Synergetics as heuristic background of modern architecture and urbanism

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Abstract. The article reveals the impact of synergetics and the evolutionary synergetic picture of the world on the architectural, urban intentions of the 20th and 21st centuries. The formation of architectural discourse is consistently shown, in which the leading place is occupied by figurative symbols, signs of a systematic (consistency), evolutionary systems, symbiosis, metabolism, self-organization, self-development, nonlinearity, dissipativity, or openness of the system, i.e. its ability to share information with the environment. The latter generates the rules of shaping in architecture, corresponding new architectural ideas, in particular, the many types of nonlinear architecture, where nonlinearity is read and embodied in different ways. These are both a surreal understanding of nonlinearity which creates a seemingly random, chaotic interweaving of lines, the possibility of infinite continuation of a building, and considering nonlinearity as the opposite of linearity, smoothness, straightness. Urban trends such as metabolism and symbiosis, synthesizing the mental unity of man and nature with the basic ideas of synergetics, a synergistic picture of the world are approved.

1. Introduction

Image and culture in general, and architecture, in particular, as language systems, discourses, which are connected by a single semantic field are established in modern theory of culture, and theory of architecture. Thus, the theorist of postmodern architecture, Charles Jencks, in formulating the basic principles of postmodern architecture, includes the principle of participatory design, the changing of the paradigmatic line “A house is a machine for living” with the paradigm “Home is a way of life” undoubtedly embodies the postmodernism’s intent on maximum proximity to everyone as an individual [1]. This intention is embodied in the development of the practice of redevelopment of residential premises in accordance with the ideas of the individual subject and its expansion on such a scale that the society was forced to adopt appropriate restrictive laws. Following the intention of proximity to each individual makes it necessary to design a variety of colors and forms, an environment that creates aesthetic and psychological comfort for people in accordance with modern research in the field of psychology and coloristics with their focus on studying the conditions of psychological comfort for each person.

This guideline includes in a single cultural space not only architecture, but also literature with its statement about the identity of literary and colloquial languages, which is realized due to the proximity of the literary language to the spoken language, and not vice versa. An appropriate sculptural discourse is formed, in which the sculptural images are concrete incarnations, signs of the idea of
being as close as possible to the reality of life, to each individual person, which is reflected in numerous sculptures of slippers, a baby, a fan, etc. At the same time, all new sculptural forms are proportional with man, brought down from pedestals to the ground, are inscribed in the habitat, the natural, everyday life of a man of the postmodern era.

It is worth noting, that each cultural epoch is a space of interaction of cultural discourses. For example, the formation of the Copernican heliocentric system with its view of the sun as the center of our planetary system affects the formation of a certain heliocentric discourse in the political sphere. Thus, the image of Sun being likened to the King who appears as the central figure of state power; a corresponding architectural discourse is formed, glorifying the king, elevating him to the rank of the center of the vital system of the state and society.

2. Relevance

Thus, the modern cultural epoch can be represented as the coexistence of various discourses, including architectural and urban. In this case, the interaction of all linguistic systems of the cultural epoch is natural. What has been said above actualizes the problem of identifying the impact of synergy, the modern evolutionary-synergetic picture of the world on the architectural intentions of the 20th and 21st centuries.

The study of the influence of synergy on different cultural discourses is inherent in modern philosophy: Kuznetsova M.A. explores creativity in the context of synergy [2]; undoubtedly the synergetic context of the genesis of the Santiago’s theory of knowledge of U. Maturana and F. Varela [3], as well as the concept of the information society as an era of bifurcations of E. Laslo [4]; H. Haken substantiates the possibility of applying the laws of self-organization in philosophical anthropology [5]. And N. Luhanmanapply this laws in considering of processes of formation and developing of social systems [6]. The contextual heuristic role of postmodern culture and the corresponding philosophy in the evolution of modern architecture is justified by I.A. Dobritsyna [7].

3. Statement of the problem

In light of the above, the task of researching synergy, the synergetic picture of the world as a genetic, heuristic background of the formation of relevant, correlative architectural, and urban intentions requires a more complete solution in terms of the current state of synergetics, a synergetic picture of the world.

4. The theoretical part

The modern scientific picture of the world considers the world as a process of co-evolution of many open, self-developing, self-organizing, time-carrying systems, both in inanimate nature and in the organic world, society, culture. This picture of the world arises on the basis of the idea of global evolution that was formed through the 1980s, uniting the ideas of the systems and evolutionary approaches into a whole. The idea of evolution came from biology since the time of Charles Darwin, but since the picture of the world is built on the basis of avant-garde discipline, which physics has always been, the time of evolutionism as a component of the picture of the world came in the 1940s and ’50s, when the main provisions of the theory of systems were formulated. System consideration of the object involves the identification of the integrity of the elements of the system, structural relationships, interaction with the environment.

The formation of synergetics theoretically substantiates the idea of the nonspecificity of the processes of self-organization, which makes possible interparadigmatic inoculation of the ideas and principles of synergetics in the field of scientific knowledge, and in the field of culture in general. Synergetics studies a consistent, coherent state of the processes of self-organization, structuring of complex systems of different nature. At the same time, in order for the system to be considered as self-organizing, it must satisfy a number of conditions, the main ones are: to be thermodynamically open, dynamic equations describing its behavior must be non-linear; processes must occur cooperatively, coherently, in concert; and deviations from the equilibrium state must exceed a critical value.
Basically, all natural objects are open systems, exchanging energy, matter and information with the outside world, that is, dissipative systems that carry the arrow of time. Nonlinearity in mathematics means having more than one solution under the same conditions. Nonlinearity as a principle of the evolution of a system means the existence of multiple paths of development; the choice of one of them is spontaneous, random, if the system is returned to its initial state, the line of development will be completely different. Deviation from the equilibrium state gives rise to a new type of dynamic state characteristic of dissipative structures. In this case, the formation of a new dissipative structure depends on the conditions of its formation. A large role is played by external factors. As a rule, for entering a new state, the system must lose stability due to fluctuations, oscillations. When fluctuations increase, the existing organization of the system may collapse. The system enters a period of chaos as the beginning of a new order, at the point of bifurcation, the choice of an evolutionary trajectory.

In the modern era of principles of self-organization, researchers adhere to the totality of natural and social phenomena. Thus, all the states of nature and society are considered as dissipative structures. The co-evolution of organisms and living systems continues the cosmic evolution with the emergence of life. The formation of man and mankind in accordance with the anthropic principle, according to which in one of the formulations, if there is something to observe, an observer should appear, means a new stage of evolution. Now the mind is the main component of self-organizing systems, which allows us to consider systems as human-sized. Thus, a person becomes involved in everything that happens in the world, which affirms the principle of humanism as the principle of a person’s responsibility towards and for everything that happens. The latter actualizes the humanistic expertise of any project, including the architectural one, which actualizes humanistic reference points, intentions within the framework and architectural activity. The main task of the architect becomes the task of harmonizing relations between natural and socio-cultural systems.

In general, the evolutionary synergistic picture of the world contributes to the formation of discourse, the basic concepts of which are: a dissipative system; self-organization; self-development; chaos; contingency; cooperativeness; coherence; system; structure; human-sized system; humanistic expertise; evolutionary humanism; evolution and related concepts from the field of biology – symbiosis; and metabolism. These concepts form a narrative in contact with the architectural discourse, influencing it as a result of transferring the basic concepts of the discourse of the new world view to architecture as a cultural sphere. The latter becomes the basis for design, for the formation of the rules and principles of architectural and design activities, for the approval of new directions in architecture.

It should be noted that the interpretation of any system as human-sized generates the need for humanistic expertise in all projects, including architectural and city-planning project expertise in terms of their compliance with the principles of the welfare of man and mankind. One aspect of humanistic expertise is aesthetic expertise, which is practically becoming the norm when evaluating architectural and urban solutions.

Indeed, the definition of architecture is changing under the influence of an evolutionary synergistic worldview. If the traditional definition emphasizes that architecture is the design and construction of buildings, that is, it acts as a means of organizing the material environment of human habitat, now its functioning is emphasized as a method of systemic organization of space, an artificial environment. Note that architecture has always been an inherent ensemble. It can be suggested that, in particular, the concept of an ensemble, along with the scientific prototypes of systems, has predetermined the content of consistency.

Organic architecture is emerging in which positions the building as a dissipative system - exchanging energy and matter with the environment. Such eco-houses are equipped with solar panels, capable of uninterruptedly providing the inhabitants of energy, with sophisticated technological tools necessary for relatively independent functioning and harmonious dialogue with nature.

Other manifestations of the synergistic aspect of systemic self-organization are the special contemporary landscape urbanism [8] and the urbanism principle of quality architecture combined with the identity of the place [9]. Synergistic systematicity is particularly manifested in the
organization of the interaction of historical cultural buildings with the modern urban environment [10, 11]. And, more broadly, it manifests itself in the interaction of globalization and local tradition while homogenizing the construction environment of the homogenization of the built environment [12].

The mainstream of modern architecture is non-linear architecture. Nonlinearity is one of the concepts which express these ideas. Its typical concept of synergetic discourse. Y. Utson understands nonlinearity as the possibility of ambiguous reading of an architectural image [13]. A surreal understanding of nonlinearity creates a seemingly random, chaotic interweaving of lines, the possibility of infinite continuation of a building, etc., S. Calatrava [14], Z. Hadid [15], D. Libeskind [16], J. Kaplicky [17,18] and a number of other architects consider nonlinearity as the opposite of linearity, smoothness, straightness. Urban trends, such as K. Kurokawa's metabolism and symbiosis, synthesizing the mental unity of man and nature, inherent in Japanese culture, with the basic ideas of synergetics, a synergetic picture of the world are approved [19-21].

The concept of nonlinearity is embodied in the emphasis on the ambiguity of reading artistic forms. For example, the opera house in Sydney by architect Jorn Utson, built in the style of expressionism has become the subject of many interpretations (sails, swan wings, etc.). The aspect of thematized non-linear interpretational becomes almost an independent direction of semantic games in the theory and history of architecture.

As a direction, nonlinear architecture is formed later as an antithesis to the image reading of linearity. Accordingly, the nonlinear architecture is characterized by shaping on the basis of a decentralized asymmetric combination of curves, of smooth lines and planes (P. Schumacher, Z. Hadid), which can be understood as the fantasy forms of the randomness of the choice of the evolutionary trajectory. In the works of D. Libeskind, in which the inclined lines dominate, one can discern an artistic interpretation of the growth dynamics of crystalline systems. The dancing house in Prague, F. Gehry and V. Milunich, the “Twisted Torso” of S. Calatrava appear as incarnations of nonlinearity, as the antithesis of a straight line. In the surrealistic interpretation of non-linearity, for example, in the works of “J. Mayer H. Architects” the figurative embodiment of chaos, the evolution of the system as a set of accidents, which generates interlacing lines, the absence of a composition center, the possibility of infinite continuation of the building, etc. come to the fore. Mathematical principles of nonlinearity formed the basis for CAD programs that expand the search for new forms and become the rule of the formation methodology.

The evolutionary-synergetic picture of the world becomes a field of opportunities for the generation of metabolism as a direction, emphasizing the understanding of the structure as a growing organism, evolving like a biological system. According to how a biological individual adapts to the environment, so too the structure in metabolism is positioned as something that contains the possibility of completion, rebuilding, and modification in accordance with the challenges of socio-cultural reality. An example of such a building is K. Kurokawa’s tower, “Nakagin”. Accordingly, the concepts of growth, development, evolution are embodied in the images of openness, and incompleteness. Note that incompleteness, ambiguity, and understatement are connotations of the Japanese understanding of beautiful. The latter is generated by a peculiar understanding of the artistic image characteristic of Japanese culture, which is likened to nature, or seen as a cast of nature. In nature, there is nothing complete. Accordingly, the work of literature, architecture and other fields of art cannot be completed, which makes this work continually nuanced and incomplete, open for further growth, as in a metabolism, ambiguous for the reader, who can put his meanings into what is read and said, as in the art of hokku. At the same time, both hokku and architecture, ikebana, and other types of art embody qualities that are characteristic of nature: wabi, conveying simplicity, naturalness, some detachment from the vanity of human existence; sabi, which means rawness, roughness of natural materials, therefore sadness for hokku; yugen, embodies the existential invariant structures of the world, which only manifesting themselves on the level of reality, acquire a colorful palette.

It should be noted, that the idea of symbiosis is close to metabolism, which connotes the maximum imitation of nature, in contrast to the concepts and images of harmony. It is a compromise between the
natural and the artificial. Therefore, the metabolism arises in the framework of Japanese culture, but at the stage of asserting the evolutionary synergetic picture of the world.

5. The practical significance of the study
The practical significance of this study lies in the formation of a methodology that sets the basic guidelines for the creation of computer programs for finding new architectural forms and urbanistic solutions, and in justifying the need to introduce humanistic expertise in the field of architectural activity.

6. Conclusions
Modern synergy, the evolutionary synergetic picture of the world has had and has a significant impact on the formation of new directions in urban planning, such as metabolism, new architectural norms of shaping, as exemplified by the reading of nonlinearity as a plurality of interpretations like curvilinearity, sinusoidality, twisting, spiraling, the interlacing of lines, the chaos of lines; new rules for architectural design of buildings as human-sized systems, which implies humanistic expertise of projects.

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