WESTERN AND RUSSIAN TRADITIONS OF BIG HISTORY: A PHILOSOPHICAL INSIGHT

AKOP P. NAZARETYAN

SUMMARY. Big History – an integral conception of the past since the Big Bang until today – is a novel subject of cross-disciplinary interest. The concept was construed in the 1980–1990s simultaneously in different countries, after relevant premises had matured in the sciences and humanities.

Various versions and traditions of Big History are considered in the article. Particularly, most of the Western authors emphasize the idea of *equilibrium*, and thus reduce cosmic, biological, and social evolution to the mass-energy processes; the informational parameter involving all mental and spiritual aspects are seen as epiphenomena of material structures' complication that do not play their own role in evolution. In Russian tradition ascending to A. Bogdanov, E. Bauer, I. Prigogine, and E. Jantsch, *sustainable non-equilibrium* patterns are used. This implies attention to the pan-material sources and evolution of mental capacities and spiritual culture (as basic anti-entropy instruments) and humans' growing intervention in the material processes on Earth and outside it.

The non-equilibrium approach in the context of modern control and self-organization theories, alters the portrayal of the past, and still more dramatically, estimation of the civilization's potential perspectives.

Key words: Universe, evolution, Big History, global history, world history, mega-trends, sustainable non-equilibrium, life, intelligence, control, matter, energy, information, techno-humanitarian balance, crises, scenario

Two significant events gave rise to this article. One was the publication of D. Christian's monograph *Maps of Time: An Introduction to 'Big History'* (Christian, 2004). The other was the forming of a special Big History section at the Historical Society's 4th biennial conference in June 2004.[1]

Since the early 1990s, the Australian–American historian David Christian has been developing an integral conception of the past, in which human history is viewed as a phase of Earth, biosphere, and Metagalaxy evolution. He is the author of the term *Big History* that has subsequently spread into English-language literature (Christian, 1991; Spier, 1996; Chaisson, 2001; Huges-Warrington, 2002). Simultaneously, the equivalent terms of *universal evolutionism*, *Universal History* (from 'the Universe'), and *Mega-History* have been adopted in relevant Russian

Journal for General Philosophy of Science (2005) **36:** 63–80
DOI: 10.1007/s10838-005-7154-7

papers (Moiseev, 1991; Nazaretyan, 1991, 2002, 2004; Fedorovich, 2000, 2002; Universal History: The Cross-Disciplinary Approaches, 2001; Panov, 2004).

The inclusion of the Big History section in the conference of the Historical Society is also to a considerable extent due to D. Christian's work and authority. Its significance becomes obvious if we recollect that a couple of decades ago Western historians used to disdainfully treat any research as 'sociology', which overlapped a period of one to three generations, while the sociologists in their turn, preferred 'middle level conceptions', and rejected more powerful generalizations as 'philosophy'. Lately, many analysts have indicated rapidly growing interest toward panhuman history as a single, coherent story (McNeill and McNeill, 2003); in particular, this has been caused by the requirements of global forecasting.

Nevertheless, Big History's utmost retrospection is still a point of distrust both in Western and Russian professional historical communities. This attitude arises from the inertia of mono-disciplinary mentality on the one hand, and on the other hand, insufficient development of a methodology to integrate diverse disciplinary patterns, such as: astro- and micro-physics, chemistry, geology, biology, paleontology, anthropology, psychology, and historiography. This is why the Big History section seems to be a good sign both for the historians (who thus recognized the telescope as an acceptable research instrument in combination with the wide-lens objective and the microscope) and for other specialists who are searching for a coherent world portrayal. So it is distressing that professional philosophers were absent in the section's program, which showed wide disciplinary and geographical representation.

It should be noted that a growing number of modern universities include in their curricula Big (Universal) History courses, mostly for the humanities, to give the students a clear idea of the current evolutionary world picture. Rich Western universities usually invite cross-disciplinary groups of up to twenty professors to deliver lectures on the subject. After a general introduction, astrophysicists and astronomers explain the bases of relativity theory, Friedman and post-Friedman models of evolutionary cosmology, and hypotheses of solar system formation. Geologists tell the story of the Earth and formation of its structures, and biochemists and paleontologists go on to describe the evolution of the biosphere at geological time-scales. After that, archeologists and anthropologists expound the evolution of the *Hominidae* family and anthropogenesis. In the final stage, specialists in social history, historical sociology, and political science describe social history; a discussion on global forecasts completes the course.

Here, again, a curious fact is that psychologists and philosophers, as specialists in mental realities and spiritual culture are absent. This article will discuss some of the reasons for this. At the same time, the absence of

informational and psychological dimensions in such an ambitious world portrayal has been lately recognized as its shortcoming. It is no mere chance that D. Christian pays essentially more attention to far-from-equilibrium states in his latest book than he used to do in his previous papers. At the University of Amsterdam, the course is supplemented by the theme of the psychological dimensions of Big History, and to deliver this lecture, a teacher from Moscow is invited.

In Russia, very few universities have yet accepted similar programs of Big (Universal) History under the aegis of the standard program 'Conceptions of Modern Sciences' recommended by the Education Ministry. In those few ones, the course is taught by a single reader, usually a philosopher who is also qualified as a physicist or biologist.

Certainly, this 'universalism' of the enthusiasts (Russian universities are not rich and independent enough to afford gathering a group of professors for one course) limits the amount of details that can be discussed. Still, the positive aspect is that it requires higher attention to the methods of interdisciplinary synthesis.

1. THE CONSTRUCTS OF WORLD, GLOBAL, AND BIG HISTORY

The medieval historians were, in Le Goff's (1977) expression, 'great provincials'. Each one used to describe the events he observed as the center of human history, and had no reason to reflect on the differences between separate 'civilizations' stories.

Geographic discoveries, colonial conquests, geologists' and archeologists' findings, and especially the new outlook essentially broadened the Europeans' space and time horizons. Formation of nations, nation states and ideologies resulted in discrimination and conceptual confrontation between local histories. In the eighteenth and nineteenth centuries, together with national histories, the *world history* conception appeared, which rested on the idea of panhuman progressive development. Current versions of it have various divisions into periods, always ascending from prehistory (the Paleolithic) to the modern history.

Originally, the concept was distinctly Euro-centric, which in the nineteenth and especially in the twentieth centuries, was strongly criticized by 'civilization approach' adherents (N. Danilevski, O. Spengler, early A. Toynbee, etc.), and later, 'historical particularists', 'post-modernists', and religious and national fundamentalists. Together with the Euro-centric ideology, the idea of panhuman history was denied, and Spengler (1980) even proposed to consider *humankind* as merely a zoological concept.

In the twenty-first century, the world-historian standpoint is not yet shared by all historians or sociologists. Still, archeological,

anthropological, and historiographical discoveries in the previous century disavowed the two key arguments by N. Danilevski and O. Spengler: those were that there had been no progression in the development of regional civilizations, and there had been no meaningful events for all of humankind (i.e. anyone meant only for this or that separate civilization). As there are abundant testimony for the mainstreams of human history and prehistory,[2] in a scientific (unlike ideological) discussion one may question certain interpretations but not world history as a subject matter.

Moreover, in the first half of the twentieth century, the profound mutual influence of geological, biotic, and social processes was revealed. As a result, a novel cross-disciplinary field took shape – *global history*: the planetary story seen as the successive formation, evolution, and interaction of the structures in which first the biota and then the society turned to be the leading agents.

The Russian biochemist V. Vernadsky and the French anthropologist P. Teilhard de Chardin and the philosopher E. Le Rouis were among the discoverers of global history. They proved that human history had been a phase in the evolution of the Earth, which culminated (or will culminate) in the 'Noosphere' – the sphere of maximum intellectual control over planetary processes. The global history approach has been developed further in more recent works (Golubev, 1992; Snooks, 1996). Particularly, the Australian global scientist G. Snooks has developed and applied a general dynamic theory of life and human society.

It is curious that in the 1930s, Vernadsky (1978) did not pass over the question whether the evolutionary standpoint could be extrapolated beyond Earth and the Solar System, but his answer was undoubtedly negative. Not being a specialist in theoretical physics, he ignored relativist cosmological models; like most of his contemporaries, he shared the idea of a stationary, isotropic, and infinite in space and time universe. That idea, which descended from Giordano Bruno obviously contrasted with universal evolution: eternity cannot have a history! Since the Russian scientist did not see an alternative to Brunian cosmos portrayal, he had to recognize that the evolutionary processes on Earth were nothing but an ordinary local fluctuation, which was doomed to dissolve with time in the infinite universe, like an ocean wave. As to the universe on the whole, he argued, it had always remained and would always remain exactly as we find it.

Before V. Vernadsky, many outstanding thinkers (F. Bacon, J. Condorcet, Ch. Fourier, F. Engels, and others) had been racking their brains over the problem of concordance between philosophy of progress and a naturalist account of reality. All of them, more or less explicitly, came to the same discouraging conclusion: no infinite perspective for life and spirit is thinkable if the destinies of Earth and Sun are limited. At the best, it was assumed that eternal matter was regularly producing splashes like the evolution of

Earth in various points of cosmic space, but any continuation or progression between those local stories were excluded.

Only the most unreserved German and Russian 'Cosmists' who used to be the laughing stock of their contemporaries, dared argue that the intelligence would lead its bearer outside his cradle planet, and Earth civilization's influence would expand far into boundless cosmic space, which would guarantee the infinite progress. These were G. Fichte, A. von Humboldt, N. Fedorov, and K. Tsyolkovsky.

Still, even the 'Cosmists' extended their evolutionary outlook to the future but not to the past: the pre-human cosmos remained outside history. As to "respectable" science, up to the twentieth century, the only reason to assume a universal mega-trend could rest on the second law of thermodynamics. Its rational corollary stated that if the world was a single whole, it had to be continually degrading with time from the maximum organization toward absolute entropy. The heat death theory in physics harmonized with the biological theory of catastrophes argued by the father of paleontology J. Cuvier and his pupils: new living forms cannot spontaneously emerge, and their original diversity on Earth has successively decreased because of the geological and cosmic cataclysms. The conceptions of social and spiritual decay constituted the roof over this theoretical building, which had been raised long before the building's walls and groundwork appeared.

While the idea of a descending trend had powerful alternatives in nineteenth century sociology and biology (A. Comte, H. Spencer, C. Darwin, K. Marx), physics could set off against heat death theory only a thesis that the infinite universe was an open system, and therefore, free from thermodynamic laws, *ergo*, from history. However, the empirical data that testified to consecutive evolution of life and society, and relevant conceptual conclusions strongly contrasted with the thermodynamic generalizations; as one physicist put it, "Clausius and Darwin cannot be both right" (quoted from Prigogine, 1981).

The *Big (Universal) History* concept that considers evolution from Big Bang to current society, appeared in the 1980–1990s. At least, two crucial achievements in the twentieth century science served as premises for that.

First, relativist evolutionary cosmology models had been mathematically deduced, received indirect empirical support (redshift effect, cosmic background radiation, etc.), and were commonly recognized. Historical method deeply penetrated into physics and chemistry: all material objects from the nucleons to the galaxies proved to be temporal products of a certain evolutionary stage, which had their histories, pre-histories, and naturally restrained future.

Second, a set of natural mechanisms had been discovered by which open material systems could spontaneously move away from equilibrium within their habitat, and using the environment's sources for anti-entropy work,

sustain their non-equilibrium condition. Self-organization patterns became a subject of interest in the sciences and the humanities.

All the above revealed that we can distinctly trace progressive vectors, or mega-trends, which enter into social (including spiritual), biological, geological, and cosmo-physical histories as a single continual process. Moreover, although no direct contradictions with the physical irreversibility laws have been found, the mega-trends' orientation conflicts with the classical natural science paradigm. Chaisson (2001) describes this as the disparity between two 'arrows of time' – the thermodynamic and the cosmological ones.

Indeed, available data allow us to retrospectively observe evolution from quark-gluon plasma up to star clusters and organic molecules; from the Proterozoic cyanobacteria up to the higher vertebrates and most complicated ecosystems of Pleistocene, and from *Homo habilis* with pebble chips up to the post-industrial civilization. Thus, as far back as our retrospective view reaches, the Universe – Metagalaxy – has been successively evolving from the more probable states (or 'natural' ones, from the 'entropy' point of view) to the less probable ('unnatural') ones.

True, the cone of evolution has been tapering. Most matter of the Universe (the so-called *dark matter*) has avoided evolutionary transformations and remained apart from atomic structures. A tiny portion of atomic structures has formed organic molecules. Living matter has apparently emerged in extremely rare and limited parts of cosmic space, and only one of millions of biologic families on Earth has reached the social stage. Thus, we may agree with Chaisson (2001) and Christian (2004) that complexity and rarity go together. Still, the appearance of a qualitatively higher structure imparts a novel faculty to the Universe as a single whole. As A. Einstein once noted, the state of the Universe is altered by a mouse just looking at it.

The new qualities are fraught with further development. Hence, an opposite trend to the cone extension is traced since a certain stage of evolution: the field of mind's influence has been growing (human activity has become a geological power, and is now spreading outside the Earth), and there are no essential reasons to see limits to its ulterior expansion (see below).

Recently, the Moscow physicist Panov (2004) claimed to have added a new trait to the portrayal. Having confronted time intervals between the qualitative leaps in the evolution of Earth, nature and society (the author used the Geochronological Table and the records of global human-induced crises and revolutionary breaks since the Lower Paleolithic (Nazaretyan, 2003)), he found that the spans successively decreased in the course of 4.5 billion years in conformity with a simple algorithmic formula. This result reported in the State Astronomic Institute (November 2003) was recognized as a scientific discovery by the participants of the seminar. Panov's equation

was conceptually pre-empted by G.D. Snooks (1996) who had formulated the 'law of cumulative genetic change': each great transformation of life was one-third the duration of its precedence. This offers complementary evidence for the unity of the Universal History, and a new context for global forecasts.

To give it a sharp graphic form, the pivotal evolution mega-trend may be drawn as a consecutive distancing, or 'digression from the natural (the most probable) state'. Still more grotesque: on the whole distance of our retrospective view (about 13–15 billion years), the world has been getting 'stranger' and 'stranger', and both our own existence, and the actual planetary civilization's condition are manifestations of the world 'getting stranger'.

In fact, this conclusion is nothing but an empirical generalization that is deduced by simply comparing evidence from different disciplines. In spite of human free choice, wrong actions, countless social fractures, and 'civilization cycles', a bird's eye view of world history reveals its progressive ascent, which continues the foregoing mega-trends. A question at the heart is why evolution has gone in such an odd direction, and here, a wide range of conceptual versions is possible.

2. THE VERSIONS OF BIG HISTORY

There is a temptation to explain universal evolution's paradoxical mega-trend ('digression from the natural state') by an assumption of an *a priori* program aimed at the final state. As soon as we assume this, the most acute questions beginning with "why?" are removed and replaced by relatively elementary ones, like "for what?" and "how?"

A vivid example of a teleological argument in modern cosmology is the 'strong anthropic principle'. It implies that a very precise balance of universal physical constants that made possible the emergence of living cells (and humans) is due to an artificial composition of the initial parameters in the giant laboratory, which our Metagalaxy is. In F. Hoyle's words, "a sound interpretation of facts allows us to presume that in physics, as well as in chemistry and biology, a Super-Intellect has experimented" (quoted from (Davies, 1982)).

In biology, we find a similar argument represented by nomogenesis and ortogenesis theories. To emphasize their essential idea, the outstanding Russian biologist L. Berg (1977) quoted from his predecessor, another enthusiast of nomogenesis K. Bar: "The final goal of the whole animal world is the human species".

The same teleological idea metaphorically expressed in K. Marx's words that "the physiology of humans is the key to the physiology of monkeys", has still deeper roots in sociology. Almost all of the progressivist theories

from the 18th to the 20th century implied a belief that the historical process was a successive ascent toward an ideal model. This argument generated severe criticism from its opponents. In the early twentieth century, the Russian Orthodox philosopher N. Berdyaev (1990) advanced a strongest anti-progress argument: the idea is immoral, he wrote, for it represents all of previous generations as nothing but foot-steps on the way to the final aim (and thus deprives them of self-value), and the future generation of lucky-guys – as "the vampires reveling on the graves of their ancestors" (p. 148).

Classic and modern philosophy still includes a greater number of teleological doctrines than do other disciplines. However, they all look exotic for the university Big History courses, and as far as I know, are hardly even mentioned; what apparently prevail are *a posteriori* interpretations. In this case, the authors tend to deduce the evolutionary effects as a consequence of actual interactions, so that their sequence within a certain mega-trend is recognized as a *problem*, which expects a scientific solution.

For their part, *a posteriori* versions are not homogeneous either. To see the difference, we should consider the recent story of the question. If we abstract from peoples' legends, religious and philosophical doctrines concerning the beginning and the end of the world, Jantsch's (1980) *The Self-Organizing Universe* seems to be the first paper that could be unconditionally referred to as a paper on Big History. The author later emigrated from Austria to the USA, and his brilliant book dedicated to I. Prigogine was published in German and in English, but drew small interest both in West Europe and in America. Soon after that, he committed suicide (indeed, personalities living a hard life often write optimistic texts, and vice versa: psychologists call it *compensation*), and in my multiple contacts with Western colleagues, I was surprised to discover that none of them had even heard of E. Jantsch; so, a decade later, Big History subject was construed anew.

The Self-Organizing Universe could have sunk into oblivion if it were not for one accidental circumstance: although the book was never published in Russian, it had a stronger impact on Russian (Soviet) readers than on Europeans or Americans. To trace the reasons for this fact, we can remember that in the 1910s, the Russian physician and philosopher, and one of system theory's fathers A. Bogdanov (1996) had paid attention to the *non-equilibrium* systems, whereas systems thinking in Western Europe (L. von Bertalanffy, W.R. Ashby, and others) emphasized exclusively the idea of equilibrium. In the 1930s, the Soviet biophysicist E. Bauer (1935) first used the concept '*sustainable non-equilibrium'*, which was developed by the Belgian I. Prigogine (who could read Russian) and philosophically adopted by E. Jantsch. Therefore, this productive category was more familiar to Russian scholars than their Western colleagues who still used equilibrium patterns for Big History construction in the 1990s.

This suggests why the Big History courses in Western universities have mostly ignored its psychological dimension. In I. Prigogine's words, 'equilibrium is blind', and only non-equilibrium gives a system vision. To sustain a far-from-equilibrium condition, an organism is doing work contra-posed to the environment's coercion. The work requires free energy to be extracted from other systems. So, in order to tap energy continually from outside and escape becoming itself a source of energy for its enemies, the organism needs *information*: it has to orientate itself in the environment, forecast the events, and organize its activity in conformity with the situation's dynamic, that is to construct anticipative world models.

Without this purposeful and highly sensitive anti-entropy activity, neither long-term far-from-equilibrium condition, nor the sequential building up living matter's non-equilibrium degrees would be possible. For its own part, competition for matter and energy resources has served as an immutable motive for the perfection of modeling procedures, so that the special weight of information versus matter-energy has been increasing with time, and on the social stage, the mind itself turned to be the determinant cause of activity and evolution more and more.

So, as we like to get rid of teleology, or the assumption of 'drive to evolution', we still have to assume living matter's drive to sustain highly improbable far-from-equilibrium condition, in a manner that is similar to Bergsonian *élan vital*; and to avoid the French philosopher's dualism, we must seek for the evolutionary premises of living organisms' immanent faculty.

As far as Western Big Historians have used equilibrium patterns, they have tended to confine themselves to matter-energy constituents of interactions, and put aside the information aspect. In this case, the history and prehistory of subjectivity, mental, and spiritual processes are viewed as exclusively epiphenomena of material structures' complication that do not play their own role in evolution, and the psycho-physical problem raised yet by R. Descartes is simply removed. Meanwhile, since mathematical theories of communication and control were formed, and N. Weiner (1950) definitely indicated that information was neither matter nor energy, the problem has been transferred from the purely 'philosophical' to the scientific sphere.

Accordingly, after the basic question of Big History's methodology (teleological versus causal approach) is solved in favor of *a posteriori* arguments, the attitude to the last constitutive in the triad 'matter – energy – information' comes to the fore. Properly, the question is whether information is a significant factor in evolutionary processes, or the two basic physical categories, matter and energy, are, in principle, necessary and sufficient for exhaustive description.

In the strict physicalist version, the evolutionary mega-trends are nothing but an irreversible growth of the aggregate Universe's entropy, and the

emergence of qualitatively higher organizations like life and society serve to accelerate the destructive processes where and if this is possible (Huzen, 2000). A moderate physicalist view, which is more popular among scientists, insofar as it denies a creative role to intellectual agents, also leads us to the conclusion that the prospect of civilization is strictly constrained by the natural laws (see Nazaretyan, 2004).

It is not an accident that the world historian and cross-disciplinarian D. Christian categorically follows the professional astrophysicists' usual estimation of the distant future. Entities as complex as modern human society, he suggests, arise close to the limit of our Universe's capacity to generate complexity, and if so, we cannot expect dramatic further development. After the Universe's youthful period ends, stars will flicker out and die, the Universe will get colder and colder as it ages, and there will be no more energy to conjure up or sustain such miracles as living and thinking matter. Apparently, this textbook physical scenario is a slightly modified wording of the heat death theory.

In Russia, 'Cosmist' philosophy influence remains so strong that even among most qualified astrophysicists and mathematicians we find the ones who reject this naturalist scenario and relate the potential future of the Metagalaxy with the increasing intervention of civilization (Novikov, 1988; Linde, 1990; Lefevre, 1996). However, not only the Russian physicists come to similar suggestions. For instance, the eminent American specialist in quantum theory D. Deutsch (1998) who seems to had never heard of the 'Cosmist' philosophers, distinctly expressed the same idea: the future story of the Universe depends on future story of the intelligence, which will sequentially enhance its control over the cosmic space as well as actually dominating the Earth's biosphere.

Although this suggestion looks amazing *prima facie*, it seems reasonable as we observe the relevant trend over previous billions of years. Looking back, first at the millennia of social history, we may note how 'virtual' events like novel ideas and values, religious and philosophical doctrines, poetic, artistic, and musical images, technological and scientific findings, have exerted, via human activities, stronger and stronger impact upon the natural processes on Earth. Ultimately, their far-reaching effects surpassed the ones of spontaneous geological and climatic cataclysms full of blind power.

Going back far beyond human history, we again find out that living matter's growing capacity to use energy flows is related to its growing 'cleverness', although in this case the fact is less obvious. To argue it, V. Vernadsky has used the concept of a 'coefficient of cephalization' – the anatomic correlate for the intellectual quotient of vertebrate species. If we take modern fauna's aggregative index for 1, the index for the Miocene (25 million years ago) would be 0.5, and for the beginning of the Cenozoic

(67 million years ago) – 0.25, etc. The great Russian evolutionist did not read the words by N. Weiner mentioned above (they were written after Vernadsky's death in 1945), but he was also puzzled by numerous facts that demonstrated the independent role of information: how can the mind that is surely not a form of energy regulate the material processes?

We will consider some approaches to respond to this question. As to the *growing* capacity of mindful regulation, modern psychology offers some suggestions about the relevant mechanism. As gestalt-psychological experiments have shown, parameters of the objective situation, which are *uncontrollable constants* within an accepted mental pattern, prove to be *controllable variables* as soon as we find a conceptual meta-system, that is the one that reflects broader causal links. Having assumed our world is infinitely complicated, no absolutely control-proof faculties of it should be theoretically imposed, and no correctly formulated technical problem should be recognized as radically solution-proof.

In fact, the whole story of social technologies shows that any cardinal problem has been practically solved as evolution required it. Most technical achievements in the twentieth century were theoretically forbidden by the natural laws as seen in the nineteenth century, and the outstanding thinkers explicitly formulated worthy interdictions more than once. Although no one law of classical physics has been dramatically disavowed, multiple additions, modified definitions, and specifications made possible quite a different conceptual and technological reality. Looking farther back at human history, or the evolution of pre-human biological 'technologies' (living matter's expansion from the sea onto the land, conquest of the air by the vertebrates, etc.), we find a slower but essentially similar succession.

So, the post-physicalist view of Big History's empirical evidence supplements the evolutionary portrayal with a new determinant. If there is a relation between structural complexity and the amount of energy consumed (which has been brilliantly shown by the American physicist E. Chaisson (2001): the more complex the order is, the denser the energy flows that pass through it), this is because complex systems get 'cleverer', and thus perfect their control capacities. The relationship between a system's capacity for energy control and the volume of its information model has been singled out as "one of the fundamental laws of nature" by the Russian system theorists (Druzhinin and Kontorov, 1976; Nazaretyan, 1991). Besides, it has been indicated that as soon as we include the information-control parameter, the *futuribles* (potential futures) of civilization as well as that of the Metagalaxy, look radically different. This should be related to the perspectives of further developing the mind. The cosmic Universe cannot always remain free from intellectual influence exerted by Earth's civilization (if it survives) or some other planet's civilizations, which manage to survive longer. This raises specific problems (including ethical ones) for the distant

future that are discussed in relevant literature but are beyond the subject of this article.

Current experience shows that differences between adherents of the *a posteriori* approach assume a scientific discussion and confrontation of the patterns' explicative power. And the discrepancies between the *a posteriori* and *a priori* (teleological; theological) approaches, are mainly the subject of 'philosophy', which being 'eternal' questions, cannot be solved by the scientific method. Whereas the post-classic model-oriented epistemology (unlike the truth-oriented one) excludes final and exhaustive solutions, gaps in any theoretical worldview may be filled by an appeal to the purposeful (and thus anthropomorphic) Actor. His mocking phantom is perpetually soaring over science and evolving together with it from the Biblical Creator to the Watch-Master, and further, to the Computer Engineer, Extra-Planet, even Extra-Galaxy Intellect, and so on, to create complementary impulses to scientific and philosophical reflection.

Nevertheless, as we have mentioned, modern scientific method accepts a telic approach as much as it is introduced in the context of actual interactions (drive to preservation). Taking this into account, we will conclude the article by quickly outlining one of the synthetic patterns that help us to interpret Big History's mega-trends.

3. BIG HISTORY, CYBERNETICS, AND SELF-ORGANIZATION THEORY

The mutual relation of causal and telic mentalities has had its own faraway and fanciful story, and essentially influenced both official ideologies and ordinary worldview in various epochs (Nazaretyan, 1991). The non-classic science implies a new synthesis of the two opposite approaches that is embodied particularly in the interdisciplinary patterns concerning cybernetic system theory and synergetics.[3]

In cybernetics, the initial kind of tasks for the interacting systems is not an eventual final condition but conservation of the parameters of all outer and inner structures. Combination of the two basic faculties – immanent activity of matter and physical conservation laws – is manifested in "the struggle of organization forms" (A. Bogdanov), or *competition of controls* for preservation of current movement condition by each of the interaction agents.

Some of patterns of classical physics, like variational principles, Le Chatelier's principle, Onsager's law, etc., organically conform to the metaphor of regulation, control, telic causality, and competition. Ultimately, as the Russian physicist Moiseev (1986) has put it, from this point of view, "any inert matter law. . . is in fact a mechanism of selection of real movements" (p. 70).

The cybernetic and the ecological metaphors put together the questions beginning with "why?", "how?", and "for what?" Molecular biologists are aware that ferment synthesis in any particular moment is regulated by the cell's actual needs. Geologists apply telic functions to describe mathematically the landscape processes. Having asked for what purpose nature needs several kinds of neutrino, or lambda-hyperons, theoretical physicists refer to system dependencies. Search for the 'lacking elements' – that is the ones required for Metagalaxy stability – has more than once led to important discoveries. Simultaneously, ideas based on categories like control, self-organization, competition, and selection (of forms, or movement conditions) have demonstrated a profound continuity between 'inert' and living matter, and the evolutionary roots of apparently aim-oriented behavior of living organisms.

In particular, cybernetic system theory first accentuated the functional essence of material *reflection*. As the Russian chemist and philosopher Yu. Zhdanov (1983) has indicated, "self-preservation against the outside coercions is an essential function of reflection as an immanent material faculty" (p. 73). Therefore, this philosophical category is similar to the interdisciplinary category of *modeling* as an instrument of control.

Provided all of the interaction agents have comparable capacities of reflection and control, the outcome is a kind of 'compromise of coercions'. Still, even in this case, equilibrium conditions are only a virtual aspect (like perfect gas, or a geometric point) of fundamentally non-linear processes.

Since self-organization effects have been discovered, we can better understand how a highly improbable far-from-equilibrium state spontaneously emerges. At the same time, combination of self-organization and control patterns make clearer why a non-equilibrium condition is preferable and purposefully defended by complex systems. From there, we see why the feedback and modeling mechanisms have been progressively improving together with structures' complexity and behavior capacities; after all, why and how the role of reflection in joint causalities has been successively growing for billions of years (Nazaretyan, 1991, 2004).

In the 1940s, E. Schrödinger (1944) showed that anti-entropy work can be done only by means of 'order consumption' from outside – that is, at the cost of the increasing entropy of other systems. In instances of abundant environments, open non-equilibrium systems increase the volume of their anti-entropy work, and expand as much as they can. Sooner or later, this exhausts the available resources, and as a result, a specific crisis in system-environment relations follows.

Crises of this type are called *endo-exogenous* in ecology. The system – an individual, a population, or a human society – runs against the unfavorable environmental transformations provoked by its own activity. Endo-exogenous crises, including all of the anthropogenic (technogenic)

ones, play a special role in evolution. As previous anti-entropy mechanisms turn contra-productive – being fraught with catastrophic entropy growth – a bifurcation phase develops. If migration is impossible, there are only two further possibilities. Either the system turns back to equilibrium – that is degrades (what is named *simple attractor* in synergetics) – or diverges from that owing to the development of advanced anti-entropy mechanisms. The last possibility is usually caused by higher inner diversity and structural complexity, and a more dynamic world model with higher resolving power and sensible feedback.

The new non-equilibrium response to crisis is known as a *strange attractor*. It looks like a 'quasi-aim' situation, as far as the actual self-preservation task has turned with directionality to a phase transition (a qualitative leap); a highly developed society can give this crisis-coping scenario a form of deliberate projects for technological, organizational, and psychological reconstruction. Retrospectively, the sequence of successful actual solutions (each time accompanied by a lot of dramatic collapses) over a long temporal distance, is lined up as the mainstreams of biological and social 'progress'.

Self-organization patterns in anthropology include the evolution of spiritual culture, which usually has been mediated by anthropogenic crises as well, when seen in the Big History context. It has been shown, for example, that instrumental intelligence like any other anti-entropy organ, in certain evolutionary conditions, led the early hominids into lethal danger: the Olduvai artifacts have once and for all broken the ethological balance between animals' natural weapons and instinctive intra-species aggression-inhibition (Lorenz, 1981). In this new unnatural situation, in which the proportion of intra-group deadly conflicts became incompatible with existence, very few *Homo habilis* groups (or maybe a single one) could survive. Archeological, anthropological, and neuropsychological data confrontation bring us to the conclusion that their survival was due to specific neurotic faculties. Necrophobia (dread of the deceased) seems to be the first artificial factor that balanced the killing power of extra-natural weapons: it restrained in-herd aggression, which was displayed in the care for the deceased, sick, and crippled conspecifies. So, the groups affected with necrophobia (which implied higher mental lability, suggestibility, and unnaturally developed imagination) were the ones to create proto-culture and start the new evolutionary spire with a different selection mechanism (Nazaretyan, 2002).

From that time, the existence of hominids, including *Homo sapiens*, has not had a natural background, and was to a great extent enabled by the adequacy of cultural regulation with technological power. Disparities in the development of instrumental and self-regulative hypostases of culture caused outbursts of ecological and/or geopolitical aggression, which has most often resulted in the destruction of society. The mechanism by which

internally sustainable social systems are selected and of unbalanced ones discarded has so far enabled the preservation of humankind. As special calculations show, although killing power of weapons and demographic densities have been successively growing for millennia, the ratio of victims of social violence to population numbers has been rather irregularly decreasing (Nazaretyan, 2003, 2004).

Those calculations (and some other ones) are conducted to check a corollary of the hypothesis, which arises from quite different empirical evidence, namely, the history of anthropogenic catastrophes and the following cultural revolutions since the Paleolithic. Summing up diverse information from cultural anthropology, history, historical psychology, and current ecology concerning anthropogenic crises, we suggested that there was a regular relation between the three variables: technological potential, cultural regulation quality, and society's internal sustainability. *The law of techno-humanitarian balance*, states that *the higher the power of production and war technologies, the more refined the behavior-regulation means that are required for self-preservation of the society*.

The formal version of the hypothesis (Nazaretyan, 2003, 2004) demonstrates that the more powerful technologies increase a social system's sustainability against external fluctuations and, at the same time, make it more vulnerable internally (less fool-proof) if the technological advance is not balanced by well-proportioned cultural aggression–retention. The law explains causally both the sudden collapses of flourishing societies and the breakthroughs of humanity into new historical epochs (which often look still more mysterious). Following it, we can better observe the progression of panhuman history, in spite of successive and dramatic replacements of leading cultures and continents. We see how one after another social organisms have fallen into evolutionary deadlocks, but humanity as a whole has always managed to find a cardinal way out. This was achieved by successive and irreversible leaps forward that commonly included: technological innovations, increasing information volume of social and individual mind, complexity social structures, and improvement of cultural values.[4]

In earlier papers, seven wide-ranging anthropogenic crises and resultant crucial revolutions since the Lower Paleolithic have been considered. Every constructive solution led into the next growth phase of the social system's non-equilibrium, intensification of society-nature and intra-social artificial mediations, and on the whole, distancing of society and its natural environment (the society–nature system) from the natural (wild) condition. This becomes clearer when we contrast, for example, gathering and hunting to agriculture and cattle-breeding (the Neolithic revolution), or farming to industry (the industrial revolution), or industry to computer production (information revolution). Each of the revolutions broadened and deepened the human species' ecological niche, furnished a new demographic growth,

new opportunities, ambitions, and consumer demands, and thus the way to the subsequent anthropogenic crisis began.

In synergetic (or mathematical chaos theory) terms, human history is the story of one 'self-similar' system, which exists on the scale of a million or so years and has been successively transforming itself to conserve sustainability (Christian, 1991, 2004). Having assumed that the nucleus of those salutary transformations is intellectual, we may see the universal roots of human intelligence and morality without appeal to God's Providence. What we call biological or social 'progress' is neither an eternal purpose (a divine program) nor a movement 'from the worse to the better' but *a means for self-preservation* by which a complex far-from-equilibrium system responds to the challenges of reduced sustainability, and on the whole, a chain of successful adaptations to the effects of non-equilibrium systems' own activity (against the background of prevailing failures).

Thus, the informational parameter of world development brings with it a relevant 'moral' (self-regulation) aspect on a certain evolutionary stage. Taking a bird's eye view of world history, especially of its turning points, in a Big History context helps us to develop reliable scenarios of future, and distinguish between forecasts and projects that are realistic and those that are utopian. Hence, the prospects of planetary civilization's in the twenty-first 'bifurcation century' are concerned either with a global fracture, or with a next drastic 'digression from the natural state' spiral; this conclusion, which is based on long-term historical observations and analysis of relevant mechanisms, discredits numerous 'back to nature' claims and projects. The creativity of the mind gives civilization unlimited potential for advancement, and the mind's inner imbalance rather than natural laws may turn with lethal menace on civilization both in the next and distant future.

ACKNOWLEDGMENT

The work is supported by the Russian Foundation for Fundamental Research, grant # 04–06-80072.

NOTES

[1] One more recent event is worth to be mentioned here. After this article was ready, the first international Symposium 'Self-Organization Processes in Big (Universal) History' (2004) took place in Belgorod (Russia).

[2] We have singled out five mainstreams of consecutive global transformations for millennia: *increases of world population, of technological power, of organizational complexity, and of mental information capacity*, and *perfection of cultural regulation mechanisms*. The first three vectors are inferred as "empirical generalizations" that can be easily illustrated with figures. The forth and the fifth ones require particular arguments (Nazaretyan, 2003, 2004).

[3] The last term is not accepted everywhere, therefore, it is to be explained. Self-organization patterns were named *synergetic* in Germany (H. Haken), *non-equilibrium thermodynamic*, or *theory of dissipative structures* in Belgium (I. Prigogine), *theory of autopoesis* in Chile (U. Maturana), *dynamic chaos theory* in USA (M. Feigenbaum), and *non-linear dynamic* in Russia (S. Kurdiumov). The linguistic diversity and competition for priority must not conceal the fact that these are various readings of a single scientific paradigm.

[4] Techno-humanitarian balance hypothesis is consonant with Kohlberg's (1984) idea of correlation between humankind's intellectual and moral development, which is still a subject of criticism, even by social evolutionists. In fact, L. Kohlberg applies to social history classical evidences by J. Piaget and his followers concerning individual development, and the "conflict-enculturation hypothesis" of anthropologists: the downward course of violence with increasing age has been revealed both in Western and primitive cultures (Chick, 1998; Munroe *et al.*, 2000).

REFERENCES

Bauer, E.S.: 1935, *Theoretical Biology*, VIEM, Moscow, 206 pp. (in Russian).

Berdyaev, N.A.: 1990, *The Sense of History*, Mysl, Moscow, 175 pp. (in Russian).

Berg, L.S.: 1977, *Oeuvre on Evolution Theory*, Nauka, Leningrad, 387 pp. (in Russian).

Bogdanov, A.A.: 1996, *Bogdanov's Tektology. Book 1*, Centre for Systems Studies, University of Hull, Hull, UK, 322 pp.

Chaisson, E.J.: 2001, *Cosmic Evolution: The Rice of Complexity in Nature*, Harvard University Press, Cambridge, MA, 280 pp.

Chick, G.: 1998, 'Games in Culture Revisited', *Cross-Cultural Res.* **32**(2), 185–206.

Christian, D.: 1991, 'The Case for "Big History"', *J. World History* **2**(2), 223–238.

Christian, D.: 2004, *Maps of Time: An Introduction to 'Big History'*, University of California Press, Berkeley, California, 588 pp.

Davies, P.C.W.: 1982, *The Accidental Universe*, Cambridge University Press, Cambridge, 139 pp. (in Russian).

Deutsch, D.: 1998, *The Fabric of Reality*, Allen Lane, The Penguin Press, 390 pp.

Druzhinin, V.V. and Kontorov, D.S.: 1976, *Problems of System Science*, Sovetskoe Radio, Moscow, 296 pp. (in Russian).

Fedorovich, I.V.: 2000, Conceptions of Modern Science in the Aspect of Universal History. A University Program and Methodic, Syktyvkar State University, Syktyvkar, 35 pp. (in Russian).

Fedorovich, I.V.: 2002, 'Conceptions of Modern Science', Universal History Position. Mercury of Russian International University, FSE Series, #7(1–2), pp. 33–43 (in Russian).

Golubev, V.S.: 1992, *Evolution: From Geochemical Systems to the Noosphere*, Nauka, Moscow, 109 pp. (in Russian).

Huges-Warrington, M.: 2002, 'Big History, Historically Speaking', *Bull. Historical Soc.* **IV**(2), November, 16–20.

Huzen, A.M.: 2000, *Nature's Intelligence and Human Intelligence*, Book 3, Novel Editorial, Moscow, 33 pp. (in Russian).

Jantsch, E.: 1980, *The Self-Organizing Universe. Scientific and Human Implications of the Emerging Paradigm of Evolution*, Pergamon Press, NY, 343 pp.

Kohlberg, L.: 1984, *The Psychology of Moral Development*, Harper & Row, NY, 729 pp.

Lefevre, V.A.: 1996, *The Cosmic Agent*, IPAN, Moscow, 183 pp.

Le Goff, J.: 1977, *Le civisation de l'occident medieval*, Arthaud, Paris, 330 pp.

Linde, A.D.: 1990, *Physics of Elementary Particles, and Inflation Cosmology*, Nauka, Moscow, 275 pp.

Lorenz, K.: 1981, *Das sogenannte Böse (L. Zur Naturgechichte der Agression)*, Dt. Taschenbuch Verlach, München, 261S.

McNeill, J.R.M. and McNeill, W.: 2003, *The Human Web. A Bird's Eye View of World History*, Norton & Co., NY, 368 pp.

Moiseev, N.N.: 1986, 'Co-evolution of Humans and Biosphere: The Cybernetic Aspects', in *Cybernetics and Noosphere*, Nauka, Moscow, pp. 65–83 (in Russian).

Moiseev, N.N.: 1991, 'Universal Evolutionism (The Conception, and the Consequences)', *Problems Philos.* **3**, 2–28 (in Russian).

Munroe, R.L., Hulefeld, R., Rogers, J.M., Tomeo, D.L., and Yamazaki, S.K.: 2000, 'Aggression Among Children in Four Cultures', *Cross-Cultural Res.* **34**(1), 3–25.

Nazaretyan, A.P.: 1991, *Intelligence in the Universe: Sources, Formation, Prospects*, Nedra, Moscow, 222 pp. (in Russian).

Nazaretyan, A.P.: 2002, 'Dread of the Deceased as Social Self-Organization Factor', *Problems Philos.* **11**, 73–84 (in Russian).

Nazaretyan, A.P.: 2003, 'Power and Wisdom: Toward a History of Social Behavior', *J. Theory Social Behav.* **33**(4), December, 405–425.

Nazaretyan, A.P.: 2004, *Civilization Crises Within the Context of Universal History. Self-Organization, Psychology, and Global Forecasts*, Per Se, Moscow (2nd edition), 339 pp. (in Russian).

Novikov, I.D.: 1988, *How did the Universe Burst?*, Nauka, Moscow, 175 pp. (in Russian).

Panov, A.D.: 2004, 'The Crisis of Universal History's Planetary Cycle', *Mercury Russ. Acad. Sci.* **74**(6), 537–550 (in Russian).

Prigogine, I.R.: 1981, *From Being to Becoming: Time and Complexity in the Physical Sciences*, W.H. Freeman and Co., San Francisco, 272 pp.

Schrödinger, E.: 1944, *What is Life? The Physical Aspect of the Living Cell's* with Cambridge University Press, Cambridge, 178 pp.

Self-Organization Processes in Big (Universal) History, Abstracts of the International Symposium (Belgorod, September 29–October 2, 2004), Belgorod State University, Belgorod, Moscow, 216 pp. cf. note 1.

Snooks, G.D.: 1996, *The Dynamic Society. Exploring the Sources of Global Change*, Routledge, London and NY, 491 pp.

Spengler, O.: 1980, *Der Untergang der Abendlandes: Umrisse einer Morphologie der Weltgechichte*, Dt. Taschenbuch Verlag, München, p. 1269S.

Spier, F.: 1996, The Structure of Big History. From the Big Bang Until Today, Amsterdam University Press, Amsterdam, 113 pp.

Universal History: The Cross-Disciplinary Approaches: 2001, *Collection of Articles*, part I, in Fedorovich et al. (eds.), Syktyvkar State University, Syktyvkar, 356 pp. (in Russian).

Vernadsky, V.I.: 1978, *Living Matter*, Nauka, Moscow, 258 pp. (in Russian).

Weiner, N.: 1950, *The Human Use of Human Beings: Cybernetics and Society*, Houghton Mifflin Co., Boston, 241 pp.

Zhdanov, Yu.A.: 1983, 'Materialist Dialectic, and Chemical Evolution', in *Dialectic in Sciences and Humanities*, Science, Moscow, pp. 46–79 (in Russian).

Institute for Oriental Studies
Russian Academy of Sciences
(anazaret@mtu-net.ru)