

ARCHITECTURE IN THE GLOBAL WORLD: THE SYNERGY ASPECT

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The paper reviews architecture in the context of synergetics, considering it as a complex self-organizing non-linear system. An attempt is made to define a third global style. Once the corresponding author of this paper came across an article by Selim Khan-Magomedov, a Russian historian and theoretician of architecture, in which he wrote about the two global styles: classicism and modern movement. He concluded his article by assuming that in the future these styles are likely to alternate or to coexist. The proposed scenario did not cover all the possible spectrum of ways in which the architectural process could develop, and this article is a result of considering other various scenarios for future architecture. When Vladimir Babich, a mathematician, joined the corresponding author, the thinking process became much more interesting. The involvement of Stanislav Zhuikov, a Master's Degree student then, made it even more exciting. Below the reader will find the outcome of our venture into the future of the architectural process.

Keywords: architecture, synergetics, a third global style, complex self-organizing nonlinear system

The first decade of the new century heads into the homestretch, meaning the end of another phase in history with all of its variety, diversity, ambiguity and contrasts. Global cataclysms, frightening environmental forecasts and political and economic instability stand next to impressive scientific and technological achievements, «information explosion» and improving quality of life. Growing instability *of global development* is becoming obvious, generating lack of confidence in tomorrow and fear of an unknown future. A situation of growing uncertainty, entropy and chaos in the world is naturally reflected in modern-day culture, philosophy, art, and architecture.

Today, the individual needs, perhaps like never before, clear reference points and moral rules. At the same time, globalization, which has affected practically all walks of life, forces us to think and operate universally, globally, on a planetary scale. The eternal questions of the humankind are still awaiting answers, but paramount importance belongs to the «*puzzle of global problems*». Among these, researchers distinguish the following groups:

- 1) intersocial problems;
- 2) issues in the «individual – society» system;
- 3) issues in the «nature – society» system.

The first group includes problems of war and peace, struggle against terrorism, social and economic problems, rational use of science and technology achievements and neutralization of their negative impact. The second group is presented by issues relating to demography, public health, computerization, human development, and forecasting of the future. The third group includes a range of issues around environmental protection, resources, energy, food, and outer space exploration [1].

While all issues that feature a global scale are open to solution in various areas of science, it is holistic thinking and collaborative action that are capable of yielding appreciable results and ensure success. It is thus worthwhile fo-

cusating attention on the decisive condition – *collaborative action*, or synergetics.

1. Synergetics

Synergetics, the science of complex self-organizing systems, is the area of the post-neoclassical period in scientific knowledge that has become a fashionable word but also a very effective tool of scientific research. Evidence of this is growing by the day, coming from professionals in various areas. The high heuristic potential and universal models of synergetics grant it the right to become a new reference point for the world outlook and help the individual find his/her bearings in the chaos of modern-day phenomena. The synergetic world outlook seems to have the integrity that is so much needed today for understanding the surrounding reality.

One of the important postulates of the theory of complex self-organizing systems is the paradoxical idea of determination of the present by the future and, hence, of the past by the present [2, 13, 14]. It suggests the need to review history and take a closer look at the present, in which, following the synergetic principle, we can behold the future and outline a forecast so much wanted in these days of instability and chaos.

At the turn of the 20th century, and of the third Millennium, the mankind is already experiencing the influence of the nascent new world. As we stand poised at the start of this complex and, probably, long process, it is essential to comprehend the past and the present in order to have an idea of what is coming. Knowledge of the future, be it in the form of hypotheses and assumptions based on the past and the present, will help draw up a plan of further action and find fundamental solutions to current and prospective problems.

We believe architecture is in a position to make a meaningful contribution to this forecast. Its role of a «prophet» in the socio-cul-

tural dimension is important and doubtless. The «architectural symbiosis» of science and art, of the rational and the irrational, of practice and theory gives birth to a material product imbued with spirituality, which in its broadest sense may be called *architectural form*. First and foremost, it materializes the world outlook of this or that time and this or that society. But an understanding of architectural form cannot claim to be complete if it lacks information on the process of its emergence, i.e. *architectural form generation*. This process is underpinned by common values and specific conceptual principles pertaining to a specific reality.

The results of any process are inevitably subject to review and evaluation. In the theory of architecture and art, the most adequate and, thus, popular «descriptive means» for architectural forms is the concept of *style*.

2. Global Style

In spite of having deep historical roots, the notion of style was introduced into art studies in the mid – 18th century by the German archaeologist J. Winkelmann. Since then, for 250 years style has been the focus of research for many a researcher: H. Wölfflin, E. Cohn-Wiener, A. Riegl, M. Dvorak, W. Gropius, E. Cassirer, M. Ginzburg, A. Losev, D.S. Likhachev, A.I. Kaplun, V.A. Oparin, A.A. Rayevsky, N.G. Eliner, Ye.N. Ustiugova and others. The majority of the research works devoted to style in art focus on style formation mechanisms in art and architecture including philosophical, cultural, semiotic, and systemic/synergetic aspects.

The accumulation of knowledge has led to the ‘fouling’ of the concept of style in architecture and, generally, in culture with excessive information, often repetitive with some variations. Despite this ‘bundle’ of information around it, style has remained, to this day, the most universal and popular concept and a descriptive means in art and, in particular, in architecture. However, the well-known problem associated with this concept, i.e. its paradoxical uses (on the one hand, it is used to express a specific stylistic characteristic, for example, the style of an author or the style of a building, on the other hand, it denotes certain uniform properties on the scale of epoch or region), is no less relevant today.

It should be noted that modern-day art, characterized by pluralism and poly-stylism, creates even greater confusion. Thus, the concept of style is used to label a certain concrete stylistic phenomenon that exists in parallel to an ocean of others. It is obvious that this concept *per se* cannot accommodate the current frameworks and scales that have grown to the global level and, consequently, cannot perform a uniting function with regard to the «motley» and «mosaic» pic-

ture of art in the contemporary globalized world [11]. We need other, more universal and capacious categories and concepts capable of contributing more clarity and order to the information chaos. In architecture, the need for such a universal concept seems to be well met by the notion of *global style*.

The notion of ‘global style’ was first used by Selim Khan-Magomedov [3, 12] to denote architectural styles, movements and schools falling within one architectural form-building system based on common art composition techniques and means of expression reflecting world culture at a specific time and eternal laws of human existence. The ability of a system to operate on global level and overcome religious, mental and ethnic constraints imparts the quality of universality to it.

To date, two global styles have arisen in architecture. *The first is Classical (Fig. 1)* based on the Greek Order, which has always been present in architecture in this or that form for over two millennia. The Greek Order architecture is perceived uniformly across the world as simply «architecture». The elements of the Order are often used as iconic signs and symbols of architecture.

The second global style is represented by the 20th century Modern Movement, also referred to as «Avant Garde» or «Modernism» (Fig. 2). Avant Garde, dating back to the first third of the 20th century, set itself in opposition against the «Classical Order». Being oriented to «left-wing» fine art and to science and technology, the new style ‘extracted’ from the Greek Order architecture its essential geometric and constructional forms and discarded the traditional decorative elements that may betray the pertinence of architecture to this or that culture. The «sterility» of the Modern Movement raised it to the level of a universal style [10, 12].

3. The Emergence of a Third Global Style from the Viewpoint of Synergetics

The change from one global style to the other was preceded by a period of transition and growth in instability and chaos. The first global style ended up in eclecticism, and the second one in postmodernism. This obvious historical analogy suggests the hypothesis of a third global style, a likely future of architecture [4, 5]. A synergetic approach may enable us to gain an insight into this situation.

It seems not only justified but also self-evident to apply synergetics to architecture. The theory of self-organization has the advantage that its concepts are versatile and source data may be easily converted between various areas of science. The science of complex self-organizing systems acts as a meta language making it possible to link together and ‘translate’

any scientific fields using universal principles. In synergetics, we can distinguish seven such principles:

- 1) homeostaticity;
- 2) hierarchy;

- 3) nonlinearity;
- 4) openness;
- 5) instability;
- 6) dynamic hierarchy;
- 7) observability [6, 7, 9, 12, 13].



Fig. 1. Architecture of the first global style. Classical Style in Architecture

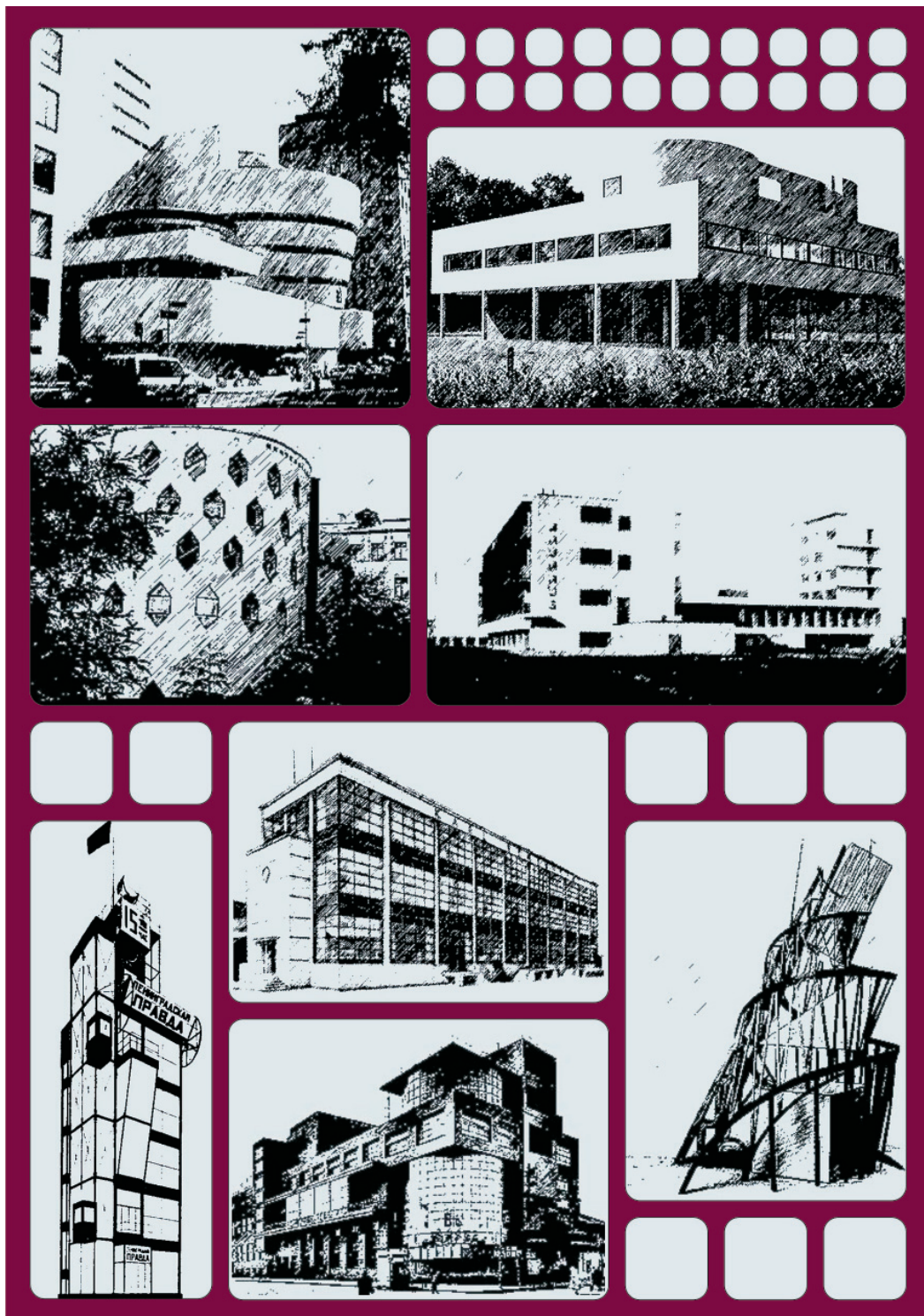


Fig. 2. Architecture of the second global style. Modernism

Consideration of architecture as a complex self-organizing nonlinear system enables one to find clear, more profound relationships between the architectural process and the reality.

1) *Homeostaticity*. Homeostasis is a relatively stable state enabling a system to pursue its

purpose, the attractor. The programmatic function of architecture is, first of all, to meet human needs. As material needs are met, other higher-level, spiritual needs arise, which are the driving force behind progress and human development. Material and spiritual needs and interests stimu-

late and form material and spiritual culture. Architecture is an integral part of culture where it operates at the interface between the material and spiritual components, being a kind of binding element (Fig. 3). In contrast to art, however, this bond is much stronger and much more interdependent. Direct interaction between material and spiritual cultures during critical moments in history transmute an architectural system from one steady state to another. Discoveries in the material sphere inevitably entail certain changes in spiritual preferences, and vice versa. For

example, the invention of «motion pictures» by the Lumière brothers brought about a new form of entertainment, which then resulted in the emergence of new functional building type and image, i.e. cinema. The development of perspective drawing generated a new approach to the construction of architectural space in the Renaissance.

If we were to speak specifically about homeostasis in architecture, generally a stable state for an architectural system would be represented by global style.

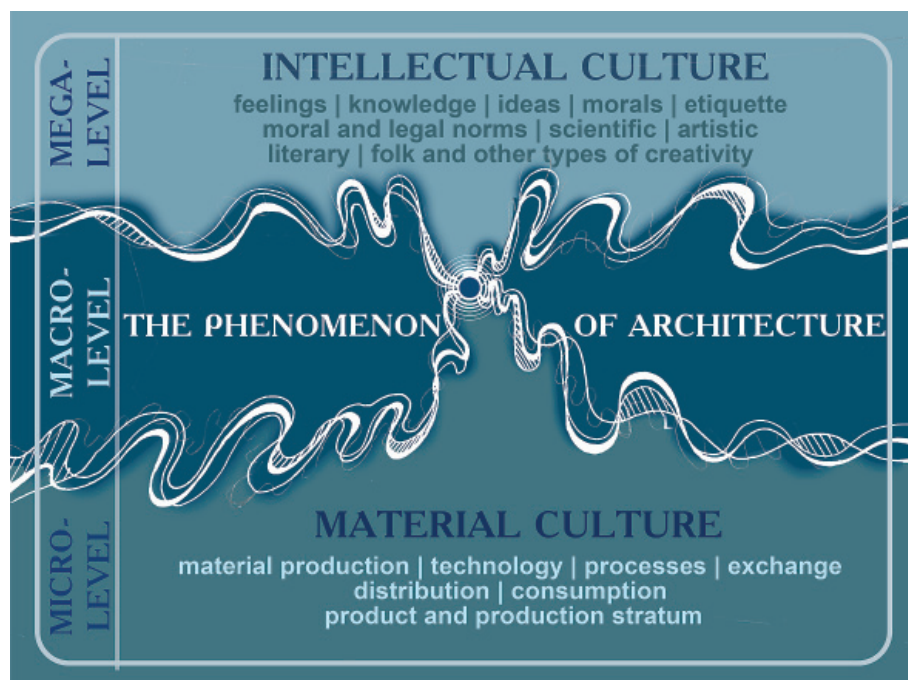


Fig. 3. Architecture in the system of culture. The synergy model

2) *Hierarchy*. The principal method of structural hierarchy organisation is the compound nature of higher levels in relation to subordinates. Among the huge number of elements in a self-organizing system there are most stable elements which subordinate all other elements in such a manner that they can be excluded from consideration. This subordination, however, is more of a consensus rather than compulsory. There is a subordinating element, or a parameter of the order, on each of the hierarchy levels. When we consider two neighbouring levels in a state of homeostasis, the principle of subordination means that the longer living variables control the shorter living ones, and a superior controls the subordinate. What is order for the lowest level is an unstructured element of chaos, «building material», for the top level.

In architecture, it is possible to distinguish the dominant, top level – architectural form

(Fig. 4) the supreme characteristic of which is integrity implemented in the Vitruvian triad «*firmitas, utilitas, venustas*». These integral elements that distinguish architecture from art or simple utilitarian construction are parameters of order for shorter living elements of the subordinate level levels: materials, processes, means, organization, mechanisms, machines – all employed in creating an architectural form. Thus, for example, knowledge of theoretical mechanics is essential for ensuring the reliability and durability of building structures, while building pigments and paints are needed not only for protecting the structures but also for imparting corresponding aesthetic qualities to them.

3) *Nonlinearity* is a violation of the principle of superposition in a certain phenomenon: the response to the sum of stimuli is not equal to the sum of responses to these stimuli. The nonlinearity of a system lies in its evolution in

a variety of ways; bifurcations in possible ways of development, and irreversibility of evolution. Periodic alternation of various stages in

the processes (enhancement and attenuation of the intensity of processes) is also a reflection of nonlinearity.

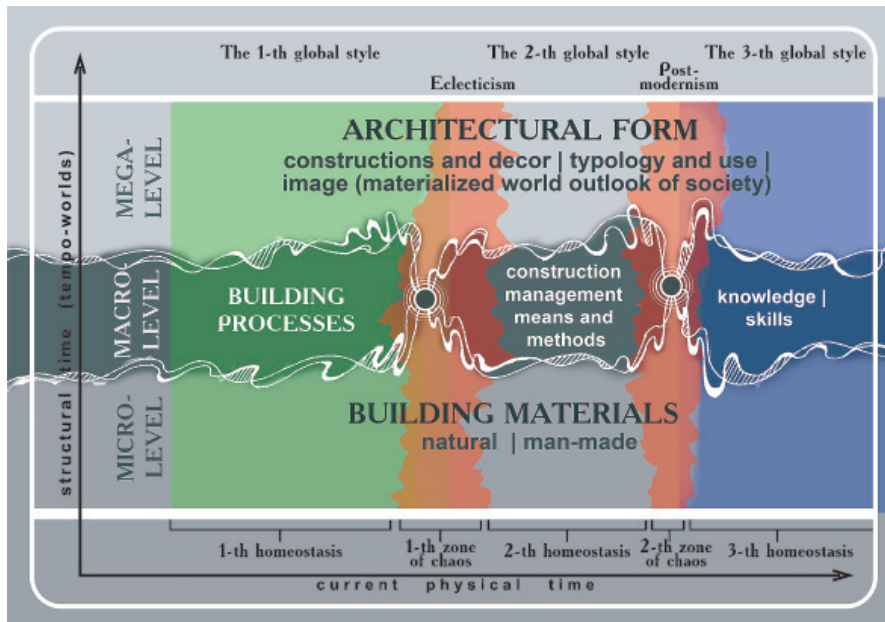


Fig. 4. The synergy model of architectural system

Like any «human-dimensioned», social system, architecture is non-linear by nature and has several alternative ways of development rather than just one. These ways are many, and they are determined, first of all, by the spectra of the attractor structures, which are inherent, «genetically» embedded in the basic properties of the system. In the history

of architecture, there are lots of examples of modal changes. A good illustration is provided by the change of styles: Antiquity and Hellenism, Romanesque architecture and the Gothic style, the Renaissance and the Baroque. Dmitry Likhachev's concept of a romantic and a rationalistic creativity method confirms this (Fig. 5).

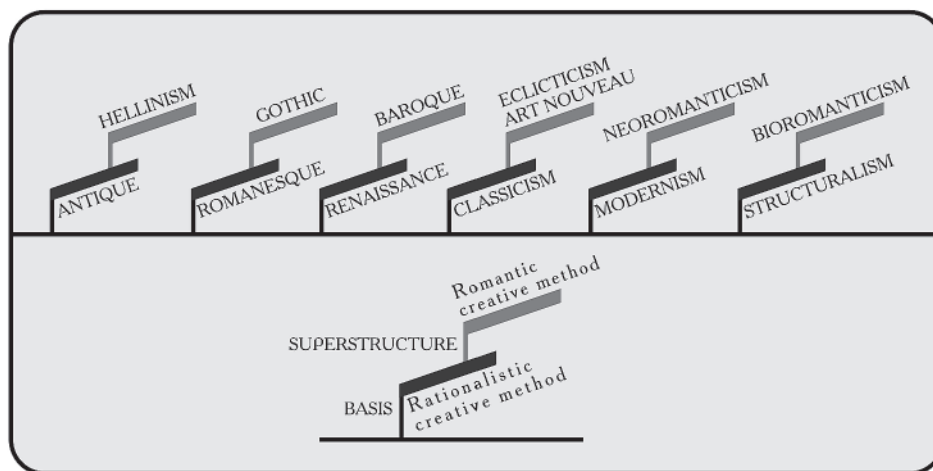


Fig. 5. Periodisation of Western European architectural styles according to S. P. Zavarikhin (based on Dmitry Likhachev's concept of creativity methods)

4) *Openness* means that a hierarchical level is capable of developing and becoming more sophisticated only in conditions where there is an exchange of substances, energy and information with other levels.

The position of architecture at the interface between the material and spiritual cultures is proof that architecture is an open system (Fig. 3).

The main properties of the architectural system are, no doubted, human related; architecture is driven by human will. In spite of this, however, there are external factors and conditions influencing both the individual and architecture. Thus, for example, climatic conditions dictate the need for certain architectural forms, irrespective of the individual's internal spiritual intentions (Fig. 6).

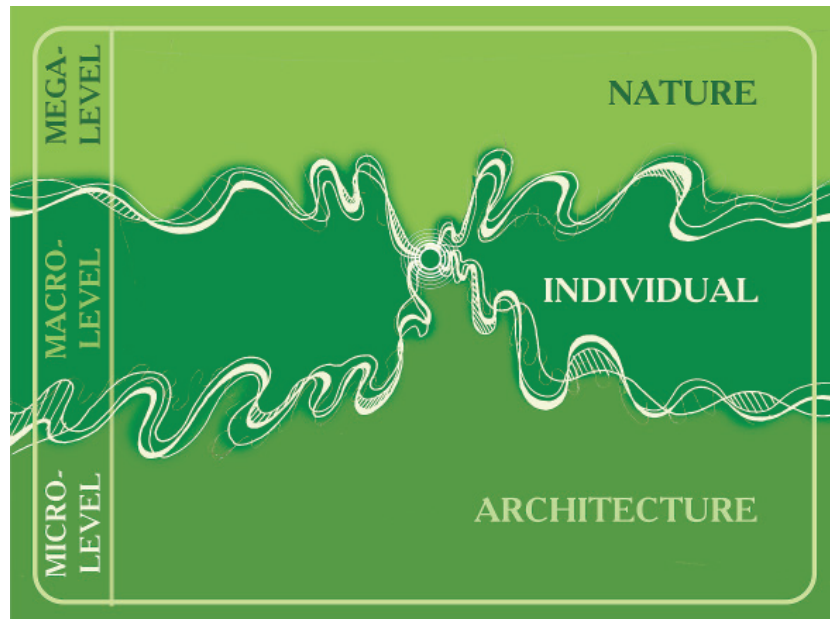


Fig. 6. The synergy model of architecture in the system «nature – man» (according to N. M. Yalandina, V. N. Babich).

5) *Instability* is the supersensitivity of a system's non-stationary elements to small influences or fluctuations, which, when in a state of supreme intensity, lead to probable chaotic disintegration of these structures or to «phase transition», that is transition to a new steady state (homeostasis).

Any long process reaches a moment of supreme intensity, a «boiling point» when the rate of development increases and instability and chaos grow dramatically. In this context, it is difficult for the system to adapt to instantly changing conditions. At such critical moment, the threat of a super-explosion and disintegration grows sharply. However, there is also a second scenario – of a «phase transition», change of the attractor structure, change to a new mode of functioning. At a moment of supreme intensity, when the system is in a state of a chaos of doubts and choices against the backdrop of high motivation, something new is born. It is, therefore, especially important to manage the situation proactively during such periods. Moments of supreme intensity in architecture frequently coincide with those hap-

pening in society. This can again be illustrated by the example of changes of style in architecture and art; moreover, it is possible to identify specific concrete stylistic phenomena associated with moments of supreme intensity.

6) *Dynamic hierarchy*. In a broad sense, dynamic hierarchy means properties of the system which are not inherent in its elements taken separately but emerge as a result of integration of these elements into a uniform, complete system. From the point of view of synergetics, this generation of parameters of order when we have to consider interaction between more than two levels and the very process of establishment of parameters of order is essentially a process of disappearance and then birth of one of them in the course of interaction between a minimum of three hierarchical levels in the system. Dynamic hierarchy is the main principle underlying the passage of bifurcations by the system, the birth and death of its hierarchical levels. At a point of bifurcation, collective variables, parameters of order at macrolevel recover their degrees of freedom in chaos at microlevel, dissolving in it and increasing its

degree of chaos. Then new parameters of order are born at new macro-level in the course of direct interaction between mega and microlevels.

An architectural system may be presented as interaction between three hierarchical levels (Fig. 4). The top megalevel is represented by architectural form understood in its broadest sense, as a material embodiment of an architectural phenomenon, a real physical product of architectural activity. We may distinguish three key parameters of order, the meanings of which are associated with the integrity of architectural form formulated in the Vitruvian triad. The parameters of order at mega-level are:

- 1) structural system and decor;
- 2) architectural typology, use;
- 3) image (materialized world outlook of society).

The lowest microlevel is represented, literally, by the building material which the architectural form is made of. The parameter of order in this case may be any of the known or invented real materials, such as wood, stone, metal, plastic, etc. In the development of materials the tendency is towards from natural and combined materials to artificial ones, which naturally influences architectural forms as well.

If «what?» has been determined at mega-level and «from what?» at microlevel, the macrolevel should «answer» the question «how?». This «how?» represents technologies and means of building construction, without which the processing of material and construction of architectural forms is simply impossible. The parameters of order here are knowledge and practical skills, means and techniques of organization in building construction industry.

Interaction between these levels promote the development of the entire architectural system, but the evolutionary process occurs only where appropriate conditions are available. For architecture, such appropriate conditions are various manifestations of material and spiritual cultures, namely: world outlook reference points of society and the individual, moral values, knowledge and achievements of science and technology basis, achievements in art during this or that time. Context and understanding of the environment in which architecture exists are, of course, important. Architecture as a complex open nonlinear system exists only in interaction with other systems. Its orientation to co-evolution with nature and man become important. All is interconnected in this world, and nothing comes and goes without inter-reflection.

7) *Observability*. This principle implies relativity in the perception of various hierarchical levels of a system, various scales,

and various tempo-worlds. Observation of a microlevel from within makes it possible to see the order. But as soon as the scale has increased, for example, to a macrolevel, the ordered structure of the lower level appears as chaos.

A vivid example is the situation with the concepts of architectural science, more specifically, the above mentioned concept of “style”. Order in the styles palette of modern-day architecture will be visible until observation occurs from within the level of the stylistic phenomena proper, such as major styles, movements, directions. As soon as we go over to the level of a global style, that is a higher hierarchical level, the situation is seen from another perspective.

With regard to ‘human-dimensioned’ systems such as architecture, it is reasonable to distinguish one more principle – replication. This principle is a kind of extension of the preceding one. In the broad sense of the word, replicator is a certain manifestation of the environment, a self-reproducing unit of information or object. Replicators are capable of copying the principles of functioning and evolution of the environment inside which they exist. However, not only do they just «adopt» the programmes of functioning of their environments and systems but may also enter into conflict with the environment and the original system, the reasons being various: delays in the reproduction of the surrounding reality, inadequate conditions of environments, failures in the process of replication.

In architecture, the most illustrative example of replicator is the phenomenon of architectural style and, naturally, global style. Reflections on the nature of global style suggest that the time of existence of a certain type of social order (Table) corresponds to the period of domination of one of the global styles in architecture [1]. Traditional society is associated with the first global style, Greek Order architecture; industrial society with the second global style, modernism; postindustrial society is likely to be associated with a third, nascent, global style. Chronological correspondence between global style and social order is determined by the nature of comprehension of the being by architecture.

Conclusions

Thus, within the first global style architecture is perceived as art, craft. The construction of any building or structure was organized empirically, with the use of common techniques. It should be noted that up until the Renaissance architectural design existed as simple drawings used only when they were needed. The architecture of the first global style existed under the

motto «Beauty will save the world». By way of confirming this it may be noted that many a historical monument of architecture are perceived by practically all people in the same

way – as works of art. Thus, we could for the architecture of the first global style offer a new name, fully describing its essence, «*Architecture of Arts and Crafts*» (Fig. 1).

Historical interrelation between architecture, social production, technology and science

ARCHITECTURAL GLOBAL STYLES	SOCIETY TYPE	KEY EVENT OF HISTORY	PRODUCTION	TECHNOLOGY	SCIENCE
THE FIRST. ART-CRAFT ARCHITECTURE	TRADITIONAL	The Neolithic Revolution (the first agricultural revolution). Around 10,000 BC	Manual labour	Based on empirical and conventional methods and skills	Pre-science. There was sporadic use of science for production
THE SECOND. ART-TECH ARCHITECTURE	INDUSTRIAL	The Industrial Revolution. Period from the 18th to the 19th century	Mechanized, manufactory	Industrial	Science was knowledge system of world's rules and laws. Since the middle of 19-th century science has become direct industrial power of society. Science was technological application to production.
THE THIRD. SCI-TECH ARCHITECTURE	POST-INDUSTRIAL	Modern scientific and technological revolution. Period from middle of 20-th century to present	Scientific information, automated	Information, bioengineering, robotics, microelectronics, nanotechnology	There are differentiation and integration of technics, natural and social sciences. Science is becoming direct production power and direct social power. Production is becoming technological application and use of science.

The second global style, which arose during the industrial revolution, may be called «*Art-Tech Architecture*» (architecture as the art and product of technology) (Fig. 2). This architecture, if we recall history, was profoundly influenced by 'leftwing' art «inspired» by progress in science and technology. The architecture of the second global style was still perceived by architects (less so by lay people) as a work of art but with other paradoxical reference points. In order to understand this paradox, suffice it to quote some coryphees of architecture of that time: «Less is more» (L. Mies van der Rohe); «Form follows function» (L.Sullivan); «The house is a machine for living in» (Le Corbusier). The idea of progress in technology was clear to all; the idea of progress in art was clear only to its creators [10].

Having passed the next bifurcation point – which, it should be noted, lasted for practically the entire century and manifested itself in an acute form in architecture only in postmodernism, architecture is yet in a state of chaos and crisis. Being within it, it is important to select an optimum way of development, one

that corresponds to the internal aspirations of architecture and man. Analysis of the modern-day situation of postindustrial society suggests a conclusion that architecture is now based on science and technology, which suggests that the architecture of the third global style may be called «*Sci-Tech Architecture*» (Fig. 7). Indeed, today architecture instantly absorbs any scientific discovery or invention and «tries it on». Architects are no longer be surprised by nonlinear CAD design – suffice it to cast a look at the latest projects and design concepts for buildings and structures that feature forms that were inconceivable in recent past [15,16]. In spite of extensive employment of achievements of science and technology in architecture for new experiments with form, it is becoming important to find solutions to global problems by the means that are available to architecture. Modern-day architects are making effort to resolve these problems. In this connection we can identify a general trend in the architecture of the third global style. It consists in that form-making in modern-day architecture, gravitating to wildlife imitations, is trying

to return to the tradition of likening man-made environment to the natural one. This time, it is not a «stylization» of nature as it was with the Greek Order architecture, or conquest of nature

as in «modernism». It is an imitation of the natural, as best as possible, by means of science and technology as a source of innovation for architecture [8, 16].

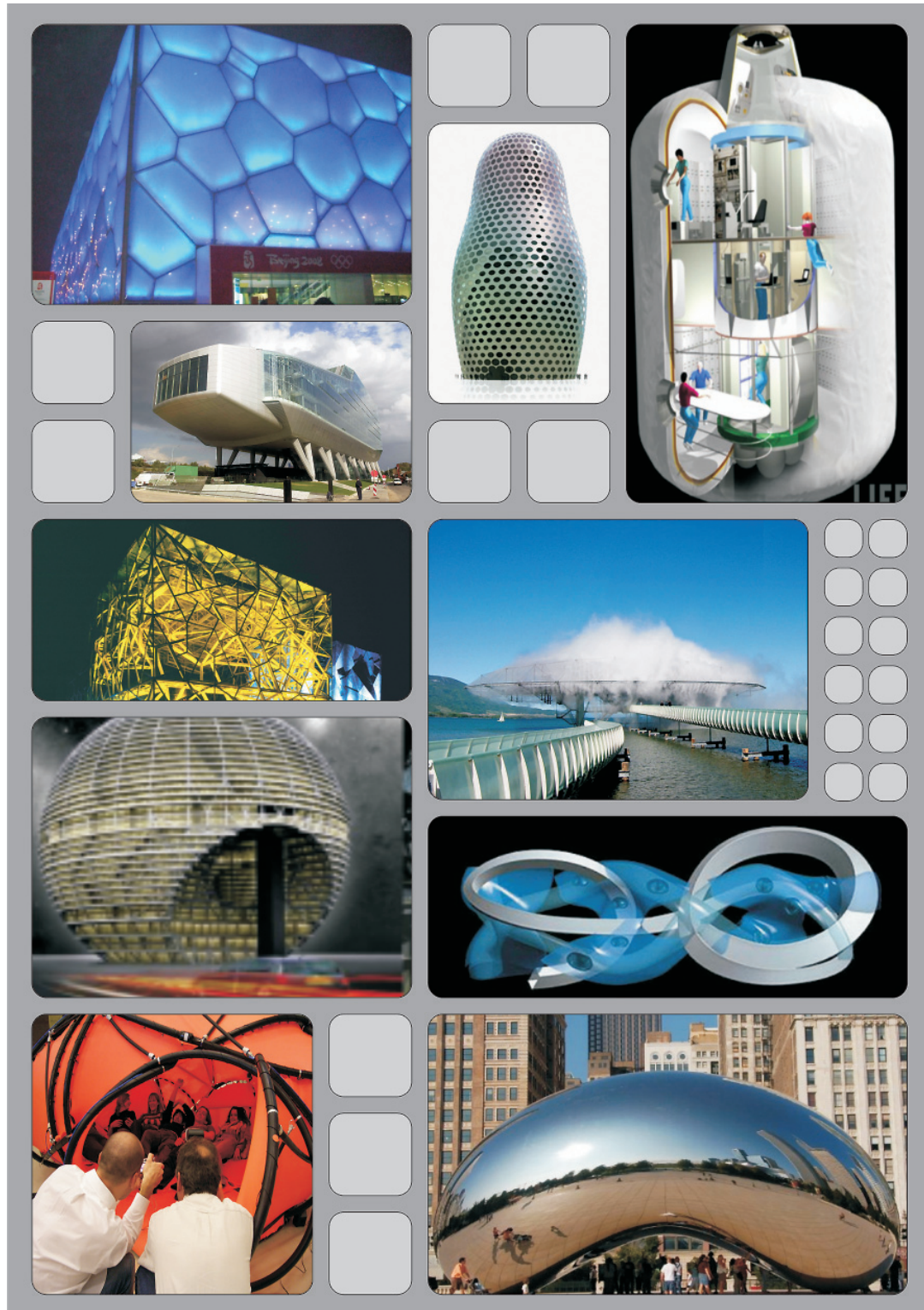


Fig. 7. Contemporary Architectural Projects as Signs of Emerging Third Global Style.

Thus, architecture cooperated and is cooperating with the environment and reality, with anthropo- and bio-spheres. It is becoming distinctly visible owing to synergetic knowledge. For architectural creativity, it is still important to produce a beneficial effect on society and nature. This, however, requires global thinking, common resonance, co-evolution with nature and man, and steadfast following after internal, transcendental values.

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