CHAPTER SEVEN

STRATEGIES OF THEORETICAL INVESTIGATION IN THE EPOCH OF POST-NON-CLASSICAL SCIENCE

UNIVERSAL EVOLUTIONISM AS FOUNDATION OF THE MODERN SCIENTIFIC PICTURE OF THE WORLD

The transition of science to post-non-classical stage of development has created new premises of establishing a common picture of the world.[1] For a long time this idea of such unity existed as an ideal. But in the last third of the 20th century there appeared real possibilities to unite notions of the three main spheres of being – non-living nature, organic world and social life – into an integral picture on the foundation of basic principles having general scientific status.

These principles do not deny specificity of each concrete branch of knowledge, but, at the same time, are invariant in the diversity of disciplinary ontologies. The construction of such principles was connected with a revision of foundation of many scientific disciplines. Such revision is one of aspects of the great cultural transformation taking place in our age.[2]

If we were to briefly characterize modern tendencies of synthesis of scientific knowledge: they are expressed in desire to build a general scientific picture of the world on base of principles of universal evolutionism, uniting into a whole integrity the ideas of systemic and evolutionary approaches.

The development of evolution ideas has quite a long history. Even in the 19th century they were applied in certain spheres of knowledge, but they were perceived more as exception with respect to the world as a whole.[3]

Most completely was the principle of evolution outlined within the framework of biology and became its fundamental principle since the epoch of Ch. Darwin. But up to nowadays it has not been domineering in natural science. In many respects it happened due to the fact that for a long time the prevailing scientific discipline was physics, that translated its ideals and norms to other branches of knowledge. Traditionally physics investigated fundamental structures of the Universe, so it had always been among those sciences which had a claim on forming basic ideas of a general scientific picture of the world. But in the course of most part of its history, physics did not include – in evident form – the principle of development into the set of its fundamental principles.

As to biology, it has not reached the high status of theoretically developed science, and is now at the stage of theorizing. Its notions dealt with the living nature, which traditionally was not considered as foundation of the Universe. That is why biology, taking part in construction of the general scientific picture of the world, for a long time did not aspire that its fundamental ideas and principles got universal scientific meaning and were applied in all other spheres of investigation.

Paradigmatic incompatibility of classical physics and biology was discovered in the 19th century as contradiction between the theses of Darwin's theory of evolution and the second law of thermodynamics.

According to the theory of evolution, in the world there permanently appear more and more complicated living systems, organized forms and states of living matter. The second law of thermodynamics demonstrated that evolution of physical systems leads to a situation when an isolated system is purposefully and irreversibly shifted to the state of equilibrium.

In other words, biological theory spoke about the evolution process as construction of more and more complicated and organized living systems, while thermodynamics – about destruction, permanent entropy growth. These collisions of physics and biology required settlement, and premises for this could be an evolutionary view of the Universe as a whole, translation of the evolutionary approach into physics, which would lead to reformulation of fundamental physical theories. But this situation is characteristic only for the science of the last third of the 20th century.

The ideas of universal character of the evolution processes in the Universe are realized in modern science in the conception of global (universal) evolutionism. Its principles enable us to describe uniformly the enormous diversity of processes taking place in non-living nature, living matter, society[4].

The conception of universal evolutionism is based on a certain complex of knowledge, grounds in concrete scientific disciplines, and, at the same time, includes a number of philosophical, worldview directions. It refers to that layer of knowledge, which is traditionally designated by the term "scientific picture of the world".

Why is it that the modern stage of functioning of science requires the ideas of universal evolutionism as principal ones, allowing investigators to elucidate the general picture of integral process of development of nature and society? Before answering this question, we have to specify, what universal evolutionism is, and
to understand, what contributed to establishing of its ideas in science, and not at the level of metaphysical speculations, but as generalization of concrete scientific data.

Universal (global) evolutionism[5] is often characterized as a principle, which extrapolates the ideas of evolution, justified in biology, astronomy and geology, over all spheres of reality and consideration of non-living, living and social matters as a united, universal evolutionary process.

It is really a very important aspect in understanding global evolutionism. But it does not exhaust the content of this principle. It is important to take into consideration that in the 20th century the evolutionary approach itself acquired new features, distinguishing it from classical evolutionism of the 19th century, which described phenomenology of development more than system characteristics of developing objects.

When in the 1940s–1950s general system theory appeared and system approach settled, it brought fundamentally new content in the conception of evolutionism. The idea of system consideration of objects turned out quite heuristic first of all within biology, where it led to unfold the problem of structural levels of organization of living matter, analysis of different connections both within a certain system and between systems of different grades of complexity. System consideration of object first of all stipulates uncovering of integrity of the system studied, its intercommunication with environment, analysis of properties of the components and their inter-communication within the system. The system approach, developed in biology, regards objects not as mere systems, but as self-organizing systems of open character. N.N. Moiseev notes that today we see the processes of evolution, self-

organization of matter more widely than at Darwin's time, and the notions of heredity, changeability, and selection, for us are filled with another deeper content.[6]

From his point of view, everything happening in the world, the operation of all natural and social laws can be presented as permanent selection, when only several classes and types of states are selected from the diversity of possibilities. In this sense all dynamic systems possess capability "to make a choice" though concrete results of "choice" as a rule might not be predicted in advance.

N.N. Moiseev indicates that we can distinguish two types of mechanisms regulating such "selection". On the one hand, adaptation, under effect of which the system does not obtain fundamentally new properties; on the other hand, so called bifurcation, connected with radical reconstruction of the system. But, besides these mechanisms, to explain self-organization, we are to point out one more characteristic of direction of self-organizing processes, marked by Moiseev as principle of entropy economy, which gives preference to complicated systems compared to simple ones. This principle is formulated as follows: if under conditions given several types of organization of matter are possible, not contradicting to the conservation laws and other principles, the one which has most chances to stability and further development is that one, which allows investigators to utilize outer energy to the largest scale, most effectively.[7]

Forming of self-organizing systems can be regarded as a special period of a developing object, a kind of "synchronous section" at some stage of its evolution. The evolution itself can be presented as transition from one type of self-organizing system to another ("diachronic section"). As a result, analysis of evolutional characteristics is closely connected with systemic consideration of objects.

Universal evolutionism is that very thing which is the combination of the evolution ideas with the ideas of system approach. In this respect, universal evolutionism not only spreads development over all spheres of being (establishing universal connection between non-living, living and social matter), but also overcomes the narrowness of phenomenological description of development, linking this description with the ideas and methods of system analysis.

Many natural scientific disciplines contributed to justification of universal evolutionism.[8]

But the decisive part in its establishing as principle of construction of the modern general scientific picture of the world belonged to three most important conceptual trends in the science of the 20th century: first, the theory of non-stationary Universe; second, synergetics; third, the theory of biological evolution and developed on its base the conception of biosphere and noosphere.

The beginning of the 20th century was marked by a chain of scientific revolutions, among those an essential place belonged to the revolution in cosmology. It played an important role in settling the idea of evolution in non-organic nature and caused radical reconstruction in notions of the Universe.

We are talking about elucidating the theory of expanding Universe. That theory introduced the following ideas of cosmic evolution: about 15–20 billion years ago the Universe started to expand from the point of singularity as a result of "the Big Bang"; the Universe first was hot and dense, but cooled off in the course of expansion, and the matter in the Universe, while cooling off, was condensed in galaxies. The latter ones, in their turn, were broken up into stars, integrated and formed large clusters. In the process of creation and death of the first generations of stars heavy elements were synthesized. After turning of

the stars into red giants, they threw out matter condensed in dust structures. Gas-dust clouds formed new stars, and there appear the diversity of cosmic bodies.[9]The 'Big Bang' theory created the picture of evolution of the Universe in general. In its origins there lay discovery of A.A. Fridman, which caused doubts in the postulate of the Universe, stationary in time. Analyzing Einstein's "world equations", describing metrics of four-dimensional curved space, Fridman found their non-stationary solutions and offered three possible models of the Universe. In two of them the radius of curvature was to grow, and the Universe, correspondingly, extends. The third model suggested the picture of pulsating Universe with periodically changing radius of curvature.[10]

The model of the expanding Universe led to three important predictions, which later could be tested by means of empirical observations. First, we mean that, with expansion of the Universe, galaxies are moving away from each other at a speed proportional to distance between them; second, this model predicted existence of microwave background radiation, piercing through the whole Universe and being relic of its hot state of the beginning of its expansion; third, this model predicted formation of light chemical elements out of protons and neutrons at the first minute after expansion had begun.[11]

The model of expanding Universe has essentially transformed our ideas of the world. It required that we should include the idea of cosmic evolution into the scientific picture of the world. This was the way to create a description of the non-organic world in terms of evolution, uncovering common evolutionary characteristics of different levels of its organization and, finally, construct an integral picture of the world on this base.

In the middle of the 20th century the ideas of evolution of the Universe got a new impulse. The theory of expanding Universe, though quite well described events which took place a second after the beginning of the expansion, faced considerable difficulties in its attempts to characterize the most mysterious stages of that evolution from the initial explosion to the world second after it. The answers to these questions, to a large extent, were given within the theory of inflating Universe. This theory emerged at the junction of cosmology and physics of elementary particles. The key element of the inflating Universe was the so called inflation phase – the stage of accelerated expansion. It lasted for 10–32 seconds, and during that time the diameter of the Universe increased 1,050 times. After enormous expansion, the phase with broken symmetry was established once and for all, and that led to change of the state of vacuum and, finally, to creation of various types of elementary particles.[12] In our Universe matter prevails over antimatter, and in this respect we live in an asymmetric Universe. The prediction of asymmetry of matter and antimatter in the Universe was the result of combination of ideas of "Grand Unification" in the elementary particles theory with the model of inflating Universe. Within the program of the "Grand Unification" investigators put forward the idea of initial symmetry, uniting the main types of interaction (strong, electromagnetic, weak and gravitational). It is supposed that in the very beginning of the Universe's evolution (10–46 seconds after "the Big Bang") spontaneous breaking of this symmetry caused a "split" of the initial state and created the four main interactions of the nature. In this approach the types of interaction are presented not as given once and for all, but as emerging in the process of evolution.

Modern science spreads the development ideas to fundamental structures of the Universe, establishing connections between evolution of the Universe and the process of formation of elementary particles. All this enable us to consider the Universe as a unique laboratory for verification of modern theories of elementary particles and their interactions.[13]

The theory of inflating Universe has radically changed our vision of the world: in particular, it changed "the view at the Universe as something homogenous and isotropic, and there emerged a new vision of the Universe as consisting of many locally homogenous and isotropic mini-universes, where properties of elementary particles, amount of vacuum energy and dimensionality of the space-time can vary".[14]

Transforming the established physical picture of the world, the theory of inflating Universe gives a new impulse to defining the general scientific picture of the world on base of ideas of global evolutionism. It requires corrections in philosophical, worldview foundations of science, putting forward a number of important problems of worldview character. The new theory allows us to consider the observable Universe only as a small part of the Universe as a whole, and that means that we have the right to assume existence of quite many evolving universes.[15] In the process of evolution most of them are unable to give create such diversity of organization forms which is proper to our Universe (Metagalaxy). But then there emerges a question: why our Universe is as it is, and how progressive evolution of matter is possible in it? Can we regard appearance of life on the Earth, as well as origin of humanity, random in the existing Universe, or is formation of man a regular process in an evolving Universe? What place belongs to this event in the processes of evolution, how does it influence upon the course of the evolution processes?

One of the variants of answer is based on so called anthropic principle founded on hidden supposition of existence of a multitude of universes, and life appears where there are special conditions. According to one variation of the anthropic principle, what we expect to observe, should be limited by conditions necessary for our existence as observers. Though our position is not necessarily central, it is inevitably privileged, in some sense.[16] This formulation of the anthropic principle let B. Carter concentrate his attention mainly on its two versions: "weak" and "strong", which got quite a broad interpretation. According to the first one, our position in the Universe is inevitably privileged in the sense that it should be compatible with our existence observers. The "strong" anthropic principle states that the Universe is to be shaped so, that at certain stage of evolution it permitted existence of observers.[17] Many times did investigators emphasize wonderful coordination of the main properties of the Universe (A.D. Zelmanov, G.M. Idlis, P. Davies and others). Its physical parameters, such as constants of physical interactions, masses of elementary particles, dimensionality of space, are decisive for the existence of the present structure of the Universe, since any violation of one of them could lead to impossibility of progressive evolution, and our existence as observers would also be impossible. The anthropic principle drives investigators into the sphere of worldview problems, making them think again about the question of people's place in the world, their attitude to this world. New data obtained in cosmology let us suppose that objective properties of the Universe as a whole create possibility of emerging of life, intellect at certain stages of its evolution. What is more, potential possibilities of these processes were present even at the earliest stages of development of the Metagalaxy, when numeric values of the world constants, which determined the character of further evolutionary changes, were formed.[18] All these results can be evaluated as one of the essential factors of settling the idea of global evolutionism in the modern scientific picture of the world.

Not less important role in forming of these ideas belonged to the theory of self-organization (synergetics). It studies any self-organizing systems which consist of numerous subsystems (electrons, atoms, molecules, cells, neurons, organs, complex multicellular organisms, people, people's communities), paying special attention to

coherent, coordinated state of self-organization processes in complicated systems of different nature.[19] To be considered as self-organizing, a system should satisfied at least four conditions: 1) the system should be thermodynamically open; 2) dynamic equations of the system are non-linear; 3) deviation from balance exceeds critical threshold; 4) processes in the system occur cooperatively (W. Ebeling). Self-organization here is considered as one of the main qualities of moving matter and includes all processes of self-structuring, self-regulation, self-reproduction. It plays the role of a process leading to formation of new structures.[20]

For a pretty long time self-organization was correlated only with living systems; as to objects of non-living nature, it was believed that if they do evolve, they evolve only toward chaos and disorder; this belief was proved by the second law of thermodynamics. But here we came across a radical problem: how systems of such kind could give creation to objects of living nature, capable of self-organization. There emerged a methodologically important question of interrelation between non-living and living matter. To answer it, we had to change paradigmatic principles of science and, in particular, eliminate gaps between evolutional paradigm of biology and traditional abstraction from evolution ideas in construction of the physical picture of the world.

For a long time functioning of the science of physics excluded the "development factor" from its consideration. Classical science mainly paid attention to stability, balance, uniformity and order. Among its objects there were closed systems. Usually, they were simple objects, and knowledge of laws of their development enabled scientists, on base of information of the state of the system in the present, to undoubtedly predict its future and reconstruct its past. The mechanist picture of the world had timeless character. Time was not an essential element, it was reversible, i.e. states of objects in the past, present and future were practically indistinguishable. In other words, the world is arranged simply and submits to fundamental laws, reversible in time.[21] All these principles and approaches were concrete expressions of non-evolutionary paradigm of classical physics. Processes and phenomena, which did not correspond to this scheme, were regarded as exception; it was believed that they could be neglected.

Gradual eroding of the classical paradigm in physics started as early as in the 19th century. The first important step was the formulation of the second law of thermodynamics, which casts doubt on timeless character of the physical picture of the world. According to the second law, the energy content in the Universe is depleting, and "the world machine in fact has to reduce its activity, approaching the thermal death". Events are not reproducible in principle, and that meant that time had direction. There appears the idea of "arrow of time".[22]

Further development of physics led to understanding of scantiness of idealization of closed systems and description of real physical processes in terms of such systems. The overwhelming majority of natural objects are open systems, which exchange energy, matter and information with the surrounding world, and a decisive role in the radically changed world passes to unstable, non-equilibrium states. Fundamental sciences dealing with non-living nature – physics, chemistry, cosmology – more and more often faced the necessity to take these features into account. But the old theory turned out unfit for their description. The traditional paradigm could not cope with growing multitude of anomalies and contradictions, leaving many discovered phenomena unexplained.[23]

There appeared a need to develop a fundamentally new approach, adequate to objects and processes drawn into the orbit of investigation.

An important contribution to such approach was made by I. Prigogine's school. Researches of that school demonstrated that, moving away from equilibrium, thermodynamic systems get fundamentally new properties and start submitting to special laws. At considerable deviation from equilibrium thermodynamic situation appears a special type of dynamic state of the matter – dissipative structures. According to Prigogine, the type of dissipative structure depends to a large extent on conditions of its formation, and external fields may play a special role in selection of the mechanism of self-organization.[24] This is a conclusion with far consequences, if we take into account its applicability to all open systems which have an irreversible character. Irreversibility is what is characteristic for modern non-equilibrium states. They "carry the arrow of time" and are source of order, engendering high levels of organization.[25]

Prigogine and his colleagues developed ideas that the "arrow of time" is displayed in combination with stochasticity, when random processes are able to cause transition from one level of self-organization to another, radically transforming the system, are getting special heuristic value. Describing this mechanism, Prigogine emphasized a decisive, in the given development process, role of inner state of the system, regrouping its components etc. The situation defined as arising of order through fluctuations – random deviations of magnitudes from their average value – is characteristic for dissipative structures. Sometimes these fluctuations can increase, and in this case the existing organization cannot withstand it and is destroyed. At these breaking points (bifurcation points) it is fundamentally impossible to predict what direction will further development take, whether the system will become chaotic, or will pass to a higher level of ordering.[26]

Stochasticity pushes what remained from the system to a new way of development, and when the way is chosen, determinism again takes effect, and so on, till the next bifurcation.[27]

And here we see that the more complicated the system is, the more sensibility it displays with respect to fluctuations; and this means that even negligible fluctuations, intensifying, can change the structure, and, in this sense, our world is presented as deprived of guarantees of stability.[28]

Prigogine and Glensdorff made an attempt to formulate the universal criterion of evolution (taking the part of a mathematical rule), the core of which was the following: under certain circumstances thermodynamics not only does not contradict to the evolution theory, but can directly predict appearance of new things. Introducing this rule, the authors evidently tried to create a universal law for both living and non-living matter, the law of self-organization and evolution of any open system.[29] Really it was the matter of extending the class of self-organizing systems, when it became possible to apply phenomena of self-organization to non-living nature, biological and social processes.

This aspect of application of the ideas of self-organization was reflected in E. Jantsch's work "The Self-Organizing Universe: Science and Human Implication of the Emerging Paradigm of Evolution".

According to Jantsch, who used Prigogine's results of scientific researches on thermodynamics of non-equilibrium processes, self-organization can be spread over the whole totality of natural and social phenomena. Proceeding from the assumption that self organization is a dynamic principle giving creation to rich diversity of forms, displayed in all structures, Jantsch made an attempt to outline a uniform paradigm able to uncover the all-embracing phenomenon of evolution.[30]

All levels of both living and non-living matter, as well as states of social life – morality, religion – are developing as dissipative structures. From these positions, evolution is an integral process, parts of which are physical, chemical, biological, social, ecological, social cultural processes. The author is not just distinguishing these levels, but tries to find specific features of each of them. Thus, for living systems, the feature of this kind is the function of "autopoesis" as the system's ability to self-reproduction and conservation of its autonomous state with regard to environment.

Uncovering mechanisms of cosmic evolution, Jantsch considers breaking of symmetry as its source. Broken symmetry, prevalence of matter over antimatter in the Universe causes diversity of various kinds of forces: gravitational, electromagnetic weak, strong, and the idea of "Grand Unification" is the program of their investigation in view of their common genesis.

Jantsch presents the next stage in global evolution as appearance of the level of life, which is "fine overstructured physical reality".[31] Jantsch's characteristic of life can be treated differently. At first sight, we can reproach him with reductionism, but at the same time his elucidation of specificity of living matter allows us to come to a different conclusion: here genetic connection between living and non-living matter is meant. If we estimate Jantsch's conception as a whole, it is this aspect which is put forward first of all.

Further complication of the initial living systems, which is now regular, leads to appearance of a new level of global evolution – co-evolution of organisms and ecosystems, and then – to sociocultural evolution. At the level of sociocultural evolution reason is presented as a fundamentally new quality of self-organizing systems. It is capable of reflecting over passed stages of evolution of the Universe and foreseeing its future states. Thus Jantsch defines the place of man in the self-organizing Universe. Inclusion of man in it makes him involved in what is happening there. According to Jantsch, proportionality of people's world to the rest of the world inserts humanist sense into global evolution.[32]

Jantsch's conception can be evaluated as one of quite fruitful attempt to make a sketch of the modern general scientific picture of the world based on ideas of global evolutionism. It offers vision of the world, where all organization levels are genetically interconnected. The bases of such vision are not only philosophical ideas, but also real achievements of concrete sciences synthesized within integral notion of self-organizing Universe.

Modern conceptions of self-organization create real premises for synthesis of this kind. They let us eliminate the traditional paradigmatic gap between evolutionary biology and physics which, in its basic theoretical constructions, abstracts from ideas of evolution and, in particular, solve contradiction between the theory of biological evolution and thermodynamics.

At modern stage these theories do not any longer eliminate, but stipulate each other, in case we consider classical thermodynamics as some particular case of a more general theory – thermodynamics of non-equilibrium processes.

The theory of self-organization, rendered in terms of thermodynamics of non-equilibrium processes, reveals important regularities of development of the world. For the first time we have scientifically grounded possibility to overcome the old gap between notions of living and non-living nature. Life does not any longer look an island of resistance to the second law of thermodynamics. It appears as consequence of general laws of physics with its proper kinetics of chemical reactions which take place at conditions far from equilibrium.[33] It is characteristic that investigators, estimating the role of Prigogine's

conception, said that, rediscovering time, opens a new dialogue between people and nature.[34]

The ideas of thermodynamics of non-equilibrium systems and synergetics have fundamental worldview and methodological meaning, since due to them it became possible to justify notions of development of physical systems and include these notions into the physical picture of the world. In its turn, it opened new perspectives for understanding connections between the main floors of the Universe – non-living, living and social matter. If before synergetics there was no conception (which would refer to the class of scientific theories, not philosophical ones), which would allow investigators to collect results, obtained in different spheres of knowledge, into a whole, appearance of synergetics gave us fundamentally new possibilities to form an integral general scientific picture of the world.

Synergetics lets us pass from "linear" thinking, established within the mechanist picture of the world, to non-linear thinking, corresponding to the new stage of functioning of science. Most studied objects (natural, ecological, socionatural complexes, economic structures) are open non-equilibrium systems regulated by non-linear laws. They all display ability to self-organization, and their behavior is determined by preceding history of their evolution.[35]

The notions of open self-organizing systems find confirmation in different spheres of knowledge, stimulating elaboration of evolution ideas there.

Let us, in this respect, mention important results obtained in modern chemistry and, in particular, in the field of evolutionary catalysis. The theory of evolutionary catalysis made considerable contribution to comprehension of what chemical evolution is, what its reasons and regularities are. Within this theory investigators expose special chemical objects with non-equilibrium structural and functional organization, while chemical evolution itself is regarded as process of irreversible continuous changes of elementary catalytic systems. In these chemical objects (chemical systems) with non-equilibrium and functional organization the order of interacting parts and stability are reached due to a permanent interchange of matter and energy.[36]

Synergetics created conditions for intensive exchange of paradigmatic principles between different sciences. In particular, application of the ideas of self-organization in biology enabled scientists to generalize a number of special notions of the theory of evolution and thus extended the sphere of their application, using biological analogies in description of very different processes of self-organization in non-living nature and social life.

As a characteristic example, we can take the application of "Darwin's triad" (heredity, changeability, natural selection) in modern cosmology and cosmogony. We mean such bioanalogies as "natural selection" of universes, galaxies or stars, "cannibalism in the world of galaxies" etc.[37]

It is necessary to denote that conceptual apparatus of biology has traditionally played a special part in the development of the ideas of evolution. As early as in the classical period a tight cooperation of the theory of biological evolution with geology and young social disciplines existed.

Employed in biology of the 20th century, the ideas of cybernetics and the theory of systems stimulated processes of synthesis of evolution notions and system approach, which was a considerable contribution to the outline of methodology of universal evolutionism. Achievements of biology of the 20th century can be regarded as a special block of scientific knowledge, which, together with cosmology and doctrine of self-organization, played a

decisive role in defining new approaches to construct an integral general scientific picture of the world.

In the 1920s in biology a new branch of the evolution doctrine started being formed; that branch was connected with the name of V.I. Vernadsky and is called doctrine of evolution of biosphere and noosphere. Certainly, it should be considered as one of essential factors of scientific justification of the idea of universal evolutionism.

According to Vernadsky, biosphere is an integral system, which has the highest degree of self-organization and ability to evolution. It is the result of "long enough evolution in interconnection with non-organic conditions" and can be regarded as a regular stage in the development of matter. Biosphere is presented as a special geological body, whose structure and functions are determined by specific features of the Earth and Cosmos. Regarding biosphere as a self-reproducing system, Vernadsky stated that its functioning is, to considerable extent, conditioned by "existence of living matter in it – totality of all organisms living there".[38]

A specific feature of biosphere, as well as of living matter, is organization. "Organization of biosphere – organization of living matter – should be regarded as equilibria, mobile, permanently oscillating in historical and geological time around an exactly expressible average. Displacements or oscillations of that average continuously became apparent not in historical, but in geological time".[39]

To maintain its existence, the biosphere as a living system needs dynamic balance. But this is a special type of balance. A system which is in absolute equilibrium is unable to develop. Biosphere is a dynamic system, it is always in development. This development, to large extent, is realized under influence of inner interrelations of structural components of biosphere, and influence of anthropogenic factors upon it is constantly growing.

As result of self-development and under influence of anthropogenic factors, in biosphere there can emerge such states, that lead to qualitative change of subsystems, compounding it. In this respect unity of changeability and stability is a result of interaction of its components. Correlation of changeability and stability here plays the part of dialectic unity of constancy and development, and because of this stability itself is stability of process, constancy of development.[40]

Considering the role of anthropogenic factors, Vernadsky noted growing power of people; consequently, their activity causes changes in the structure of biosphere.[41] At the same time, man and humanity are most closely connected with living matter inhabiting our planet, from which they cannot be separated by whatever physical process.[42]

Evolutionary process of living beings, which has embraced biosphere, also exerts influence upon its inert natural bodies and acquires special geological meaning due to the fact that it has created a new geological force – scientific thought of social humanity.[43]

Vernadsky noted that we can more and more clearly see an intensive growth of influence of one species of living matter – civilized humanity – upon transformation of biosphere. Under influence of scientific thought and human activity biosphere is passing to new state – noosphere.[44] "Man is becoming a more and more powerful geological force, and change of his position on our planet coincided with this process. In the 20th century he got to know and embraced all biosphere, by its life humanity has become a whole".[45] In Vernadsky's opinion, "human power is connected with human reason and labour directed by this reason. It should give man base to take measures for preservation the shape of the planet. At the same time the force of reason will let him leave the bounds of his planet, the more so, as biosphere now is getting new understanding, it is regarded as planetary

phenomenon of cosmic scale, and, correspondingly, we are to reckon with the idea that life exists not only on our planet".[46] Life "always appeared somewhere in the Universe, where corresponding thermodynamic conditions exist. In this respect we may speak about eternity of life and its manifestations".[47]

In Vernadsky's conception life is presented as integral evolutionary process (physical, geochemical, biological), included into cosmic evolution as a special component. By his doctrine of biosphere and noosphere, V.I. Vernadsky demonstrated indissoluble connection of planetary and cosmic processes.

Understanding of this integrity has imperishable heuristic value, as it in many aspects determines the strategy of further development of humanity. The very existence of man depends on how he will build up his interrelations with environment. It is no mere chance that problems of co-evolution of man and biosphere are gradually becoming domineering problems of not only modern science and philosophy, but also of the very strategy of human practical activity, as "further development of the species homo sapiens, its further well-being require extremely accurate correlation of the character of evolution of human society, its productive forces and development of the nature. But while correlation of processes, taking place in the world of non-living matter, is provided with mechanisms of natural self-organization, correlation of characteristics of natural medium and society can be accomplished only by Reason and will of Man".[48]

We may conclude that the theory of evolution and on its base created the conception of biosphere and noosphere considerably contribute to justification of the idea of universal interconnection of all processes and demonstrate the irreversible character of evolutionary processes, clearly marking a time factor in them.

Thus, we can ascertain that modern science possesses all necessary natural scientific data, which allow us to justify the universal character of evolution. Evolution approach in science of the second half of the 20th century turns out closely connected with system consideration of objects. From these positions global evolutionism, which contains principles of evolution and systemness, presents characterizing interconnection between self-organizing systems of different degree of complexity and uncovering mechanisms of appearance of new structures in the process of development. Such structures emerge in open systems in non-equilibrium state and are formed due to fluctuations and cooperative effects, and thanks to it transition from one type of self-organizing system to another is realized, and evolution finally gets an oriented character.

Universal evolutionism allows us to consider interconnection not only between living and social matter, but also include non-organic matter into integral context of the developing world. It creates base to consider man as an object of cosmic evolution, a regular and natural stage in development of our Universe responsible for the state of the world, in which man himself is immersed.

The principles of universal evolutionism are becoming dominant of synthesis of knowledge in modern science. This is the core idea, which pierces through all existing special pictures of the world and is the foundation for a construction of the integral general scientific picture of the world, where the central place is passing to man.

In view of basic foundations of the modern general scientific picture of the world, the principles of universal evolutionism are demonstrating their heuristic value right now, when science has turned to studies of new types of objects – self-developing systems (unlike simple and self-regulating systems, which were studied at previous stages of functioning of science). Having included a new type of objects into the orbit of investigation, science has

to seek also new foundations for their analysis. The general scientific picture of the world, based on the principles of universal evolutionism, is a very important component of such foundations. It plays the part of global investigation program, which determines the strategy of investigation of self-developing system. And this strategy is accomplished at both disciplinary and interdisciplinary levels.

The general scientific picture of the world outlines a preliminary vision of objects studied, taking active part in putting problems, determining initial strategy of investigation. Study of complex, unique developing objects is possible only in the system of interdisciplinary interactions. In this case the general scientific picture of the world as a global investigation program is able "to give a hint", which methods and principles can be translated from one discipline in another, how it is possible to realize joining of knowledge acquired in different spheres of science, how to include this knowledge into culture at corresponding stages of functioning of scientific knowledge.

Setting strategy of investigation of self-developing objects within concrete scientific disciplines and providing strategy of interdisciplinary investigations, whose specific weight is growing in modern science, the general scientific picture of the world takes many functions which used to be performed by special scientific pictures of the world. The latter are losing their autonomy, are transformed under influence of system and evolution ideas and are included as fragments into the general scientific picture of the world and do not have a claim on a separate, independent status any longer.

This aspect of development of modern scientific knowledge should be regarded especially. Here we come across fundamentally new (in comparison with previous states of science) tendencies of historical development of the scientific picture of the world.

What was ideal at the stage of appearance of disciplinarily organized science, is becoming reality in modern conditions. In place of a poorly joined mosaic of pictures of reality studied there appears a common scientific picture of the world, absorbing contents of different disciplinary ontologies.

But this requires that investigators should study the preceding development of pictures of reality studied in different disciplines, include new notions of fundamental objects and structures, of interactions and space-time, which correspond to the ideas of system approach and evolutionism. And when these ideas find support in theories and empirical facts of leading spheres of scientific knowledge – in physics, cosmology, chemistry, geology, biology, technical and social disciplines, – then they start forming vision of objects as complex, historically developing systems. This vision gradually transformed special scientific pictures of the world, intensifying exchange of paradigmatic principles between them. As result, they began to unite naturally into an integral system of notions of the Universe, which, as it developed, gave creation to new levels of organization. Each of the sciences determines the place of its subject in this common picture, connecting it with either certain levels of the world organization, or with common features which determine interrelations and genetic transitions from one level to another.

As a result, relative isolation of special scientific pictures of the world from each other, characteristic for development of disciplinary science of the 19th century, is being replaced by their integration within the general scientific picture of the world. The degree of autonomy of special scientific pictures of the world in the second half of the 20th century has considerably decreased; they are transforming into aspects and fragments of the integral general scientific picture of the world. They join in blocks of this picture, characterizing

non-living nature, organic world and social life, and realize, each one in its area, the ideas of universal evolutionism.

At first sight, here we see as if reproduced a situation characteristic for early stages of development of new European science, when a mechanist picture of the world, playing the part of general scientific one, provided synthesis of achievements of science of the 17th – 18th centuries. But behind exterior similarity there is deep interior difference. The modern scientific picture of the world is based not on striving for unification of all spheres of knowledge and their reduction to ontological principles of one discipline, but on unity of different disciplinary ontologies in diversity. Each of them appears as a part of a more complicated whole, and each of them inside itself renders concrete the principles of global evolutionism. But in this case the problem, which was formulated above, in analysis of functions and typology of scientific pictures of the world, achieves a solution. We mean historicity of those typologies. It turns out that, special pictures of the world as relatively independent form of synthesis of knowledge not always existed in this quality. In the age of the development of natural science they did not exist. Appearing at the time of differentiation of science into independent disciplines, they started losing independence and turning into aspects or fragments of a modern general scientific picture of the world. Therefore it is senseless to argue, whether special scientific pictures of the world (pictures of reality studied) exist as independent forms of knowledge, or whether they are only fragments of the whole – the general scientific picture of the world.

Out of historical context any direct answer to these questions may result both right or wrong. Everything depends on to what historical stage of development of science we attribute the corresponding answer.

The destiny of disciplinary ontologies is at the same time destiny of disciplinarily organized science at different stages of its historical evolution. Sometimes the opinion is expressed that one day strengthening of interdisciplinary connections will lead to complete disappearance of independent disciplines. This point of view seems too extreme. It emerges as mere extrapolation of today's situation of considerable growth of specific weight of interdisciplinary investigations to the future. But it does not take into account the fact that different spheres of knowledge have their own specificities which cannot be reduced to each other. Besides, we are to take into consideration that disciplinary organization of science is determined not only by features of different objective spheres of investigation, but also by possibilities of forming subjects of scientific activity, presence of certain limits of "information capacity" of the subject and, consequently, necessary to quantize the body of knowledge, which are to be mastered in order to do scientific search.

Specialization necessary for work in science is still conserved; it is not destroyed even by modern possibilities of computerization of scientific activity, because using base of knowledge requires understanding them, interpretation and mastering methods of work on their content.

It seems that science of the future, at least, nearest future most likely will combine disciplinary and interdisciplinary investigations. Quite another matter is that their direct and reverse links can become far more intensive, and boundary between them less hard. Consequently, the general scientific picture of the world will be comprehended more and more clearly as a global investigation program and necessary horizon of systematization of knowledge.

Intensification of connections between different disciplines and growth of importance of interdisciplinary investigations as factor of development of the general scientific picture of the world affect not only cognitive, but also institutional aspects of modern science.

We may ascertain that modern synthesis of achievements of different sciences is proceeding in conditions, when the role of large complex programs and problem oriented interdisciplinary investigations is increasing.

In his analysis of tendencies of development of science in the first half of the 20th century, V.I. Vernadsky noted that they are classified more in accordance with problems than with subjects.

In science of the late 20th century this tendency attained clearly shaped features, especially in connection with appearance of complicated, often unique complexes as objects of investigation, and their studies stipulate joint work of specialists of different profiles.

Modern practice of social support and financing of "high science" is an evidence of priority of branches which appear on junction of different disciplines. These are, for instance, informatics, ecology and biotechnology, programs of search of energy sources, biomedical investigations etc.

Prestige of branches and programs of such kind is determined first of all by modern search for a way out of global crises caused by the industrial, technogenic development of civilization.

It is just the point of joining two types of factors, which determine development of the modern scientific picture of the world. Social aims and values, changing the shape of science as a social institution, and intrascientific, cognitive factors act in the same direction: they actualize interdisciplinary connections and interactions. Social disciplines actively participate in this process along with sciences, since most of modern trends of investigation study complicated developing complexes which include man and his activity as a component.

All this, on the one hand, reinforces the role of the general scientific picture of the world, which provides an integral vision of complicated developing "anthropomeasured" systems and understanding of the place of each discipline in their possible assimilation, on the other hand, it stimulates "exchange processes" between natural, technical and social disciplines, and that, in its turn, accelerates "building bridges" between corresponding special scientific pictures of the world, their inclusion into the general scientific picture of the world.

At modern stage the general scientific picture of the world, based on the principles of global evolutionism, more and more clearly appears as ontological foundation of future science, uniting sciences on nature and sciences on spirit.

The old opposition of sciences and humanities led investigators to conclude that the gap between them is broadening more and more, and finally it can lead to their isolation and, as a consequence, even to appearance of separate cultures with languages alien for each other.[49]

Actually, for a long time natural science was guided by cognition of "the nature in itself" irrespective of the subject of activity. Its aim was to obtain objectively true knowledge, not burdened with value-meaning structures. The attitude to the natural world was understood as monologue. The main thing which was to be done by scientists – to uncover and explain existence of natural connections in the natural world and, revealing them, reach objectively true knowledge, ascertain the laws of nature.

At the same time humanities were oriented at comprehension of man, human spirit, culture. Priority consisted in uncovering meaning, more in understanding than in explanation. The relation between subject and object (as any cognitive relation) was not monologue but dialogue. To obtain knowledge within humanities, exterior description was insufficient. Method of "objective", or "exterior" investigation of society should be combined with the method of its investigation "from inside", from the point of view of people who have formed social and economic structures and are acting in them.[50]

M.M. Bakhtin quite precisely noted these specific features of methodology of natural scientific and humanitarian knowledge: "Exact sciences are a monologue form of knowledge: intellect contemplates a thing and speaks about it. Here we can see only one subject – comprehending (contemplating) and speaking (uttering). He is opposed only to a voiceless thing. Any object of knowledge (including man) can be perceived and comprehended as a thing. But subject as such cannot be perceived and studied as a thing, since, being subject, he cannot, remaining subject, become voiceless, consequently, cognition of subject can be only dialogue".[51]

It really seemed that an insuperable contradiction arose between sciences and humanities. Moreover, science did not form such general scientific picture of the world, which could integrate them in a single space.

But nowadays there emerge real foundations for solution of this problem. Sciences and humanities can be integrated based on the principles of global evolutionism, which immanently include attitude to objective study of self-developing objects. Correlation of development of such objects with problems of the place of man, man's inclusion and actions in functioning of the overwhelming majority of historically developing systems, assimilated in human activity, introduce new, humanist meaning into scientific knowledge.

The need to join cognitive and value parameters of natural scientific knowledge is more and more clearly understood in natural science itself. An example is the position of representatives of so called biological structuralism, which are attempts to define a new paradigm in biology. Looking for basis, this new paradigm turns not only to "exact" natural science, but also to humanitarian knowledge. Taking into account that biology is closer than any other natural science to study the nature of man, representatives of "biological structuralism" to large extent hope for such changes in the scientific picture of the world, which would attach human dimension to it.[52]

In modern natural scientific cognition new tendencies of people's attitude to the nature arise. The nature, in broad sense of the word, is not any longer presented as "dead mechanism", at which human activity is aimed: man cannot treat it in the way a judge would do, knowing in advance what answers it should give to questions put.

As Prigogine and Stengers note, "it died, that finite, static and harmonious old world, the Copernican revolution destroyed it, having put the Earth into endless space. Our world is not a silent and uniform world of a watch mechanism... The nature was created not for our sake, and it does not submit to our will... It is time to answer for human old ventures, but if we are able to do it, it is only because that such is the way of our participation in cultural and natural settling, such is the nature's lesson, when we take the trouble of listening to it. The time for new alliance came, alliance started long ago, but for a long time unrecognized, between human history, human societies, knowledge and employment of the Nature for our purposes".[53]

To ensure his future, man cannot believe that he has no fundamental restrictions in his attempts to transform the nature in accordance with his own needs; he has adapt his needs according to the requirements put by the nature.[54]

All this means that now it is time to settle new relations of man and nature, not monologue but dialogue. In the past these aspects were characteristic for humanitarian knowledge. Now they penetrate into very different spheres and become priority principle of analysis.

At the same time ideas and principles, developed in natural scientific knowledge, are gradually penetrating to humanities. The ideas of irreversibility, variability in the process of making decisions, diversity of possible lines of development which appear at system's passing bifurcation points, organic connection of self-regulation and cooperative effects – all these and other ideas, justified in synergetics, turn out to be significant for the development of humanities. Constructing various conceptions of development of society, studying man, his consciousness, they cannot any longer ignore these methodological regulations, which are acquiring a general scientific character.

When science assimilates complicated, developing, "anthropomeasured" systems, former insuperable boundaries between methodology of natural scientific and humanitarian cognition are washed away.

We may conclude that, having started investigation of "anthropomeasured objects", sciences are coming closer to "the object field" of investigation in humanities. In this respect we can remind the reader K. Marx's well known statement that "history itself is a real part of the nature, becoming of the nature by man. Afterwards natural science will include science of man to that same extent, to which science of man will include natural science; that will be single whole science".[55]

Thus, in the late 20th century there appeared fundamentally new tendencies of development of scientific knowledge, which led to a reconstruction of the general scientific picture of the world as an integral system of scientific notions of nature, man and society. This system of notions, forming based on the principles of global evolutionism, is becoming a fundamental investigation program of science at the stage of intensive interdisciplinary synthesis of knowledge.

Absorbing the totality of fundamental scientific results and synthesizing them within integral image of development of the Universe, living nature, man and society, the modern scientific picture of the world actively communicates with worldview universalities of culture, in the context of which its development takes place. On the one hand, it adapts to them, but on the other hand, it introduces radical mutations into established cultural mentalities.

Development of the modern scientific picture of the world is one aspect of search for new worldview meanings and responses to historical challenge which modern civilization is facing.

SCIENTIFIC PICTURE OF THE WORLD AND NEW WORLDVIEW REFERENCE POINTS OF CIVILIZATION DEVELOPMENT

Modern science is developing and functioning in a special historical epoch. Its general cultural meaning is determined by inclusion into solving the problem of choice of life strategies of humanity, its search for new ways of civilization development.

Needs of this search are connected with crises of the late 20th century, which led to the appearance of modern global problems. Their comprehension requires that we should re-estimate development of the technogenics civilization, which has existed for four centuries. Many of its values, connected with attitude to nature, man, understanding of activity etc., which used to seem an unshakeable condition of progress, are now cast doubt on.

At our time the technogenics civilization, developing as a kind of antipode of traditional societies, has approached that "bifurcation point", after which transition to a qualitatively new state may follow. What direction the system will choose, what character its development will have – not only status of science in society, but also the very existence of humanity will depend on all that.

The culture of the technogenics civilization has always included scientific rationality as its basic value. Exactly within it the scientific picture of the world as such form of theoretical presentation of knowledge, which embodied the worldview status of science, became, functioned and developed.

In the technogenics civilization employment of science was first of all connected with technologies of transformation of the object world. The scientific picture of the world orientated man not only in understanding the world, but also in transforming activity, aimed at its change.

In fact, from the 17th century to the present, new European culture was regulated by paradigm, according to which man is called for actualization of his creative abilities, when he should direct his activity outwards, at transformation of the world and first of all – nature.

Attitude to nature as opposed to man was a worldview premise of science of the New Age. V.I. Vernadsky wrote: "Copernicus, Kepler, Galileo, Newton in a few decades broke the connection between man and the Universe established in ages. The scientific picture of the Universe, enveloped by Newton's laws, did not leave place for any display of life. Not only man, not only all living matter, but our whole planet were lost in the infinity of Cosmos".[56]

The idea of demarcation between the world of man and the world of nature, which was presented as alien to man, was immanently included in the scientific picture of the world and for a long time served as worldview foundation of its historical development.

This idea found justification in many values of the technogenic civilization, in particular, it correlated with those interpretations of Christianity, which gradually gained dominance in culture beginning with the period of Reformation. This variant of Christianity not only fixed dualism of man and nature, but also insisted on the postulate that it is the God's will that man should exploit the nature to suit his own ends.[57] It gave psychological confidence in man's striving for transforming the nature in the spirit of indifferent attitude to "health" of natural objects. Thus it destroyed bans for exploitation of the nature.[58]

The attitude to transformation, reshaping of the nature and then society gradually turned into the domineering value of the technogenic culture. An investigator, acting within this cultural tradition and guided by some scientific picture of the world, realized himself as an active creator of the new, eliciting the nature's laws from it in order to extend possibilities to bend the nature to people's needs.

The civilization oriented at such type of scientific rationality, achieved indubitable successes: the ideas of progress, democracy, freedom and personal initiative were established in it.[59] It provided constant production growth and improvement of the quality of people's life. But at the same time in the late 20th century, when humanity faced global

problems, questions of correctness of the choice of development paths in the Western (technogenics) civilization and, as a consequence, of adequacy of its worldview orientations and ideals arose again.

The search for ways of development of civilization is now attended by the problem of synthesis of cultures and forming of new type of rationality. In this connection arise questions of place and role of the picture of the world in search for new worldview orientations, which will provide the possibility for humanity to survive.

These questions can be formulated in the following way: does the modern scientific picture of the world require any system of values and worldview structures, fundamentally different in comparison with previous stages of development of science, for its justification? Did this picture cause radical transformation of worldview foundations of scientific cognition? What is its concrete contribution to settle worldview reference-points, corresponding to requirements of the new stage of civilization development, called for overcoming global crises and provide survival and further development of humanity?

First of all we are to distinguish those fundamentally new ideas of the modern scientific picture of the world, which concern notions of the nature and man's interaction with it. These ideas do not blend with the traditional technogenics approach understanding of the nature as non-organic world, indifferent to man, and understanding of attitude to the nature as to "dead mechanism", with which one could experiment infinitely and assimilate its parts, transforming it and bending it to man.

In the modern situation we are developing a new vision of natural environment, which we interact with our activity. It is now considered not as a conglomeration of isolated objects, not even as a mechanical system, but as an integral living organism, which can be changed only within certain limits. Violation of these limits leads to change of the system, its transition into a qualitatively new state, able to cause irreversible destruction of the system's integrity.

At previous stages of development of science, from the establishment of natural science to the middle of the 20th century, such "organismic" understanding of the surrounding nature would have been perceived as an atavism, return to half-mythological consciousness, not coordinated with the ideas and principles of the scientific picture of the world. But after notions of living nature as complex interaction of ecosystems had been formed and had entered science, after modern ecology had developed, such understanding of immediate sphere of human vital functions as of organism, not as a mechanical system, became a scientific principle, justified by numerous theories and facts. Ecological knowledge plays a special part in forming scientific system of notions of that sphere of natural processes, with which man interacts in his activity and which is his immediate habitat as a biological species. This system of notions constitutes a most important component, which combines knowledge of biosphere, on the one hand, and knowledge of social processes, on the other hand. It serves as a sort of bridge between notions of development of living nature and development of human society. So it is not surprising that ecological knowledge is getting special importance in solving problems of interactions of man and nature, overcoming the ecological crisis, and so is becoming an important factor in forming new worldview foundations of science.

At the same time the principles, developed in ecology and included into general scientific picture of the world, are also getting a wider worldview character. They exert influence upon worldview of the whole culture, "essentially affect spiritual and intellectual

climate of the modern epoch in the whole, determine transformation of value structures of thinking".[60]

In the modern culture more and more clearly shaped contours of the new vision of the world are present, and the scientific picture of the world makes a considerable contribution to its establishment. This vision is based on the idea of interconnection and harmonious relations between people, man and nature, which constitute a single whole.

Within such approach we can trace outlining of new vision of man as an organic part of the nature, not as its lord; science develops the ideas of priority of cooperation over competition.[61]

E. Laszlo speaks of the world, "new vision" of which is, in essence, forming of new worldview system, absorbing achievements of modern science. F. Capra's ideas of "united ecological vision of the world" are keeping such approach. Capra uses this notion in the meaning of "profound ecology", as opposed to "superficial ecology", which is anthropocentric by nature and regards man as towering above nature, sees in him source of values, assigning nature the role of auxiliary means.[62] Unlike "superficial ecology", "profound ecology", in Capra's opinion, does not pick out man from the natural environment, but interprets the world as integral totality of phenomena connected with and dependent on each other. It is oriented at consideration of value of all living beings, and man is regarded as a regular and integral part in the whole diversity of life.[63]

Ecology and, in particular, "united ecology" (A. Ness) demonstrates evidently enough scantiness of anthropocentrism, proving that "man is neither lord, nor centre of the Universe, he is only a being who submits to the laws of reciprocity".[64]

Changes, happening in modern science and fixed in the scientific picture of the world, correlate with intense search for new worldview ideas, which are elaborated and polished in very different spheres of culture. These are searches for new religion, rethinking of the old one, as in works of R. Attfield and L.White,[65] creation of "new ethics", as suggested by E. Laszlo and O. Leopold. Laszlo says that we need new morality, which would base more on necessary requirements of humanity's adaptation as a global system to surrounding natural environment, than on individual values. Such ethics can be created on base of ideal of respect to natural systems.[66]

Similar ideas are developed by Leopold who proposes to distinguish ethics from the philosophical point of view as distinction of social and antisocial behavior and ethics from the ecological point of view as restriction of the freedom of action in the struggle for existence.[67]

Leopold's new ethics is ethics which determines man's relations with the Earth, animals and plants. In his opinion, it should change man's role, converting the conqueror of community into ordinary and equal in rights its member. Ethics of the Earth reflects existence of ecological conscience and, correspondingly, conviction in individual responsibility in health of the Earth. Humanity is facing the goal to form ethical attitude to the Earth, which cannot exist without veneration for its value.[68]

These ideas are in keeping with A. Schweitzer's thoughts expressed in his conception of veneration for life as base of ethical world and life asserting. For him the idea of veneration for life appears as an answer to the question how man and the world are correlated with each other. He notes dual character of relations between man and the world, taking into consideration that man bears both passive and active relations to the world: on the one hand, man has to submit to natural course of events, in accordance of which he builds up his life, on the other hand, he has all the possibilities to exert influence upon life and its

change within certain limits. And the only way to attach meaning to human existence is to raise natural connection with the world and make it spiritual.[69]

All these speculations of the prominent philosopher and scientist are developed in the principles of so called biosphere ethics, which includes not only interrelations between people, but also interrelations between man and nature. It contains "veneration for the high (celestial world), compassion to the equal (human world), aid to the low (plant and animal world)".[70]

New worldview ideas appear as sort of resonance of modern science and created pictures of the world with other spheres of cultural creative work. Mutual influence of these spheres accelerates the process of formation of new meanings of cultural universalities and, correspondingly, new system of value priorities, stipulating way to other, non-traditional strategies of human vital functions.

In their turn, new senses and value orientation to larger and larger extent are included into the system of philosophical and worldview foundations of science.

The key moment in their development is notions of the scientific picture of the world of organic involvement of man in an integral cosmos and of proportionality of man, as a result of cosmic evolution, to the world which engendered him.

Ethical ideas of man's responsibility before nature, which appear on this base, make the picture of the world axiologically loaded.

Striving for considering man in his connection with the rest of the world, regarding the world as organic integrity, is an important methodological reference-point, able to lead to change traditional technogenics civilization notions of destination of man and his activity. New worldview ideals of attitude towards nature, based on ethics, rejecting the principle of supremacy over the nature and including the idea of man's responsibility, in their turn, pave the way to new understanding of rationality as dialogue between man and the world.

The principles of openness and self-regulation of complicated systems, developed in synergetics and introduced as the most important principle into the modern scientific picture of the world, lead to the same philosophical and worldview ideas.

As Prigogine and Stengers note, "natural sciences nowadays display need of dialogue with the open world. The time for new concord came, concord started long ago, but for a long time unrecognized, between human history, human societies, knowledge and using the Nature for our purposes".[71]

Comprehending the world, man should not thrust his own language on the nature, but enter dialogue with it. In Prigogine's opinion, modern science has learned how to treat the studied nature with respect, the nature which cannot be described "from outside", from the spectator's position. Description of the nature is a lively dialogue, communication, and it submits to limitations which are evidences, that we are macroscopic beings, immersed in a real physical world.[72]

Dialogue with nature in the new type of rationality is attended by the ideal of openness of consciousness to diversity of approaches, to close interaction (communication) of individual minds and mentalities of different cultures.

This aspect of openness and communication as characteristic of the new type of rationality and corresponding strategies of activity is especially emphasized by J. Habermas. He notes: "instead of relying on reason of productive forces, i.e. finally on reason of natural science and technics, I trust the productive force of communication".[73] Frames and structures of communication, shared activity and openness are continuously changing – both "in themselves and in relation to other spheres of society as such".[74]

Ontology of this new type of rationality is notions of integral cosmos, which organically includes man, notions of the objects of reality as historically developing "anthropomeasured" systems possessing "synergetic" properties.

These ideas, concretized in the modern scientific picture of the world, lead to new consideration of subject and object of cognition, which are now not regarded as alien for each other, but are presented as only relatively autonomous components of a special integral, historically developing system built into the world.

In this approach rationality is already endowed with new distinctive features. It is characterized by openness, reflexive explication of value and meaning structures included in mechanisms and results of objectively true comprehension of the world.

"Open rationality" (V.S. Shvyrev) is now opposed to closed rationality, intraparadigmatic rationality, when an investigator is moving within an adopted rigid conceptual carcass. Open rationality assumes "attentive and respectful attitude to alternative picture of the world, appearing in cultural and worldview conditions different from those of modern science, it assumes dialogue and mutual enrichment of different, but equal in rights cognitive positions".[75]

From this point of view, we are to pay special attention to new and unusual properties of the modern scientific picture of the world. In many aspects it embodies the ideals of open rationality, and its worldview consequences correlate with philosophical and worldview ideas and values, which appear on the soil of different, even in many aspects opposite cultures.

We mean wonderful correspondence of the modern scientific picture of the world not only to those mentalities, which are gradually forming in the Western (technogenic) culture of the late 20th century, but also correspondence to philosophical ideas grown on the soil of distinctive Russian culture and its Silver Age, as well as philosophical and worldview notion of traditional cultures of the East. Up to now, the scientific picture of the world has developed on base of mentalities of technogenic culture, embodied proper only for this culture type of scientific rationality, which occupied one of the first places in the system of its value priorities. When other types of cultures adopted science, it required simultaneous transplantation of certain fragments of Western experience to different ground. Such transplantation have always transformed traditional culture and were realized in the course of catching-up modernizations, aimed at transition of the traditional societies to the way of technogenic development (for example, Peter the Great's reform in Russia). The process of transplantation of science to Russian soil in Peter's epoch is a characteristic example. It became possible only along with adoption of fragments of urban culture, European education, new way of life, which Peter the Great often implanted by force in boyar midst and nobility.[76]

A quite tight connection of new European science with mentalities of the technogenic culture led to fundamental mismatch of the scientific picture of the world, its philosophical and worldview foundations, on the one hand, and prescientific cosmologies of traditional societies, on the other hand.

Scientific knowledge, appearing in traditional cultures, submitted to myth-cosmic and religiously ethical worldview structures, in the forming of which this knowledge did not directly take part. A different situation we can detect in the technogenics civilization. Here scientific rationality claimed for the role of justifying principle of worldview ideas – social, ethical, religious (an example – neo-Thomist philosophy).

No surprise that distinctive opposition of the Western technogenic culture to the culture of traditional societies first of all was displayed in opposition of the scientific picture of the world and its philosophical corollaries to "organismic" notions of the world of traditional oriental cultures.

But such opposition hardly can be applied in respect to modern science. The changes, which took place there in the late 20th century, formed a new picture, which created special philosophical and methodological corollaries. These corollaries are in resonance with fundamental life-sense reference points of cultures of the East and have a lot in common with original philosophical ideas grown on the soil of Russian cultural tradition.

We would like to discuss the latter situation especially, as here we face the fundamentally important, for modern civilizational development, problem of dialogue of cultures, interchange of ideas born by different cultural traditions.

First, let us pay attention to the coincidence of many notions of the modern scientific picture of the world with the ideas of philosophy of Russian "cosmism". These ideas for a long time were taken for some kind of periphery of the world flow of philosophical thought, though they certainly exerted influence upon works of such prominent natural scientists as V.I. Vernadsky.

Traditionally in Russian cosmism at least three trends are distinguished: natural scientific (N.A. Umov, N.G. Kholodny, V.I. Vernadsky, K.E. Tsiolkovsky, A.L. Chizhevsky); religious-philosophical (N.F. Fedorov); poetical (S.P. Dyachkov, V.F. Odoevsky, A.V. Sukhovo-Kobylin).[77]

Russian cosmism appeared as sort of antithesis to classical physicalist paradigm of thinking, based on strict differentiation of man and nature. It made an attempt to revive ontology of integral vision, which organically united man and cosmos. These problems were discussed both in scientist and religious trends of cosmism. In the religious trend N. Fedorov's conception was the most significant. Like other cosmists, he was not satisfied with split of the Universe into man and nature as opposed to each other. Such opposition, in his opinion, condemned nature to thoughtlessness and destructiveness, while man – to submission to existing evil. Fedorov maintained the idea of unity of man and nature, connection between "soul" and cosmos in terms of regulation and resurrection.

He offered a project of resurrection, which was not reduced only to resurrection of ancestors, but contained at least two aspects: raising from the dead – in narrow, direct sense, and in wider, metaphoric sense, which included the nature's ability to self-reconstruction.[78]

Fedorov's resurrection project was connected with the idea of human mind's going out to the outer space. For him, "the Earth is not bound", and "human activity cannot be restricted by the limits of the terrestrial planet", which is only the starting point of this activity.

Critically looking at Utopian and fantastic elements of N. Fedorov's views, which contain a considerable grain of mysticism, nevertheless we distinguish important rational moments of his conception: the quite clearly expressed idea of interconnection, unity of man and cosmos, the idea of correlation of rational and moral elements of man, the ideal of unity of humanity as planetary community of people.

But while religious cosmism was more notable for fantastic and speculative character of its discourses, the natural scientific trend, solving the problem of interconnection between man and cosmos, paid special attention to comprehension of scientific achievements, which confirmed that interconnection.

N.G. Kholodny developed these ideas in terms of anthropocosmism, opposing it to anthropocentrism. He wrote: "Having put himself in place of God, man destroyed his natural connections with the nature and condemned himself to long solitary existence".[79]

In Kholodny's opinion, anthropocentrism passed through several stages in its development: at the first stage man did not extract himself from the nature and did not oppose himself to it, he rather "humanized" the natural forces – this was the attitude of the weak to the strong; at the second stage man, extracting himself from the nature, looks at it as the object for investigation, the base of his well-being; at the next stage man uplifts himself over the nature, basing on spiritual force, he studies the Universe, and, at last, the next stage is characterized by crisis of anthropocentric worldview, which starts to collapse under influence of achievements of science and philosophy.[80]

N.G. Kholodny was right noting that in the past anthropocentrism had played a positive role; it freed man from fright of the nature by means of uplifting him over the latter. But gradually, beside anthropocentrism there appeared sprouts of the new vision – anthropocosmic. Kholodny regarded anthropocosmism as a certain line of development of human intellect, will and feelings, which led people to their aims. An essential element in anthropocosmism was the attempt to reconsider the question of man's place in the nature and of his interrelations with cosmos on base of natural scientific knowledge. Anthropocosmism started to consider man as one of the organic parts of the world and settling the conviction that only on this way we can find the key to understanding the nature of man. Man should strive for unity with the nature, which enriches and broadens his inner life.[81]

N.A. Umov developed similar ideas, emphasizing that "man can understand himself as a part, one of transient links of the Universe". He also believed that anthropocentric worldview was going into ruin, ceding place to anthropocosmism.[82]

The idea of interconnection of man and cosmos was especially emphasized in K.E. Tsiolkovsky's works, one of which was even entitled "Cosmic Philosophy". He wrote: "All cosmos conditions our life ... Everything is continuous and everything is united".[83] "The Universe would be meaningless if it were not filled with organic, intelligent, feeling world".[84]

We can see certain concord of Tsiolkovsky's ideas with the anthrop principle, formulated later.

Tsiolkovsky not merely points at interconnection of man and cosmos, but stresses dependence of the former on the latter. "... It is hard to suppose that any part of it (cosmos) will not exert, sooner or later, influence upon us".[85]

This idea – influence of both nearer and far space upon human life – was at length analyzed by A.L. Chizhevsky, who believed that "our scientific worldview is still far from the historical notion of the role of space radiations for the organic realm".[86] But the number of advances of the 20th century science in Chizhevsky opinion allows to conclude that "in science on nature an idea of the unity and coherence of all phenomena in the world and appreciation of the world as undivided whole become nowadays especially clear and deep … The structure of the Earth, its physics and chemistry, biosphere are penetration of the structure and mechanics of the Universe".[87]

Chizhevsky opposed his point of view to the existing opinion that "life is a result of random game of only terrestrial forces". For him, to a considerably larger extent life is a cosmic rather than a terrestrial phenomenon. It was created by influence of creative dynamics of space upon inert material of the Earth. He noted that man "is not only a

terrestrial being, but cosmic, connected by all his biology, all molecules, particles of the body with the space, with its rays, flows and fields".[88]

In this sense influence of solar energy upon the course of life processes does not seem accidental. Chizhevsky was one of the first investigators who justified this theory by concrete scientific facts. In particular, he analyzed correlations between solar activity and peaks of epidemic deceases and demonstrated that solar activity plays the part of some kind of regulator of the course of epidemic processes. Certainly, it does not mean that "the state of solar activity is the direct reason of epidemic spread of such and such deceases", but activity of the Sun "favors their fast ripening and intensive course".[89]

In the scientist tradition of Russian cosmism the problem of united world and united knowledge of the world was elaborated, in a most significant form, in V.I. Vernadsky's conception. As well as other cosmists, Vernadsky supposed that "anthropocentric notion does not coincide with the real reveal of cosmos, which is enveloped by scientific work and scientific thought of investigator of the Nature".[90] He noted that "science still has no clear understanding that phenomena of life and phenomena of dead nature, taken from geological, i.e., planetary point of view, are displays of the united process".[91] But, as Vernadsky emphasized, biologists should not forget that they study the world of life, which is an integral part of the Earth's crust and exerts active reverse influence upon it, transforming it. They should not consider life out of touch with evolution of the integral cosmos. In his opinion, such direction was caused by the fact that for a long time the Universe had seemed lifeless. The basis for such statements was establishing of Copernicus's principle in science. When in the first half of the 19th century scientists obtained numeric data of size of the Universe, it seemed that life was entirely dissolved in the space, and gradually was settling the opinion that the inconsiderable meaning of life is the proper conclusion from scientific investigations. But, as science developed, there appear reasons to cast doubt on the indisputability of such conclusions.[92]

Vernadsky, like other cosmists, opposes a different point of view to the traditional position. He demonstrated that, in the world evolution, life is not random, but a regular consequence, that character of cosmic development of life processes is conditioned by the cosmic whole. In such consideration life is now presented as a cosmic phenomenon.[93]

V.I. Vernadsky regards humanity as the part of biosphere, which exerts active influence upon this system. Human consciousness, emerging in the course of bioevolution, becomes a special factor of evolution, whose meaning grows in time. The development of biosphere into noosphere is a logical completion of evolution of matter: all parts of the developing world turn out interconnected, and man is naturally fits in with this world.

Russian cosmism quite clearly understood not only man's dependence on cosmos, but also (what is especially important) reverse man's influence upon the surrounding world.

Commensurability of man and the rest of the world served base for the by Russian cosmists developed idea of need to commeasure human activity with the principles of integrity of this world.

Russian cosmism justified the principles of new man's attitude to the nature. In fact, it approached closely enough to understanding the problems, which later received the name of global. At least, the idea of possible ecological crisis, though in hidden form, but quite clearly was expressed in the words of representatives of this trend. It is no mere chance that N.G. Kholodny emphasized that "transformations imposed on the nature by the man, has its limits".[94] As a reasonable being, man should foresee the results of his activity, for which he bears responsibility.

Russian cosmism's intuitive understanding of global contradictions between man's technocratic activity and harmony of cosmos led to searches for a way out of a possible future unfavorable state, in which humanity may find itself.

Practically each of the cosmists offered his own version of humanity's future development. K.E. Tsiolkovsky painted a quite idyllic picture: "... climate will be changed at will of need. All Earth will become inhabited and yield great fruits. There will be total scope for development of human both social and individual qualities. Technics of the future will give people chance to study all planets... imperfect worlds will be destroyed and replaced by own population. The Earth will give heavenly colonies its surplus of people ... Finally, we will see infinite Universe with infinite number of perfect beings".[95]

V.I. Vernadsky in his conception regarded a more realistic scenario. Consideration of man as a special geological force, able to transform the world, where he lives, radically, led to the conclusion of possible negative consequences of human activity, which can be seen as prevision of possible global ecological crises. At the same time, Vernadsky was optimistic when he looked at perspective of humanity, connecting its future with the processes of transition from biosphere to noosphere and growth of the regulating role of human reason.

Original speculations, anticipating the modern situation of global crises, were offered in N. Fedorov's philosophy of "common deed". The thinker brilliantly cautioned against unreasonable treating nature and its possible consequences. "People have, most likely, done all the harm he could do concerning nature (exhaustion, devastation, spoiling), and concerning each other (invention of deadly weapons, just means of mutual annihilation)".[96] All evil of our life, in Fedorov's opinion, proceeds from disharmony of man and nature.

Having drawn a quite bright picture of "all-Earth crisis", he offered his project of solving the problem of "the common deed". This common deed is presented as regulation of spontaneous natural forces. "In regulation, in ruling the forces of blind nature consists that great deed, which can and must become common".[97] In realization of his project Fedorov mostly relied on man's moral force and force of his reason. He wrote: "Cosmos needs reason to be cosmos, not chaos. Cosmos (as it is, but not as it must be) is force without reason, while man is (yet) reason without force. But how can reason become force, and force become reason? Force will become reasonable when reason rules it. So, everything depends on man".[98]

In N. Fedorov's conception "the common deed" was presented as the way leading to unity and renovation on a humanist, moral base.

Thus, the cosmist philosophy quite clearly brought out two aspects of interconnection of man and space: on the one hand, man presented as a fragment of evolving cosmos, its integral part, in all its revelations dependent on the cosmic whole. On the other hand, man himself was regarded as a factor of evolution, developing his abilities in such a way, that, creating new technics and technology, he started exerting active influence upon the surrounding world. Though in the late 19th – early 20th centuries belief in scientific and technical progress was evident enough, and crisis consequences of technocratic attitude to the world were not displayed yet, cosmists warned future generations against possible negative consequences of unrestrained, limitless technological exploitation of the nature.

But still cosmism, though it contained original ideas and possessed considerable prognostic power, did not gain wide spread. In fact, it repeated the destiny of many philosophical conceptions, whose productive ideas greatly outstripped their time.

But in today's situation, when humanity is facing ecological crisis, search for "common deed" as regulation of relations between man and nature is gaining priority meaning.

We may state that cosmism as a special branch of philosophical thought is in tune with modern strivings for new life senses and ideals, harmonization of man and nature.

The coincidence of the main principles of cosmist philosophy and many fundamental ideas of the modern scientific picture of the world and its worldview conclusions is to be especially emphasized. Cosmism returns to an integral vision of the world as unity of man and cosmos. It is able to play a positive role in the synthesis of ideas developed in the Western European cultural tradition and in oriental philosophical systems, where man from the very beginning has been considered as an integral part of cosmos. Correspondingly, the ideas of cosmism are organically included into outlining new metaphysics, which could be philosophical foundation of post-non-classical stage of development of science, providing further development of general scientific picture of the world in the course of global evolutionism ideology, notions of "anthropomeasured", historically developing systems and ideals of "anthropocosmism".

Open character of the modern scientific picture of the world reveals its wonderful commensurability not only with the principles of Russian cosmism, but also to many worldview ideas established in traditional cultures of the East. The clearest display of it we can see in comprehension in terms of synergetic and global evolutionism of numerous fundamental ideas of oriental philosophy, which for a long time had no adequate perception in the European cultural tradition.

First of all it refers to notions of the world as a united organism, different parts of which are in distinctive resonance relation to each other.

This ontology has immanently the ideal of harmony of man and nature and their inner unity. Striving for unity found its expression in the statement "one in all and all in one", which was the domineering principle of Taoism and Confucianism.[99] In Buddhism it is expressed in the doctrine of dharma. "All elements of dharma are something homogenous and equal in force; they all are connected with each other".[100]

For cultures of the East, in particular, the Old Chinese philosophical doctrines, characteristic is the notion of the world as an enormous living organism. It was seen not as dually divided into natural and human worlds, but was perceived as organic whole, all parts of which are correlatively connected and exert influence upon each other. This cosmology excluded opposition of subject and object and was based on adoption of binary nature of things corresponding to the Yin-Yang model.[101] Yin and Yang represented two primary forces, which express bipolarity of existence: Yin acted as the negative pole, which embodied passive (feminine) element, and Yang as positive, active, creative (masculine) element. Being interconnection as light and darkness, Yin and Yang permanently alternate and interact with each other.[102]

The conception of Yin and Yang is set the foundation of understanding of universal interconnection of phenomena and their mutual resonance. "Everything is penetrated by the united way – Tao, everything is interconnected. Life is united, and striving of every part of it should coincide with striving of the whole".[103]

Man, included in the world, should feel the world rhythm, bring his mind into accord with "celestial rhythm", and then he will be able to grasp the nature of things and hear "Music of humanity".[104]

The very idea of rhythms of the world, their influences upon each other, including rhythms of human vital functions in the process of this interaction, was long perceived by

the European mind as something without serious base in scientific facts, something mystical and inexpressible rationally. But in the modern scientific picture of the world, assimilating achievements of synergetics, new notions of interaction of parts of the whole and of concordance of their changes are formed. It has been elucidated that non-forced interactions, based on cooperative effects, start playing a special role in complicated systems.

For open, self-organizing systems such interactions are the constituting factor. It is thanks to them the system is able to pass from one state of self-organization to another, creating new structures in the process of their evolution.

Cooperative properties are traced in very different self-regulating systems, which consist of a very large number of elements and subsystems. They can be found, for instance, in behavior of plasma, in laser coherent radiation, in morphogenesis and dynamics of populations, in economic processes of market self-regulation.[105]

For examples, at certain critical levels of energy laser pumping there emerges an effect of emitting of light wave by atoms: they act in a strictly correlative way, each atom emits a purely sinusoidal wave, as if coordinating with behavior of another emitting atom, i.e., here emerges the effect of self-organization.[106]

Similar effects can be observed in processes of embryonic cell division, when each cell in the tissue receives information of its situation from surrounding cells, and so their mutually coordinated differentiation takes place.[107] In the experiments on embryos a cell of the central part of the body, after transplantation into the head sector, developed into eye. These experiments demonstrated that cell do not dispose of information of their further development from the very beginning (for instance, through DNA), but extract it from its position in cellular tissue.[108]

Synergetics generalizes similar situations of cooperative effects of elements and subsystems in complicated self-organizing systems. It regards "resonance" of functioning parts in such systems and presence of cooperative effects as one of the important displays of self-cooperation.

If we turn again, from these positions, to the ideas of oriental philosophies about "resonance" of different parts of united cosmic whole, they will obtain new sounding: in any case, they can be perceived as a worldview guess, which finds response in modern notions of the scientific picture of the worlds, which realizes a "synergetic" approach to description of various processes of the nature, social life and human spirit.

We can give many parallels between cosmological notions of traditional oriental cultures and ideas of synergetics included into modern scientific picture of the world.

In traditional worldview systems of the East a special role belonged to the idea of non-being, which was perceived as all completeness of the world. Non-being was interpreted as reality, wherefrom situations of being (objects, processes, phenomena) emerge, submitting to a strict rhythm of the world development, and then, having exhausted themselves, return to non-being.[109]

It is very interesting to compare these ideas with fundamental synergetics' notions of appearance of structures in non-linear medium. Non-linear medium as potentially possible field of structures, where they appear and disappear, is a special kind of reality, giving creation to the given structures. If we imagine an infinite number of potentially possible structures in an infinitely complicated non-linear medium, it will appear analogue to non-being (with respect to already emerged and disappeared structures), containing all future completeness of the world.

Old oriental notions of the world as an integral organism, in which man is included, of resonance between different parts of this organism, formed an ideal of human activity, different from the one of the Western technogenic culture.

Understanding man as demiurge, who does force transforming objects in order to bend them to his will, was alien to oriental cultures. As H. Hesse stressed, people formed in traditions of those cultures put themselves the same aim – to know how to rule the laws of nature, but they choose entirely different ways. They did not split themselves from the nature and did not try to intrude by force into its mysteries, they never opposed themselves to nature and were not hostile to it, they always remained a part of it and loved it in reverential love.[110]

The Chinese cultural traditional prescribed that human activity toward the nature should not bear character of violence. As J. Needham noted, within this tradition force was always recognized a hardly perspective way of action. In Chinese culture man was associated with the image of a peasant, not that of a sailor or cattle-breeder (who are believed to be inclined to command and submission). "But the peasant-farmer, one has done all that is necessary for the crops, must wait for them to come up. A famous parable in Chinese philosophical literature derides a man of Sung State who was discontented with the growth rate of his plants and started to pull at them to help them to come up".[111]

In Chinese doctrines opposition of force to non-force action was developed in the terms "Wei" and "Wu-Wei"(application of force and non-action). Non-action (Wu-Wei) meant not absence of any action, but such kind of action, which enables nature to develop in its own way. "A perfectly wise, doing deeds, prefers non-action. Realization of non-action always brings calmness".[112]

It is indicative, that the "Wu-Wei" principle, rejecting the way of action based on permanent force intrusion into the course of natural processes, at our age unexpectedly correlates with the ideas of synergetics of possible strategies of regulation of complicated self-organizing systems.

For instance, it becomes clear that such a system, undergoing violent and active force pressure from outside, probably will not give creation to new states and new structures, but will "decline" to old structures. But if it passes a bifurcation point, then a little energetic "influence-prick" in the proper time-space locus is enough to make the system reorganize, and new type of structures will appear.[113]

We have noted above that man's interaction with complex open systems goes on in such a way, that human action itself is not something exterior, it is as if included in the system, transforming every time the field of its possible state.

Hence, it becomes important in the action strategy to determine thresholds of interference in proceeding processes and provide, by means of minimized influence, those directions of development of the system, which would let it avoid catastrophic consequences and achieve people's goals.

The "Wu-Wei" principle is oriented at quite similar behavior and human activity strategies. It required that people should feel natural rhythms of natural world and act in accordance with them, letting the nature itself disclose its interior potentials and choose such ways of development of processes, which would be coordinated with human needs.

The Old Chinese philosophy stressed that only people "ignorant of the true laws of being" understand the "Wu-Wei" principle as absence of action, obedience and submissiveness. But sage, who developed understanding Tao in themselves, by "non-

action" meant not absence of action, but natural action, which corresponded to the nature of things.[114]

In discussion of ideals of human activity it is important to distinguish one more extremely significant aspect in oriental doctrines, which has a lot in common with modern searches for new values and strategies of human vital functions.

We mean interconnection between morality and truth, gaining which has always been proclaimed the aim of scientific knowledge.

The question of their correlation has been permanently discussed in Western philosophy, but it was given the following solution: the process of comprehending the truth by itself supposes to be a moral action.

The scientific revolution in Europe, as J. Needham noted, isolated scientific truth from ethics, and the world became more dangerous, while the oriental doctrines never knew such isolation.[115] They developed a more delicate treatment of relation between truth and morality. From the point of view of sages of the East, true knowledge consists not in investigation of objects with the aim to take possession of them, but to reach co-being with the world.[116] One can comprehend this, only following Tao, regarded as natural way of things and at the same time moral way, which one should travel. Tao opens only to moral people, and only this is able to lead people to perfection.[117]

In order to have the truth opened, one needs moral self-training. People's activity, directed at cognition of the exterior world, and their activity, directed at perfection of their interior world, should be coordinated and cannot exist without one another.

One of the oldest and most fundamental ideas of Chinese philosophy was the idea of cosmic importance of man's moral qualities. Thinking of resonance of all parts of cosmos, Chinese sages believed that "it is man's behavior, his morality that the order in cosmos, regular change of seasons, heat and cold depends on".[118] The way the image of Tao, or Heaven, regulates people's actions. But Heaven "can turn to man, and it can turn out from him". It is no mere chance that the Chinese say: "Heaven acts in dependence on people's deeds".[119] The Old China natural calamities were perceived as evidences of untrue ruling, as indicators if immoral behavior of sovereigns.[120]

Certainly, if we understand these ideas literally, they will sound as mystical ones. But they also contain more profound meaning, connected with demand of ethical regulation of people's cognitive and technological activity (including technology of social managing). In this, more profound meaning they are quite consonant to modern searches for new worldview reference-points of civilization development.

Thus, in the late 20th century, when humanity found itself face to face with the problem of choice of new strategies of survival, many ideas, outlined in traditional oriental doctrines, correlate with new values and worldview meanings, which appear within modern technogenic culture, and are formed in different spheres of this culture, including scientific cognition.

Development of the modern scientific picture of the world justifies new methods of cognition of the world, which are consonant to forgotten achievements of traditional cultures, as worldview corollaries.

We may ascertain that development of the modern scientific picture of the world is organically included in the processes of formation of new type of planetary thinking, based on tolerance and dialogue of cultures and connected with the search for a way out of modern global crises.

Getting openness, the scientific picture of the world contributes to the processes of synthesis of different cultures. It unites new approaches, which emerged on base of developing scientific rationality, a constant characteristic of technogenic (Western) civilization, with ideas developed in entirely different cultural traditions, in oriental doctrines and in "cosmic philosophy'.

The modern scientific picture of the world is included in the dialogue of cultures, whose development has up to now passed along parallel lines. It is becoming one of the most important factors of cross-cultural interaction of the West and the East.

NOTES: CHAPTER 7

[1] Ideas developed in this chapter are the results of my investigations of last years. Partially those results were published in my works Stepin (1989), (1992), (1992a, pp.177-189), (1998). In a more complete version they are presented also in the book *Scientific Picture of the World in the Culture of Technogenic Civilization* (1994) written together with L.F. Kuznetsova.
[2] Capra (1989, p.113).
[3] Incidentally we mean raising the problem in the framework of science while concerning philosophy there were surmised ideas on global cosmic evolution beyond the science of their own time.
[4] Moiseev (1989, p.53).
[5] In the following discourse we will use these terms as synonyms.
[6] Moiseev (1986, p.25).
[7] Ibid.
[8] See Saushkin (1976), Calvin (1971), Kuznetsov V.I. (1973), Rudenko (1987) and others.
[9] Silk (1982, pp.16-17).
[10] Friedman (1965). On Friedman's conception see Eremeeva (1985, pp.160-161).
[11] Guth and Steinhardt (1984).
[12] Ibid.
[13] Linde (1984), Gut and Steinhardt(1984).
[14] Linde (1984, p.210).
[15] Gut and Steinhardt (1984).
[16] Carter (1974).
[17] Ibid.
[18] For more details see Kazyutinsky (1989).
[19] Haken (1987).
[20] Klimontovich (1986, pp.56-58).
[21] Prigogine and Stengers (1984).
[22] Ibid.
[23] A characteristic example is the fact that Belousov–Zhabotinsky reaction, which is the striking evidence of synergetic effects, did not get justification at the period of its discovery and was not accepted by the scientific community.
[24] Prigogine and Stengers (1984).
[25] Ibid.
[26] Ibid.
[27] Ibid.
[28] Ibid.
[29] Klimontovich (1986, p.104).
[30] Jantsch (1980, p.19).
[31] Jantsch (1980, p.19).

[32] Ibid, p.19.
[33] Glensdorff and Prigogine (1971).
[34] Toffler (1986, p.17).
[35] See Dobronravova (1991, p.7).
[36] On the role of evolutionary catalysis in settling an idea of chemical evolution see more details in Rudenko (1987, pp.70-78).
[37] Kazyutinsky (1986, p.70).
[38] Vernadsky (1977, p.70).
[39] Ibid, p.15.
[40] Vodopianov (1981, pp.193-194).
[41] Vernadsky (1940, p.47).
[42] Vernadsky (1977, p.13).
[43] Ibid, p.18-19.
[44] Ibid, p.19.
[45] Vernadsky (1944, p.117).
[46] Ibid. P. 114-115.
[47] Vernadsky (1934, p.82).
[48] Moiseev (1990, pp.40-41).
[49] Snow (1971).
[50] Gurevich (1990, pp.30-31).
[51] Bakhtin (1980, p.383).
[52] See Karpinskaya (1992, pp.145-146).
[53] Prigogine and Stengers (1981, p.296).
[54] Such a state of man–nature attitude N.N. Moiseev calls ecological imperative. See Moiseev (1990, p.40).
[55] Marx and Engels (1955-1981, vol. 42, p.124).
[56] Vernadsky (1940, p.176).
[57] White (1967).
[58] Ibid.
[59] See Kara-Murza (1990, pp.3-15).
[60] Zelenkov and Vodopianov (1987, p.81).
[61] Laszlo (1990, pp. 23-31).
[62] Capra (1990, p.33).
[63] Ibid, p.33.
[64] Macey (1990, p.82).
[65] Attfield (1983), White (1967).
[66] Laszlo (1972, p.281).
[67] Leopold (1983)
[68] Ibid.
[69] Schweitzer (1990, p.339), (1992).
[70] See Shipunov (1990, p.450).
[71] Prigogine and Stengers (1981, pp.273, 296).
[72] Prigogine and Stengers (1984).
[73] Habermas (1992, p.85).
[74] Ibid, p.131.
[75] Shvyrev (1992, p.98).
[76] This social experiment was in detail analyzed in N.I. Kuznetsova's works. See Kuznetsova (1982).
[77] Guirenock (1960, p.5).
[78] Fedorov (1982). An analysis of N. Fedorov's conception` see, e.g., Kogan (1990).
[79] Kholodny (1982, p.187).

[80] Ibid, p.175.
[81] Ibid, pp.178-197.
[82] Umov (1916, p.215).
[83] Tsiolkovsky (1986, pp.302, 278).
[84] Ibid, p.378.
[85] Ibid, p.302.
[86] Chizhevsky (1976, p.27).
[87] Ibid, pp.24, 26.
[88] Ibid, pp.33, 331.
[89] Ibid, p.246.
[90] Vernadsky (1978, p.40).
[91] Ibid, p.12.
[92] Ibid, pp.31-33.
[93] Ibid, pp.43, 36.
[94] Kholodny (1982, p.142).
[95] Tsiolkovsky (1986, pp.287-290).
[96] Fedorov (1982, p.55).
[97] Ibid, pp.58-59.
[98] Ibid, p.535.
[99] See Grigorieva (1979, p.119).
[100] Rosenberg (1991, p.128).
[101] Grigorieva (1979, pp.106-112, 148).
[102] East – West (1982, p.244).
[103] Ancient Chinese Philosophy (1972, vol.1, p.26).
[104] Grigorieva (1983, p.127).
[105] For more details, see Haken (1987).
[106] Ibid.
[107] Ibid.
[108] Ibid.
[109] See Grigorieva (1979).
[110] Hesse (1970).
[111] Needham (1964, p.135).
[112] Ancient Chinese Philosophy (1972, vol.1, pp.115-116).
[113] Kurdyumov (1990).
[114] Grigorieva (1983, p.128).
[115] Needham (1988).
[116] Grigorieva (1979, p.75).
[117] Ancient Chinese Philosophy (1972, vol.1, pp.114, 119-121, 128).
[118] Grigorieva (1979, p.112).
[119] Kuo Yü (1987, p.298).
[120] Grigorieva (1979, p.113).