all kinds of substitute activity developed in culture (art, rituals, sports) have been able to inhibit its actualization only provisionally. Sooner or later the craving for the 'not for fun' passions is intensified, and individuals feverishly seek its 'rationalization'.

Those phases in the oscillatory dynamic of mass sentiments are spectacular for ideologists. They feel by their internal experience that the inertia of mythological worldview has not been eradicated by millennia of civilization. The burden of individual responsibility is distressing, and an adult, like a child, feels more comfortable under the auspices of an all-powerful Lord (father's Father) who can always punish them and embrace them and lead them down the Road of Truth. A sweet sensation of dependence on Authority is the emotional background of infantile and slave mentality.

The question of whether religion is an adaptive mechanism or a kind of a *'virus'* in the human mind has been intensively discussed of late in evolutionary ethics (Dawkins 2006; Boyer 2008; Norenzayan and Shariff 2008; Markov 2009). The complexity-studies approach provides some amendments to this discussion. The anti-entropy mechanism of religious and quasi-religious ideologies has played a stabilizing role throughout millennia. Nonetheless, by the Law of delayed dysfunction, it is becoming counter-productive at our new historical stage, so that the explosive mixture of mystical impulse with fatal rationality of modern weapons is threatening to blow up global civilization. Insufficient awareness of the menace increases the danger of planetary collapse (see the concepts of 'menace' and 'danger' above).

This is a dramatic collision-point of modernity. The humanitarian counterbalance to rapidly developing technologies urgently demands the emancipation of our mind from religious and ideological crutches (otherwise, modern society is doomed), but without those crutches humans feel uncomfortable. We have to suggest that in the observable future either the human (post-human? man-machine?) mind will outgrow the inertia of an ideological worldview or the ideologically-minded humanity will destroy civilization.

From there, our evaluation of the global perspective depends on the answers to the following questions.

First: *Is strategic meaning-making in an entirely secular context feasible in principle or not?* Having accepted that in our Universe meaning-making is anyhow tied to (quasi)religious beliefs through the logic of prior knowledge or inbred gestalts (beyond such beliefs life's meanings eventually fail), we cannot escape a sad deduction. Namely, there is a certain limit for technological development after which civilization on any planet destroys itself, and the evolution on the Earth is approaching this limit. If this is so, then the cosmic perspective of intelligence, which is theoretically allowable from the point of view of physics, complexity theory and heuristics, is shortened by the laws of cultural anthropology and social psychology, as far as the opportunities of outward control exceed the range of psychological self-regulation. As a result, the developments

of life and intelligence look like the side effects (epiphenomena) in a particular stage of the evolution of the physical Universe, ones that can never play an essential role in the process. After all, long-term universal prospects are reduced to the physical scenarios (including natural deaths of planets, stars, galaxies and particles), and the 'silence of Cosmos' gets a most trivial explanation: there can be no intelligence-induced activities outside some local spheres.

> This conclusion corresponds to the methodology of the *Anthropic cosmological principle* in its so-called weak (non-teleological) version. Had one of the basic constants of the physical world slightly differed (for instance the ratio between the masses of proton and electron), protein molecules could not have emerged. In the 'weak' version, it is conjectured that a conscious observer emerges only in those universes of the infinite Multiverse, which by chance get all of the constants happily combined.
>
> We do not know if the range of freedom in thinking (imagination) is limited by the prior mental constructs determined in turn by the physical properties of the Metagalaxy, or to what extent it is. But we do know that the specific weight of mental realities in the aggregate determination of material processes has been steadily increasing throughout the history of life and society: this is demonstrated by the huge mass of empirical data on evolutionary biology and historical ecology. As a result, the mental component is actually becoming the determinant factor in further development. From there comes our assumption: if the field of meaning-making has an immanent boundary, further evolution may be excluded because of limited ability to restore the techno-humanitarian balance.
>
> Gestalt-psychologists were among the most confirmed adherents to the Kantian doctrine of prior ideas in the 20th century science. However, there are reasons to suppose that their experimental results were based on an insufficiently representative sample of subjects. This was shown in the 1930s by A. Luria and his pupils in the Middle Asia and later on by his followers in Africa (Luria 1974; Cole and Scribner 1974). Their researches demonstrated that the adults, who had not gone to European schools, did not have either inherent images of geometric figures or instinctive sense of syllogism, *etc*. If so, our supposition about prior closure of the strategic meaning-making inside (quasi)religious constructs may be premature: it is merely a strong historical momentum, one that is surmountable in principle. In this case, humanity's 'full age' in the future 'nonecclesiastical world', forecast by the German philosopher and priest D. Bonhoeffer (1997) in the first half of the 20th century, might be achievable.

If we answer the first question in affirmative, it is appropriate to suppose that the capacity to develop and adopt the strategic life's meanings free from (quasi)religious context is the precondition for the cosmic diffusion of any planetary civilization at this stage of the universal natural selection. In this case, the 'silence of Cosmos' may testify to the fact that either no civilization in the Metagalaxy has yet reached the relevant stage of development or none of those that have reached this stage, could have passed the maturity test (the test of secular meaning-making). From here, we face the second question: *Whether or not will the civilization on the Earth achieve its intellectual full-age before it irreversibly slides down to self-destruction?*

The psychological specification about universal natural selection is that an intellectual agent, whose self-identification is attached to a particular nation, religion or class, cannot become universal and rise to a cosmically significant level; as a result, he is unable to escape self-destruction beyond a certain level of technological might. To achieve universality, *intelligence is to be highly individual and, therefore, cosmopolitan*.

What might be the content of meaning-making strategies and the new worldview reference points is an important issue for multi-disciplinary discussions. I see a reason for hope in the fact that the elements of strictly secular and critical worldview have been accumulated in world philosophical thought during the latest 2500 years. They are there in the doctrines of the Greek and Chinese philosophers in the origin of the Axial Age, of the Arab *Zindiq*s (Atheists) of the 10th century CE, of the Renaissance humanists, of the Progressives and the Enlighteners in the Modern Era, of the pantheist materialists, the agnostics and the skeptics, and others.

These great thinkers, who tried to meet the challenges of their own epochs, sought the background for morality free from otherworldly sanctions and searched for a direction for life activities outside the framework of individual existence, but without the appeals to celestial sovereigns or the collective totem, of spirituality without mysticism and of solidarity without confrontation. Although their ideas were not adequately appreciated by the majority of their contemporaries, they are now claimed by history, and the 'redundant variety' of those ideas may constitute a framework for the new worldviews.

The dissemination of computer networks, accompanied by the development of their mechanisms and languages is a material factor in loosening religious-ideological attitudes. Under its influence, linear ('bookish') thinking is being superseded by the mosaic and palliative thinking, which is less prone to dogmas. The frontiers of state, confessional and regional 'civilizations' are being washed away: the intensity of individual contacts is becoming less and less shaped by geographic location, as well as one's contacts hardly depend on residence in a megalopolis with good telephony.

This process entails a networked organization of the world community, limitation of variety and the dying out of *macro-group* cultures (national, confessional, and class) that are always constructed according to 'them *versus* us' scheme. By the Law of hierarchical compensations, the unification in basic values and norms is a premise for a growing diversity of *micro-group* cultures, which are built on actual common interests and repeatedly interlaced among themselves; such cultures are therefore non-confrontational and do not need ideological braces.

Antagonism of the two trends – the resuscitation of fundamentalism and 'religious Renaissance' on the one hand, and globalization and washing out of the macro-group demarcations on the other – is the *leitmotif* of our modern stage in world history. The destiny of the Earth's civilization may essentially depend on how this antagonism will be resolved.

It goes without saying that the survival scenario does not foreshadow the idyll: realistic scenarios differ from utopian ones in their capacity to foresee the price for success. Progress will bring, as always, an increasing stream of new global problems related to the next spire of the 'digression from the natural state', development of genetic engineering, man-machine intelligence, and so on. The multidimensional conflict between the artificial and the natural may become the pivot of global problems by the middle of the 21st century, and the next decades will be marked by a cardinal review of such fun-

damental categories as *life, death and immortality, human and machine, solidarity, mind and intelligence…*

NOTES

[1] *Big History, Universal History, Mega-History* and *Weltallgeschichte* are the terms (in various national traditions) for the single cross-disciplinary model of evolution involving its cosmological, geological, biological pre-social and social stages. *Complexity theory, synergetics, chaos theory, theory of dissipative structures* and *nonlinear non-equilibrium thermodynamics* are the designations of the single model of self-organization and sustainable non-equilibrium involving relevant processes in physics, chemistry, biology, anthropology, sociology and psychology.

[2] Instrumental (culture, intelligence) here and below refers to technologies and abilities to handle them.

[3] In synergetic terms, those planetary systems eventually succeed, which have successively followed 'progressive' scenarios, *i.e.* at each polyfurcation stage they have moved toward the *strange attractor* – the sustainable state at a higher non-equilibrium level *versus simple attractors* – regressive sustainability on a lower level of non-equilibrium.

REFERENCES

Alaev, L. B.
2007. *The History of the East.* Moscow: ROSMEN. *In Russian* (Алаев, Л. В. *История Востока*. М.: РОСМЭН).

Ashby, W. R.
1964. *Introduction to Cybernetics*. London: Methuen.

Audergon, A.
2005. *The War Hotel. Psychological Dynamics in Violent Conflicts*. London – Philadelphia: Whurr Publishers.

Bonhoeffer, D.
1997. *Letters and Papers from Prison*. New York, NY: Simon and Schuster

Boyer, P.
2008. Religion: Bound to Believe? *Nature* 455: 1038–1039.

Cole, M., and Scribner S.
1974. *Culture and Thought. A Psychological Introduction*. New York, NY: John Wiley & Sons, Inc.

Contamine, Ph.
1980. *La Guerre au Moyen Age*. Paris: Presses Universitaires de France.

Cope, E. D.
1904. *The Primary Factors of Organic Evolution*. Chicago, IL: Open Court Publications.

Dawkins, R.
2006. *The God Delusion*. New York, NY: Private Eye.

Deutsch, D.
1997. *The Fabric of Reality*. London – New York: Allen Lane, The Penguin Press.

Diakonov, I. M.
1994. *The Paths of History. From the Ancient Humans to Our Days*. Moscow: Vostochnaya Literatura. *In Russian* (Дьяконов, И. М. *Пути истории: От древнейшего человека до наших дней*. М.: Восточная литература).

Diamond, J.
1999. *Guns, Germs, and Steel. The Fates of Human Societies*. New York – London: W.W. Norton & Company.

Gaev, G. I.
1986. Christianity and the 'Pagan Culture'. *Ateisticheskie Chteniya* 16: 24–35. *In Russian* (Гаев, Г. И. Христианство и «языческая культура». *Атеистические чтения* 16: 24–35).

Hayek, F. A.
1990. *The Fatal Conceit. The Errors of Socialism*. Vol. I. Chicago, IL: The University of Chicago Press.

Joy, B.
2000. Why the Future doesn't Need Us? *Wired* April: 238–262.

Kanevsky, L.
1998. *Cannibalism*. Moscow: Cron-Press. *In Russian* (Каневский, Л. *Каннибализм.* М.: Крон-Пресс).

Krug, E. G., Dahlberg, L. L., Mercy, J. A., Zwi, A. B., and Lozano, R. (eds.)
2002. *World Report on Violence and Health*. Geneva: World Health Organization.

Lorenz, K.
1981. *Das sogenannte Bose. (Zur naturgechichte der Agression).* Munchen: Dt. Taschenbuch Verlach.

Luria, A. R.
1974. *On the Historical Development of Cognitive Functions. An Experimental Psychological Inquiry*. Moscow: Nauka. *In Russian* (Лурия, А. Р. *Об историческом развитии познавательных процессов. Экспериментально-психологическое исследование.* М.: Наука).

Markov, A. V.
2009. Religion: A Useful Adaptation, a Side Product of Evolution, or a 'Brain Virus'? *Istoricheskaya psikhologiya i sotsyologiya istorii* 2(1): 45–56. *In Russian* (Марков, А. В. Религия: полезная адаптация, побочный продукт эволюции или «вирус мозга»? *Историческая психология и социология истории* 2(1): 45–56).

May, R.
1972. *Power and Innocence.* New York, NY: Norton.

Nazaretyan, A. P.
1991. *Intelligence in the Universe: Sources, Formation, and Prospects*. Moscow: Nedra. *In Russian* (Назаретян, А. П. *Интеллект во Вселенной: истоки, становление, перспективы*. М.: Недра).

2004. *Civilization Crises within the Context of Universal History. Self-organization, Psychology, and Forecasts.* 2nd ed. Moscow: Mir. *In Russian* (Назаретян, А. П. *Цивилизационные кризисы в контексте Универсальной истории. Синергетика, психология, прогнозирование*. М.: Мир).

2005a. Fear of the Dead as a Factor in Social Self-organization. *Journal for the Theory of Social Behavior* 35(2): 155–169.

2005b. Western and Russian Traditions of Big History: A Philosophical Insight. *Journal for General Philosophy of Science* 36(1): 63–80.

2008. *Anthropology of Violence and Culture of Self-organization. Essays on Evolutionary Historical Psychology.* 2nd ed. Moscow: LKI. *In Russian* (Назаретян, А. П. *Антрополо-*

гия насилия и культура самоорганизации. Очерки по эволюционно-исторической психологии. М.: ЛКИ).

2009a. Virtualization of Social Violence: a Sign of our Epoch? *Istoricheskaya psikhologiya i sotsyologiya istorii* 2(2): 150–170. *In Russian* (Назаретян, А. П. Виртуализация социального насилия: знамение эпохи? *Историческая психология и социология истории* 2(2): 150–170).

2009b. Technology, Psychology and Catastrophes: On the Evolution of Non-violence in Human History. *Social Evolution & History* 9(2): 102–132.

Norenzayan, A., and Shariff, A. F.

2008. The Origin and Evolution of Religious Prosociality. *Science* 322: 58–62.

Panov, A. D.

2005. Scaling Law of the Biological Evolution and the Hypothesis of the Self-consistent Galaxy Origin of Life. *Advances in Space Research* 36: 220–225.

2007. *Universal Evolution and the Problem of Search of Extra-terrestrial Intelligence (SETI)*. Moscow: LKI. *In Russian* (Панов, А. Д. *Универсальная эволюция и проблема поиска внеземного разума (SETI)*. М.: ЛКИ).

Rabotnov, N. S.

1992. Shall We Enter the 21st Century with Firewood? *Znamya* 11: 195–213. *In Russian* (Работнов, Н. С. С дровами в XXI век? *Знамя* 11: 195–213).

Rapoport, A.

1993. *Peace as a Mature Idea*. Darmstadt: Darmstädter Blätter. *In Russian* (Рапопорт, А. *Мир – созревшая идея*. Дармштадт: Дармштадтер Блаттер).

Sedov, E. A.

1993. Information and Entropy Attributes of Social Systems. *Sotsialnye nauki i sovremennost* 5: 92–101. *In Russian* (Седов, Е. А. Информационно-энтропийные свойства социальных систем. *Общественные науки и современность* 5: 92–101).

Snooks, G. D.

1996. *The Dynamic Society. Exploring the Sources of Global Change*. London – New York: Routledge.

2005. The Origin of Life on Earth: A New General Dynamic Theory. *Advances in Space Research* 36: 226–234.