The Process of Restoration of Objects of Design as a Critical State Morphology and Colour in Images of Visual Cognitive Information Dynamic Systems (VKIDS)

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Abstract

In this article, the restoration is investigated from the perspective of self-organizing system, as some oscillation process in the state of "life" of design objects: from chaos to its creation and back to chaos as a result of losses and again to its original author's version as a result of restoration work.

Keywords: restoration, design object, synergy, information, a critical state, phase transitions, oscillatory process, logistic equation.

1. Introduction

Modern restoration is ideological activities preservation of historical and cultural heritage. It's confirmed by the presence of a huge, accumulated of centuries human experience, multi-numerical publications, outlines and most importantly- recognition of the worldwide major postulates, objectives and tasks of conservation and restoration defined in many international documents, and firstly in such as the Venice Charter (1964), "The Conservator-restorer: definition of the profession "(1984) and the Nara Document on Authenticity (1994).

The Narva document said, "the authenticity stands as the most substantial defining factor of heritage and associated values. Understanding the importance of authenticity plays a fundamental role in all

research on cultural heritage preservation and planning the work on the restoration. These provisions which were not designed by one generation of scholars, museum curators, conservators, art historians and Western culture as well as domestic, not only performed in our country but in practice often perceived

as anachronism. When for the sake of tinsel "Splendor" many monuments are updated partially or completely, or virtually destroyed called restoration process. A real loss evidence of our history, whether it be a church, a palace, a memorial house, icons, paintings, sculptures and objects of decorative art becomes the reality.

2. Visual Cognitive Dynamic Information Systems in the Design Process of Restoration of Design Objects

One of the options for changing the current situation can be specific research into the theory and practice of modern design, based on the synergetic approach. Design object is represented as a complex information structure, which operates near an unstable state, and all behavioral functions are described as non-

equilibrium phase transitions.

One of the most important features of wildlife, including human - is the ability to manage unstable states and processes, especially in the humanitarian sphere. On the one hand sensitivity of unstable information systems, which are represented mostly by the design objects, to external influences, simplifies the task of managing because it does not require a lot of power and energy resources. On the other hand, it transforms a management process in true art, as it requires exposure to high precision controlled system. In this case, the scenario of the emergence of order out of chaos, as a result of cognitive simulation , - is the appearance of works of art or Object Design (self-organization), which is related to information dynamical systems with a large number of elements($> 10^{10}$). Creating an image design object can represented as synchronization phenomenon in the network of related oscillators (a point, a line, a plane, in geometry-physical sense) which can be considered as a special case of self-organization. In this case we can talk about the system of self-organization, consisting of any number elements (oscillators), for example consisting of only two elements (two coupled oscillators, in the evolution of design - it is fundamental philosophical categories, form, space and relationships)[2]. The reason is clear - oscillation is already an ordered organized process. Synchronization can also be considered as one of the scenario emergence of order from chaos and vice versa with different value of entropy. In the domain of design objects – it is the creation of visual cognitive information of the dynamical system (VCIDS) as a result of cognitive distortions (simulation) objective reality in the space-time image (temporal model) presented by iterating a certain number. This also applies to copyright works considered as relatively objective reality. If it undergoes total or partial loss in time in the event of crises or disasters, the establishment of synchronization of time between social relays design phenomena will already apply to the conservation, reconstruction and restoration, which can be assessed measure of aesthetics. [3]

Adjust rhythms oscillating systems due to the weak (VCIDS) interaction between them is called synchronization. In the simplest case, two oscillatory systems with different frequencies and initially independent phases, being loosely coupled, adjust their

rhythms and begin to oscillate at the same frequency. This gives a rise to a certain sustainable relationship between the phases of the two oscillators.

It is important, that the frequency equalization is performed in an original range of detuning frequency. Synchronization is called mutual, when two or more oscillators equally interact with each other and mutually adjust their rhythms. Another important type of synchronization is the synchronization with an external force. When the design of the object begins to change its properties in the direction of chaos, the applied external action returns it into an organized state.

Synchronization is a special case of an effect called 'phase locking'. When two identical oscillators are connected with each other, there are two possibilities of joint movement: when the difference phases of their oscillations is zero (synchronization), and when the phase difference is 180 degrees (anti-synchronization). If the network of coupled oscillators contains more than two oscillators, the number of possibilities increases. Live nature and art often presented with a large number of related oscillators, and it is usually implemented exactly synchronous type of behavior.

Mathematical analysis of the behavior of a large number of network-related oscillators shows that most easily way occurs in synchronization mode when for each individual oscillator affects already formed the rhythm of the surrounding oscillators. Obviously, these conditions in many cases performed synchronous behavior and social system. When there is a small variation of frequencies in the network-related oscillators, the process of their mutual synchronization is very similar to the phase transition where the temperature's role is played by a frequency bandwidth of the oscillators in the network

This deep connection between the synchronization phenomenon and phenomenology of Critical instances is a good illustration of how the natural sciences methods can reveal hidden everyday consciousness unity of nature.

Thus it is necessary to emphasize one more important fact that consideration of the phenomenon of synchronization is carried out only in relation to periodic oscillators. In fact, the nature of this phenomenon is more fundamental and is not limited to periodic oscillator systems. For example, the allocation of design objects to some artistic styles is synchronization with certain canons, but not a recurring periodic motion. So, recently synchronization is considered as a time operation of two or more processes or objects. Restoration process shows the ability to synchronize and use of strange attractors this phenomenon in the transmission of information.

3. Elements of Discrete Mathematics in the Engineering of Restoration Process of Design Objects

It is convenient to present cooperation of elements in many difficult biological and social systems as networks. Elements are the nodes of this system. Communications between elements are represented by segments (ribs). In mathematics such system received the name of graphs.

In the social system any design object and its subject area can be represented by a network or ribs

that bind them together into objects (nodes). These units provide solutions for composite solutions of interiors and exteriors of the spatial environment. Any complex system can be represented as a network of interconnected elements of this system.

Instead of the expected distribution of κ connections (the Poisson law P (k)), which has a strict maximum of about the average value $\kappa = (\kappa)$, there are no average, but it is subject to all the critical state of the power function:

$$P(\kappa) = \kappa. \qquad (1)$$

In this way, there is a small number of nodes contains a very large number of links in the real networks. Huge number of nodes com-

prises only a few links. Such systems are called scale free networks.

General properties of natural and social networks are their inhomogeneous and cluster structure. Each cluster forms, for example, artistic styles. It combines certain functional properties, the algorithm of restoration processes, etc. The network belongs to the universal critical phenomena. Their structure obeys to a power function, and topology occupies an intermediate position between the strictly ordered structure with crystalline type and random graph[3].

The nonlinearity of the science progress and culture progress are manifested in its uneven pace.

Periods of accelerated growth, rapid growth and breaking of old knowledge structures followed to periods of relative stability or balance during scientific revolutions.

In general, cyclical, "oscillating" and "vibration" mode of development inherent to all highly organized entities of the universe, to all the spheres of culture, and culture in general.

"A man is such constituted that he cannot go forward every time, — he goes and returns... (the vibration process). This is the way of human inventions over the centuries". The same patterns of behavior reveal themselves in the culture. Uneven movement is peculiar to nature. It goes forward and back, starts to run and stops, takes a step, then jumps, etc."[4]

Changes happen in poetry, the romanticism alternates with classicism, the luxury and opulence of some styles (Baroque, etc.) are replaced by geometric composition of other styles (classicism, constructivism, etc.). Spiritual and psychological climate of society and the intellectual climate of the scientific community, change cyclically, by analogy with the cycles of N. Kondratiev.

All the culture has its own breath. It is blooming, or calming down, sinking into itself and returning to its roots. Bursts of cultural innovation, creative activity come to the surface at the crest. But in every culture depletion of creative forces and the extinction of the spirit happens after its blossom.
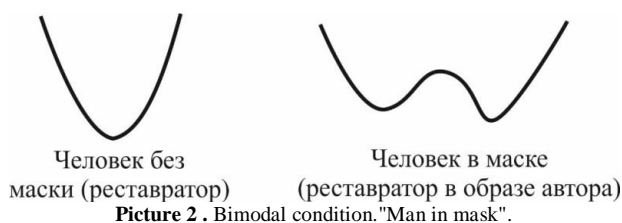
The vibration mode is a universal behavior form of self-organizing systems. Rhythm is manifested not only in individual works of art culture and design, but also in the areas of art: music, dance, poetry, ornaments, restoration, etc. Repetition of an element or elements of the design project or object may appear in a new place and time, in a different context in fact is a variation. Therefore object of design acquires with a new content, a new artistic significance. The functions of each restored elements are changing in depending on the operations with them. Such overt and covert variations significantly alter the emotional impact from the design object.

Different phase transitions among design objects are possible in the presence of an unstable bimodal nature. Specialist in the field of restoration is necessary transformation to the image of the poster for maximum accuracy of the design objects. This transition to a new ambiguous, bimodal condition, of course, is in the nature of the phase transition, which is using the Hopfield model, can be represented as shown in picture 1.

Реставратор   Реставратор - автор
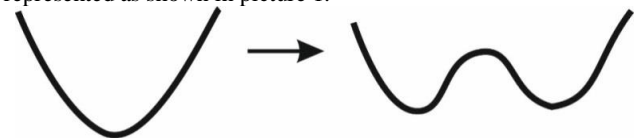
Picture 1. Bifurcation in the process of restoration of the design object.

Some remarks about the nature of the phenomenon of 'masks'. The mask has always been a symbol of art. The mask acts as author in the restoration of the design objects. 'Dressing in a mask' also means a transition phase from a single-modal to bimodal state (Picture 2). "Removing the mask" - it is a phase of transition from a bimodal to a single-modal condition. Multiple processes of restoration will fit multimodal states.

Человек без
маски (реставратор)

Человек в маске
(реставратор в образе автора)

Picture 2 . Bimodal condition. "Man in mask".

Structural studies of phase transition are understood as a change in the type of symmetry, that is, as a transition structure from one type of symmetry to another. Such phase transitions can be found in ornamental art, music and poetry (as a change of pace or size), they are widely represented in the choreography, of course, this also applies to the restoration. Replacing of the lost design element to the same element can be interpreted as a phase transition. When you create a new element and introduce it into the design object, there is some change in the rhythm of the emotional impact from design object. Since the process of restoration is a periodic, repetitive, it is possible to speak of non-equilibrium phase transitions [5].

Design is the basis of all human activity. Planning and formation of any action in accordance with the intended purpose is the essence of design. Any attempt to isolate design works against its inherent values of the primary base matrix of life.

4. Information Technology in the Projection of Restoration Process of Design Objects

An integrated, comprehensive design is predictable. It is the process of planning and development, which is continuously at the interface between different disciplines.

The integrated design is all-encompassing; it tries to consider all factors and details which are necessary to make decisions. It seeks to address the real facts and trends and constantly extrapolate and interpolate information from the future, which he constructs. [6]

Any object of design is a source of information incentives that affect the mind and / or human psychology. Now there are many definitions of 'information' and none is universally accepted. This is natural, since the generally accepted definitions in science appear when it becomes a science and stops growing. Recently, it became clear that information plays a fundamental role in science. [7]

From the cultural point of view [6], an integral part of which is to design, the information - is the sum of the accumulated human community of spiritual knowledge (ideational conception of culture) and practical skills (functional concept of culture), expressed in the sign-symbolic form, and it can be transmitted to the addressee (another community, the next generation, or the aliens for the first acquaintance). In the modern understanding of culture in the unity and integrity of the material and spiritual principles, understanding, starring antinomy of its radiation and functional concepts, social information is almost identical with the culture in which it is formed and which determined it. The design information relationship - it is an active professional impact on the global information field (order of degree, aesthetic organization, suggestiveness, etc...), and thus a direct impact on people's minds.

At present the scope of the information approach has expanded considerably. The notion of "information" is used in the study of self-organization processes (bionic evolution). The question of the origin of information and the evolution of its value becomes quite relevant.

The choice depends on the determination apparatus and research purpose, in other words, the definition should be meaningful, and can be suitable for use in the apparatus. Therefore, it is advisable to use the apparatus of the theory of dynamical systems, since it is the basis of the science about self-organization, which largely develops the theory and practice of design.

Determination suggested by Henry Kastler to the greatest degree satisfies all of the conditions: information: it is a single stored random selection out of the multiple possible and equal choices (Q).

The word 'random' is related to the process (method) of choice and thus narrows the area of the definition applicability. Generally speaking, the selection does not have to be random (prompted or predicted). In that case we talk about the reception of information. The random choice corresponds to generation (i.e. spontaneous appearance) of the information. That's why the word 'random' in waived in the definition of information, however, then considered while discussing the processes of generation and reception.

The word 'stored' plays a significant role. It relates to fixing the information. Generally speaking, the choice does not have to be stored (i.e. could be forgotten). Such a choice is called micro-information. On the contrary, the stored choice is called macro-information. Macro-information is used in all of the information processes. Micro-information is mainly used in physical processes.

The words 'possible' and 'equal' mean that the choices belong to a one range (e.g. subjective area of the design objects) and the prior differences between them are not significant. Ideally, the choices may be totally equal and equally possible, however may be different. In such a case the word 'equal' means that the prior possibilities of different choices are of the same decimal order.

The word 'choice' – is verb-formed subjective. It could be understood in both meanings – as a process and as a result of the process. In the Kastler's definition the choice is understood as the process result, but not as a process itself. That is where it is quite practical and in this sense it is used in real tasks.

The word 'process' is quite busy in the natural sciences, it means the changing of the system in time (its movement), which in general case is not known when and where it is going to end. According to the definition (Q) the information is absent in the current state. However, as a result of a choice, the information is meaningless without the process of choice. Also, not every process ends up with a choice. The latter is only possible in the special class of processes. So, it is very useful to introduce the concept of information process.

Considering the above discussion, the definition of H. Kastler is widely used in the researches. The definition (Q) is different from the previous [7] with the following:

- It is clearly, transparent and widely used in the natural sciences. This definition does not contradict with the previous when talking about real tasks. Such as defining the information as an instruction or an operator in exact cases comes to the direction of which choice has to be made in a particular case;

- According to this definition, the information reveals as something specific. But at the same time this definition from the natural scientific point of view allows to understand such particular events as origin of life and thinking mechanisms. In other words – to build a bridge between natural and humanitarian sciences the functions of which are realized through the design [6];

- Definition [Q] allows introduction of the limit – the quantity of the information.

- It is necessary to underline another feature of the definition [Q]. Usually, in the real tasks we are dealing not just with information but with valuable or intelligent information. The analysis of the information role in the creative process has two mutually connected aspects: a problem of origination and a problem of using the information in the creative activity. The origination, accumulation and storage of information demands meeting of the two following conditions: condition of choice and condition of memory.

Condition of choice. To make the choice possible it is necessary to have a range of sustainable steady states in which the developing system could transfer.

Condition of memory. Information originating as the result of random choice must be stored and saved.

The qualitative theory of the dynamic systems allows formulating a clear difference between the concepts of selection and choice. If there are several steady states then the situation is defined by a choice in accordance with the fundamental law of comparison. If

there is only on steady state, we can talk only about selection. Information develops only as the result of memorizing a random choice. While during selection one can realize prior underlying information without developing any new information. Therefore, information may only appear in the non-linear systems where bifurcation points exist as well as decision trees where random choices occur.

Reception of information is a choice directed from upper level at someone's will or by exact circumstances. In other words we talk about a choice made based on the information which a human person (or a system) will receive.

In the dynamic systems theory language the receipt of the information means a transfer of the system into one particular state regardless of its previous state. In the modern technical equipment this is usually reached by electric or light impulses. In all of the cases the impulse energy must be greater than the barrier between the system's states.

In the dynamic system theory this transfer realized by external powers is called a power transfer. In line with it there exists and used another type of transfer - parametric. The substance of the latter is when system settings are changing during some time so that the system becomes monostable (one of the states becomes unstable, then disappears). Regardless of system state it passes to a remaining stable state. After that the settings are returned to their previous values, the system becomes multistable, but it keeps the state to which it was transferred.

Parametric transfer as well as power transfer is the information reception, but switching mechanisms (receptions) are different. Modern electronics there used mainly information reception by a power transfer. Biological and humanitarian systems use mainly parametric transfer. It may be achieved by nonspecific factors (temperature changing, pH and another way to change the design object). So, nonspecific factors can act as switches or carriers of the information received.

Generation of information is a random choice made without external tips.

In both cases the ability to perceive or generate depends on the information that receptor or generator already contain.

The object that saved any information is its carrier. The information being neither a matter nor energy may only exist in a fixed state. The ways of fixation (saving) may be conditional, not related to semantics. So we have necessity to divide the information on conditional and unconditional. The example of conditional information is a code or an art style used to code a message or an emotional state. A code is a correspondence between conditional symbols and real subjects (actions, feelings). The choice of code type is random and is saved by the transferor and by the receiving party. The coded information has value when several objects (people) possess it so this information is related with collective behavior (Social activities).

Sinergetics allows combining all of these definitions and to see the big picture of information process and understand the main point of information phenomenon.

It's not a accidental – the developing complex systems have many aspects. In humanitarian sciences, especially in design, the information is a multi-faceted image – quite emotional term but not clear. In the synergetics this image is clear as a multi-stationarity or multi-variance. In synergetics these concepts are clearly formulated and structured, so we could work with it.

The phenomenon of logistic equation is most universal tool for the description of art styles development evolution and other significant parameters, qualities and relations. The logistic equation (Maltus model and its synthesis by Ferhulst) may be used for describing various processes. The range of the events which are modeled with the logistic equation method (multi-logistic system of equations) is quite wide. The best exposure of it was in the research where the author is leading to a logistic equation various processes and events. In this paper the logistic equation has a role of a universal tool for the description of the environment with which one could get to the secrets of evolution of mankind, receive information about the past and even predict future [9]:

$$dN/dt = p\,N, \tag{2}$$

where:

N – number of population, where population is a score of objects (for example, various sciences and its followers) of a certain kind inhabiting a certain geographical area for a certain period (several generations), such as scientific, pedagogical schools in different regions, where inside of it one could see a free random mating. Population is a limited number of members [3], [10];

p – is a difference between the birth rate (creation of design object) and death rate (loss of design object). Solution of the equation (2) predicts exponential growth of population known as Maltusian growth if p>0 (birth rate exceeds death rate) or, if p<0 (death rate exceeds birth rate) – the exponential decline of the number of population.

In 1838 Ferhulst suggested the logistic model which describes best the dynamics of the population. The respective equation looks as the following:

$$dN/dt = p\,N\,(K-N)/K, \tag{3}$$

where

K – environment capacity (the limit of the population it can reach (creation of art style, science school, etc.) When the number of population is small (N<K), the equation (3) corresponds to (2) and the number of population exponentially grows (given p>0). Increasing of N results in the limitation of creative resources, the speed of the population growth decreases and with $t \longrightarrow \infty$ the number of population N goes to K and the speed of population growth *dN/dt* goes to zero, so results in a decline. It is not hard to see that the equation (3) has two equilibrium states, one of which is (N=0) not stable, the other one (N=K) is stable, making best combination of qualities in the author's work, restorer's work in the design object. In the stable state at any point of time there are born the same quantities of a kind as dying. It is clear that in the evolution process the parameters of the system may change, for example, under the influence of fluctuation of ideology and fashion. The research [11] describes the concept of logistic evolution, in other words, the processes described by the logistic equation (3). "…Every ecological equilibrium defined by the logistic equation has a temporary character and the logistic niche is subsequently filled with the series of kinds, each of them later pushes out the previous when it gets experience of using the niche becomes greater…"

Given [10] that the population is understood as a multiple range of objects (for example, science disciplines and their followers) of a certain type living in a certain geographical space (scientific, pedagogical schools, etc.) for a significant period of time (several generations) where random cross-breeding occurs from tme to time between the members. It is a limited range of objects [12] where the objects (a certain set of excercisers, i.e. a mezo-level organization [1] from 2 or more projected design objects united by one creative aim) belonging to the population are presented as chromosomes with coded task parameters, i.e. the solutions which are called 'dots' (dominants of the composition in design) in the search space.

It is not necessary to solve a system of multi logistic equations. Even a simple logistic equation, which describes the model of growing populations in a closed niche with limited resources and competition between its members, the equation with only three parameters, for design a form, color, time, can describe a wide range of processes.

Logistic equation in the subject field of design can be illustrated by clusters of populations [13].

Synergetics in its current form is not always able to provide the basis for specific and effective output models of crisis situations, in particular the economic and environmental. In general, from the standpoint of the possibility of synergy search the universal principles of self-organization and evolution are open. But this kind of knowledge is essential for a particular modeling of catastrophic situations and evolutionary processes in the environment, the economy, politics, culture [4].

The main objective of synergy is to show how the ideas of nonlinear dynamics are penetrate in different sciences and especially in science, which are far from physics. We consider the simple qualitative model.

They do not give and cannot give a quantitative correspondence of actually occurring socio - economic processes. Models are constructed differently: the process is important in them without which it is not. It often opens up new routes for further analysis. Dynamics, evolution and organization of ecological systems have been studied for more than one decade. Models of development and interaction in ecology have a lot in common with the models which are describing the socio-economic processes and phenomena. They often coincide with models that describe the processes taking place in human society, and play an important role in understanding the mechanisms of applying the methods of nonlinear dynamics to social, economic and design models. It is not necessary to solve a system of multi logistic equations. Even a simple logistic equation, which describes the model of growing populations in a closed niche with limited resources and competition between its members, the equation with only three parameters, for design a form, color, time, can describe a wide range of processes.

5. Conclusion

Conducted research in this study served as the basis in creating design solutions during the restoration process of the design objects which are executed in the technique of Byzantine mosaic.

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