



FEATURE ARTICLE

Co-evolution as the Art to Live Together

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Abstract

Co-evolution is “the art to live in one tempo-world”. Co-evolution means that diversity is not curtailed but it is maintained and is under development both on the levels of elements and separate subsystems. In a self-organizing society, it is necessary to cultivate a feeling of responsibility of each state structure and of each individual for the whole in a plural and united world. “The art to live together” means stimulation of tolerance to another style of life / other people and maintenance of diversity in globalizing communities.

Key Words:

Co-evolution, tempo world, complex systems, constructing of the future, nonlinear dynamics, self-organization.

Introduction

In order to understand the modern complex and changeable global world, which is full of instabilities and crises and processes of decay and integration, we have to master a complex nonlinear thinking. The basis of such thinking is the modern theory of complexity, which is under development under a number of different names, viz nonlinear dynamics, the theory of self-organization, the theory of dissipative structures, fractal geometry, studies in deterministic chaos, the theory of autopoiesis, etc. Following the German Professor Hermann Haken, the Russian scientist community call this field of scientific research synergetics.

1. Constructive Principles of Co-evolution

The idea of co-evolution was one of the most favorite ideas introduced in the theory of self-

organization of complex systems (called also synergetics) by the founder of the synergetic movement in Russia, Corresponding Member of the Russia Academy of Sciences, my Teacher Sergey P. Kurdyumov (1928-2004) and propagandized emphatically by him. I was lucky to collaborate closely with him during almost two decades. He talked about the synergetic discovery of constructive principles of co-evolution of complex system and about the possibility to master time and to construct a desirable future (a great scope of materials in this respect may be found at his site: www.spkurdyumov.narod.ru)

Why did Kurdyumov call the principles of co-evolution discovered by synergetics constructive ones? Because they may be used for the effective management activity, for the strategic vision of the future and for the long-term planning, for

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elaboration of rational national and state policy in the modern globalizing world. Because the synergetic principles of co-evolution are substantial and oriented to the remote future, which is practically impossible to predict using the traditional methods. Because the deep understanding of the synergetic principles of co-evolution, of non-linear synthesis of parts into a sustainable evolutionary whole can and should underlie the modern "art to live together", when promoting the strengthening of the position of tolerance and the preservation of diversity in globalizing communities (Knyazeva and Kurdyumov 2007).

To train a holistic rather than analytical view is, to all appearances, the today's need of managerial practice. "To think globally in order to succeed in solving a local and peculiar problem;" - that is a slogan of the modern time. The comprehension of the barest reform of systems of management is based on non-traditional knowledge of sociosynergetics, i.e. upon the understanding of laws of co-evolution and self-organization of complex social, economic and geopolitical systems. These results are of great and inestimable significance as a kind of world view that is necessary for understanding of the course of evolutionary processes in complex systems, to which kind of systems human and social systems par excellence belong.

To carry out appropriate reforms of social management it is necessary to change mentality, the very mode of thinking (Knyazeva 2004). Thinking should be global, non-linear, holistic, solidary, based on the understanding of constructive principles of co-evolution, i.e., at bottom of fact, of rules "to live together" and "to develop together in a sustainable way". In other words, to think globally means to think integrally and holistically, to understand ways of integration of structures, which develop in different tempos and are on different levels of development, into a united concordant evolutionary whole.

Complexity of a structure is connected with its coherence. By coherence, we understand the concordance of tempos of life structures by means of diffusive and dissipative processes that are a macroscopic manifestation of chaos. In order to

build a complex organization, it is necessary to coherently join subsystems within it, to synchronize tempos of their evolution. As a result of the unification, structures fall into one tempo-world, so they acquire one and the same moment of peaking; they start to co-exist in the same tempo-world (Knyazeva and Kurdyumov 2001).

To create a complex structure, it is necessary to know how to unify structures "of different ages", i.e. structures of different stages of evolution and having different rates (tempos) of evolution. It is necessary to know how to include the elements of "memory", the biological memory, DNA, or the memory of culture, cultural traditions. Inasmuch as the structure-attractors, which characterize the developed, steady evolutionary stages of structures in the nonlinear world, are described by the invariant-group solutions, the spatial and temporal properties of structure processes turn to be tightly bound. The dynamics of development of a complex structure needs a coordinated (with one and the same moment of peaking) development of substructures of "different ages" within it, this leads generally to the breakdown of spatial symmetry. The insertion of "memory" (of elements of the past) signifies the symmetry breakdown in space.

Different but not arbitrary structures can be unified. The degree of connection of structures, which are to be integrated, and the stages of their development are not arbitrary as well. There are various but not arbitrary ways of unification of structures into integral ones. There is a restricted set of integration ways, ways of construction of a complex co-evolutionary whole.

The selectivity (the quantum character) of ways of integration of parts into a whole is connected with the imposed requirement of existence in one and the same tempo-world, i.e. of development of all parts with one and the same moment of peaking. This is the physical basis of quantification by integration of complex evolutionary structures. If joinable structures have even slightly different from each others moments of peaking, then near the moment of peaking (the singularity), they will become incomparable in intensity. Thus, the synthesis of relatively simple evolution-

ary structures is an entire complex structure occurs by the establishment of a common tempo of evolution in all unified parts (fragments, simple structures). The intensity of processes in various fragments of the complex structure (for example, for the social medium - a level of economic development, quality of life, provision with information, etc. in different countries) can be diverse. The fact of integration signifies that structures, becoming parts of a whole, acquire a common rate of development.

An integrated complex structure arises only if there is a certain degree of overlapping of simple structures. There must be a certain topology, "architecture" of overlapping. A constructive "sense of proportion" must be observed. If the area of overlapping is not sufficient, then the structures will develop independently, they will not feel each other, they will live in different tempo-worlds. However, if the overlapping is too wide, then the structures will flow together very fast, they will straight away "degenerate" in one rapidly developing structure.

One may attempt to formulate rules of symmetry breakdown, when uniting structures of "different ages" into a whole and to indicate an optimum degree of connection (of overlapping of areas of localization) of substructures within a complex structure, a proper topology of their location, laws of switching of regimes and other factors, ensuring sustainable concordant development in one and the same tempo-world.

When integrating structures, a magnitude of maxima of intensity of processes occurring in them must be in an appropriate way matched with their distance from a center. Three structures having equal maxima of intensity (levels of development), when integrating, settle themselves in apexes of an equilateral triangle. If one of these structures is more developed, the equilateral triangle turns into an isosceles one: bigger intensity of burning is "compensated" by its bigger distance from a center of symmetry. But there is no continuity in such a mechanism of "compensation", i.e. a majority of intermediate states is unstable and only selected, definite configurations of structures are metastable. The com-

pensation of a magnitude of a maximum by its bigger distance from the center of symmetry of a complex structure "works" in a discrete, quantized field of possibilities of integration.

When maxima of intensity increase, a distance between them decreases ((the model of "converging waves of burning" is developed and studied by our scientific school), and, on the contrary, when they decrease, the distance increases. One can integrate structures with different powers of intensity by arranging them at different distance from the center and by observing certain forms of organization

The factor of unification of parts into a whole structure is chaos, dissipation, fluctuations or for social structures their analogue (exchange processes of various kinds). Chaos plays a constructive role not only in the moments of choosing a further evolutionary path, but also in the processes of assembling a complex evolutionary whole. Chaos leads to the establishment of coherence of development in all parts (substructures). To put it figuratively, chaos serves as a "glue" that binds parts into a united whole.

2. Acceleration of Development as a Great Gain from Integration

If a complex structure is organized from more simple ones in a right topological way (that is, if there are a certain degree of interaction and overlapping of substructures and a certain symmetry of "architecture" of an emerging united structure), the united structure finds itself on a higher level of a hierarchical organization, i.e. a step towards a super-organization is taken. Thereby, the rate of development of structures, which are integrated into a complex one, is being picked up. The rapidly developing structures "pull to themselves" by their tempo of life the slowly developing structures. In case of right unification, a ratio of maxima of more developed structures to maxima of less developed ones remain constant, i.e. small, underdeveloped structures don't fallout into another tempo-world, they don't become a simple background for development of structures with bigger maxima, there is no decay of tempo-worlds.

Besides, if an evolutionary whole is organized in a right topological way, the whole begins to develop at a rapid pace, which is higher than the pace of the most rapid developing structure before the unification.

The path of unity and of integration of different parts into entire structures is not steady, permanent and monodirectional. The evolutionary ascent towards more and more complex forms and structures passes through a number of cycles of decay and integration, of tearing off from the whole and inclusion in it, the slowdown of the processes and their acceleration.

From the theory of self-organization, it follows that any open systems with strong nonlinearity are most likely to pulse. They have natural cycles of development: the stages of differentiation of parts alternate with the stages of their integration, scattering alternates with rapprochement, the weakening of bonds changes into their strengthening. The world seems to go towards a universal unity, a super organism. But it moves forward not monotonously but through certain fluctuations and pulsation. The stages of decay, even if partial, are followed by stages of more and more powerful unifications of structures. This modern scientific notion of complexity reminds us of the eastern images of "rhythms of life" that are peculiar to our world, first of all, of the Chinese symbol Yin-Yang.

The cycles of increase and decrease of the intensity of processes, of decay and unifications of parts indicate regularity of nonlinear processes; the cycles are determined by the very nature of nonlinear processes. Any complex structures at the moment of maximum of accretion, or at the culmination of development (at the moment of peaking of processes), are subjected to the inner instability with respect to small perturbations, they are under the threat of decay.

The history of humankind testifies that the world empires increased in size and became stronger to the maximum extent and in the end they came asunder, sometimes disappeared completely without leaving a trace. But if the beginning of decay of some geopolitical system is observed, it is reasonable, from the synergetic point of view, to

put a question: is the nonlinearity of the system sufficient to turn the evolutionary processes back, to switch them to another regime of the renewal of bonds, the attenuation of processes in the central domain and their stirring at the periphery of the structure? If the nonlinearity is not sufficient, then the former intensive processes may simply be extinguished and come to naught.

Thus, the fundamental principle of behavior of complex nonlinear systems is the periodical alternation of stages of evolution and involution, the unrolling and rolling, the explosion of activity, the increase of intensity of processes and their fading, weakening, the converging to the center, the integration and the disintegration, at least the partial decay. There are profound analogies here to the historical testimonies of the downfall of civilizations and the break-up of great world empires, to the cycles of Nikolai D Kondratiev, the oscillatory regimes of John K. Galbraith the ethnogenetic rhythms of Lev N. Gumilyov.

At the initial stage of formation of a complex structure, its right topological organization is of great importance. When the process of integration occurs, the structures are not simply put together; they do not simply become parts of the whole in an unaltered, undistorted form. They become somehow transformed; they from strata on each other and intersect, and at the same time some of their parts fall out. As the physicists say in such a case, there exists an overlapping with the energy loss. This signifies that the unification leads to the economy of energy, to the diminution of material expenses and human efforts.

The topologically proper organization of structures in an entire evolutionary structure results in an approach to the moment of peaking, the moment of maximum development. The whole develops faster than its integral parts. It is more profitable to develop together, since the joint, co-evolutionary development is connected with a saving of material (in particular, energetic), spiritual and other resources. Every new way of the topologically proper integration of structures, the appearance of successive layers (with bigger exponent of nonlinearity) of hierarchical organi-

zation picks up speed of development of the whole as well as its integral parts. Therefore, the evolutionary path to the building of more and more complex organization of structures in the world is to a certain extent pre-determined.

We should lend our ears to Eliot's advice:

"We must be still and still moving

Into another intensity

For a further union, a deeper communication"
(Eliot 2000, p.260).

Co-evolution is *per se* "the art to live together". To follow the rules of co-evolution signifies to construct the preferable and the sustainable future. An important task can be set: to define order parameters of evolution of states that determine a corridor of their sustainable co-evolution. General rules of co-evolution of complex social, economic and geopolitical structures on national, international and global scales, which arise from the methodological analysis of mathematical models, can be summarized in a form of the following key notions:

- a) it is a common tempo of development that is a key indicator of connection of complex structures into a single whole;
- b) *non-uniqueness* and involuntariness of ways of assembling of a whole from parts;
- c) structures-parts enter the whole not in an invariable form, they are transformed and became deformed in a certain way in accordance with the peculiarities of an emerging evolutionary whole;
- d) for assemblage of a new complex structure, for re-crystallization of a medium, one need to create situation "at the edge of chaos" when small fluctuation are able to initiate a phase transition, to throw down the system in another state, and to set another course to process of morphogenesis, another way of assembling of the complex whole. "The very nature of co-evolution is to attain the edge of chaos" (Kauffman 1995, p.29)
- e) to make a dynamically evolving integral structure, a proper topology of combination of structures is of great importance;
- f) in case of right, resonant unification of complex structures into the whole, a united su-

per complex structure begins to develop at a higher rate ("it is profitable to live and to develop together").

Co-evolution is not simply a process of adjustment parts to each other by formatting a complex whole, of their resonant positional relationship and of synchronization of tempos of development, but it is enactive cognition of the world by a human being, synergism of cognizing and constructing subject and of a medium surrounding him. This is also an interactive connection between human organizations and single individuals, the universal collaboration, complicity and solidarity, concerted efforts in construction and rebuilding of the world, and thereby of one's own mentality. This is disclosure of universal affinity of all with everything and of mysterious connection between the past, the present and the future.

3. To Manage Co-evolutionary Complexity Means to Manage Time

Complexity is the unity of plural and diverse elements. According to E. Morin, who argues the problem in the true philosophical context, complexity is "unitas multiplex". i.e. both "unity of diversity" and "unity in diversity" (Morin 1977, p. 147)

According to the models of non-linear dynamics and evolution of open dissipative structures elaborated by the Moscow school, complexity of structures and of their behavior is conditioned, first of all, by their tempos of evolution. The tempo, or the rate of evolution of open nonlinear systems, is a key characteristic in exploring complexity.

The thesis can be explained by a few ideas that are more concrete:

- a) there are very fast, avalanche-like processes, the blow-up regimes, which are of great importance. An effect of localization, i.e. the structure formation, and the appearance of extremely complicated structures may be observed in these very regimes;
- b) periodical alternation of various evolutionary regimes may take place. The change of tempo of evolution as well as of general character of the occurring processes is a ba-

sis for self-maintenance of complex structures in the world;

- c) it is the tempo of evolution that serves as indicator of integration of structures developing with different speeds in a whole complex structure;
- d) synchronization of tempos of evolution of different complex structures in a way of co-evolution and sustainable development in the world.

To manage time, to put it more precisely to master time, is to know how to unify complex structures in a resonant way, i.e. to create a common tempo-world which is able to accelerate development of a produced whole and its constituent parts. The path of co-evolution is a mutually beneficial path into the future.

The world we live in is non-linear and open. The world is creative. An unexpected and often charming new appears in it. The future is multiple and uncertain in our non-linear world; it is a fuzzy future. The non-linear world often gives surprises to us. In such a world, the probability of fulfilment of even improbable events increases. The science of synergetics is an optimistic attempt to cope with nonlinear situations and to make use of the methods of effective nonlinear management of complex system in their states of instability. This is the way of attainment of a desirable and at the same time feasible future, the future that is coordinated with the own properties of complex system.

In order to succeed in constructive and management activity in the modern complex and globalizing world and to build oneself properly in co-evolutionary processes, one should;

- a) know how to take robust decisions under the conditions of deep uncertainty which is determined by the increasing complexity of social processes. And for that an intellectual alliance (intellectual synergy) between prediction, production of innovations and entrepreneurial (management) activity is necessary;
- b) know how to think globally and to act actively and interactively, in a way that is adequate to a situation (the principle of situatedness of action);
- c) to be in synergism with a medium, with an organization or enterprise which is under our management control (the principle of non-linear feedbacks which is being established between a subject and a medium of his/her activity);
- d) to create a coherent and mutually concordant world fitting not only his/her own cognitive and constructive possibilities, but also inner latent tendencies of medium (attitude towards, not only desirable but also feasible, future).

Co-evolution as "the art of live together" signifies

- a) to live each other not against each other;
- b) to live in a such a way in order not to diminish chances of other people, including future generations, to live very well too;
- c) to take care of those people who are poor and having no rights as well as of the state of environment, to widen the circle of our attention, sympathy and concern (tolerance and the ecological consciousness).

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