The phenomenon of digital architecture: problems and prospects

El fenómeno de la arquitectura digital: los problemas y las perspectivas

Author:

Abdulkhalyk S. Nabiyev[1*]

Innovaciencia
ISSN: 2346-075X

E- ISSN: 2346-075X
Innovaciencia 2022; 10(1); 1-14
http://dx.doi.org/10.15649/2346075X.2967

SCIENTIFIC RESEARCH

How to cite this paper:
Sadvakasova G, Actual questions of ecological and urban planning zones of the regions for the formation of territorial and industrial complexes (TIC). Innovaciencia 2022; 10 (1): 1-14, DOI:http://dx.doi.org/10.15649/2346075X.2967

Date received
Received: 16 november 2022
Accepted: 25 november 2022
Publicated 01 december 2022

Keywords:
digital architecture; generation of nonlinearity; digital formation in architecture; BIM technology; the phenomenon of digital civilization.

Manuscript presented in International research and practice conference *"Problems of formation of a comfortable object-spatial environment of cities. Issues of architecture, construction, design"* September 19-20, 2022 Opatija, Croatia. Edited by Innovaciencia.

ABSTRACT

Introduction: The article discusses the current problems of the digital age in nonlinear formation, the problems of digital formation arising in the context of digital architecture, the prerequisites for new synergies between architecture and digitalization. The problems of the influence of digital culture on the formation of architecture are revealed. The concepts of architectural theorists in the development of nonlinear architecture based on the topic under study are presented. Contradictory aspects of modern design related to the limitations of new technologies and the difficulties of their integration into architectural processes are presented. **Materials and Methods**: Possible methods of solving some of the considered problems of shaping are also proposed. Special attention is paid in the article to the identification of the phenomenon of digital architecture based on internal factors - house theory, complexity theory and catastrophe theory. Examples of the work of architects and digital performers performed using the generative method of practice, including in the design processes, are given.. **Results and Discussion**: The practical value of the work, despite the generality of the problems posed in the article, has many "exits" to various levels of knowledge about digital architecture, from techno-philosophy to the culture of digital opportunities in architecture. The article can be used in the course of further research of digital architecture in its philosophical understanding as a whole, in the study of digital architecture at the present stage of its development, in a combined architectural and technological perspective. **Conclusions**: The work can be useful to researchers of architecture, culture and philosophers in the digital direction.

[1*] Corresponding author. International Education Corporation, Kazakh Head Architectural and Construction Academy, Almaty, Republic of Kazakhstan, abdnabiyev@univ-info.org

INTRODUCTION

The modern architecture of the last twenty years is technological and complex. Digitalization is fundamental to the development of digital architecture. In working with form-making, computer programs play a key role in this - they are often assigned to solve functional problems. BIM programs have emerged as powerful platforms for end-to-end design, where it is necessary for a wide range of technologies. Therefore, today it is a common condition that has a significant impact on the project's miscalculations. In the new global economy of efficiency problems, design has become a central issue for architecture and construction, as well as industrial design. This suggests that there is a growing body of literature that recognizes the importance of digital methods, where digitalization is one of the most important factors for the effectiveness of business modeling in the field of technology and technology in general. After all, digital technology is important for a wide range of scientific and industrial processes.

A key aspect of digital architecture is the influence of the premise of the phenomenon of transformation. Digital influence is of interest because it has the ability to integrate into architecture, and in this digitalization is a classic problem in digital architecture. The primary task of digital architecture is to establish a relationship with the phenomenon of digitalization in architecture. The development of the theory and practice of nonlinearity is the dominant feature of digital architecture. The integration of digital cultures is an important aspect of digital architecture. The theory of the premise of nonlinearity is a fundamental property of digital architecture. The concepts of nonlinearity and its phenomenon occupy a central place in modern architecture. Modern architecture is at the heart of our understanding that the ways of new developments are revealed under the digital influence.

The theory of nonlinearity (digital) has been studied by many researchers using various methods for obtaining complex curved form-making in architecture. So, the problems of the CAD system have been the object of research since the 1960s. Obtaining CAD design, in particular program development, was the subject of many classical studies during the computer period and after computerization. Complexity theory (Ilya Prigozhin), catastrophe theory (Rene Tom) (Figure 1). and chaos theory (Edward Lorenz) (Figure 2).

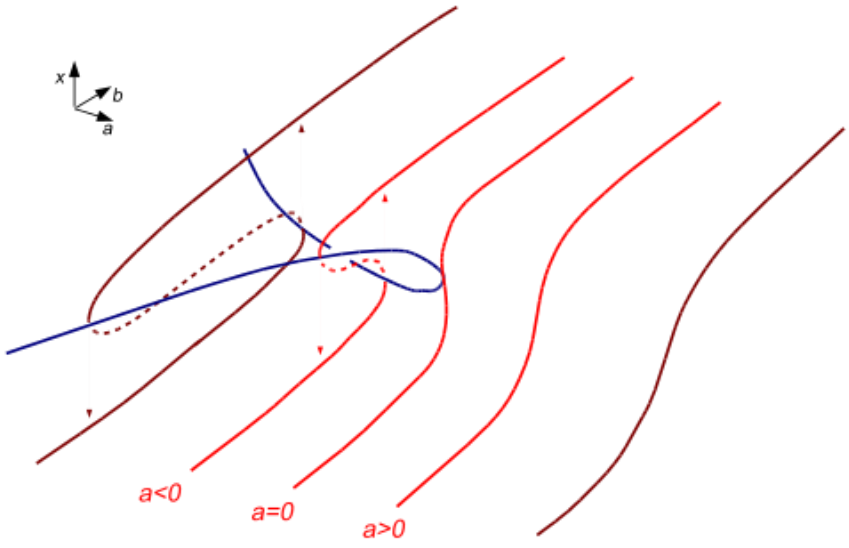


Figure 1. Diagram of cusp catastrophe

They provide useful explanations of how the formation of new trends from concepts such as digital, nonlinear, parametric, constructivism, blobitecture and other styles of architecture are a prerequisite phenomenon of theories that gained momentum back in the 60s of the XX century, the theory of the three titans of physics and mathematicians. Based on the past 60-70, one of the most important events of the 1970s, Benoit Mandelbrot, as a mathematician and founder of fractal geometry, wrote a monograph "Fractal Geometry of Nature", in which he gave examples of fractals manifested in all kinds of nonlinear dynamic environments, from symbolic dynamics to Fibonacci numbers and Pascal's triangle [1].

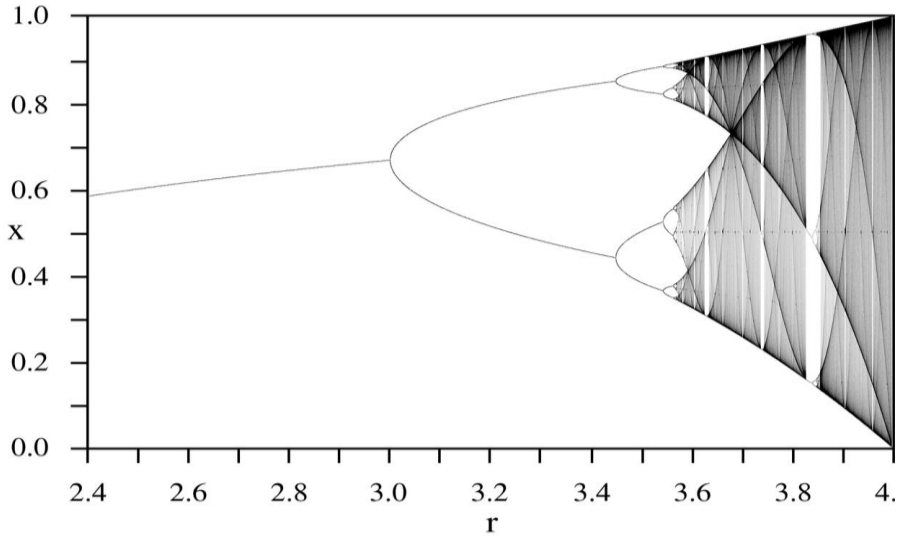


Figure 2. Bifurcation diagram for logistic mapping

The purpose of the study of digital architecture; identifies emerging theoretical problems of its phenomenon and their solutions, defined in the context of architectural projects that were created and operate using computer technology in a digital virtual environment. The objectives of the study include: to establish specific boundaries of the phenomenon of digital architecture; to identify positive and negative aspects of the relationship in the practice of novelty and tradition; to consider methods of creating shaping within the framework of digital architecture; to identify new phenomena in the field of digitalization.

The subject of the study is digital architecture and its technological, cultural and philosophical foundations of existence in the technology of digitalization, an example is an "object model" for its study and modeling, the process of creating which can be generated as an integral phenomenon existing in the digital space [(2)].

Is there a basis in digital architecture for the concept as a genuine phenomenon? When we see architecture, in addition to objects, we see fluctuations in the waves of the space of ensembles. Its essence is not limited to physics: digital architecture is generated by artificially created virtual metaphysics. In addition, this artificiality throughout the existence of architectural design is, in a philosophical sense, the main subject of this study.

Ubiquitous software algorithms that can automatically generate concepts in a matter of seconds, but they turn an architect practically into a cyborg author, in the end, with such a machine approach, one step remains to the uselessness of a human architect as such. It turns out that a computer - in particular, programs, and simpler ones - by a person, already perform the most complex technological things. Moreover, the human brain is often used not where "there is no way without it", but where the architect simply wants it, although there is no fundamental need for this - moreover, a computer could do the same even more consistently. Moreover, human abilities are often used not where "there is no way without it", but where the architect simply wants it, although there is no fundamental need for this - besides, a computer could do the same thing even more consistently, but so far, all this is impossible without human intervention [(3)].

Previous studies on digital architecture have not dealt with the factors and phenomena of digital architecture. The researchers did not consider digital architecture in detail from the point of view of techno-philosophy.

Most of the research in the field of nonlinear architecture has focused only on what happened to the styles of architecture. To date, research tends to focus on in-depth analysis rather than content.

In the period of the IV generation of computers, from 1970 to the beginning of the 90s, the era of "Computer Design" had a great influence on deconstructivism, in this the exemplary works on architecture by P. Eisenman. A rather capacious source, philosophical and theoretical understanding of nonlinearity and parametrism are described by Ch. Jenks, J. Kipnis, P. Schumacher, I.A. Dobritsyna and others. All the above-mentioned researchers and masters in the context of modern philosophy and science, dedicated to nonlinear architecture, in which the problems of digital architecture are raised, make thoughts diverse, preserving architectural thinking in a situation of radical changes in culture, science and technology.

At the next stage, the concept of "nonlinear architecture" entered the world. Which combines many styles, ranging from parametricism, virtual architecture, digital architecture of organitec and others. Thus, these styles have revived new styles based on existing styles: metabolism, hi-tech, bionics, structuralism, organic architecture [4].

METHODOLOGY

The approach to the phenomenon under study determines the features of the methodology adopted in the work. It is based on the modern achievements of the world theory of architecture in particular and science in general. In accordance with the objectives of the study, a comprehensive approach to the phenomenon is applied, including architectural, technical, cultural, philosophical approaches from various fields of modern science. The main methodological basis of the research is the general influence and phenomenon of the theory of digital architecture, which has changed the world science so much that technologies in architecture are undergoing great development, both in the general philosophical aspect and within the framework of the culture of studying the structure of digital architecture. Thus, attention is paid to those innovations that cannot be considered on the traditional scientific apparatus of architectural [5].

The world is changing, from the usual ways of working, performing mechanical design work is gradually moving to full BIM. People have already begun to interact with virtual reality and artificial intelligence, completely, to one degree or another, the spheres of digitalization are turning into a single global information world with instant access to any information inside it. Constructed structures that are made from an analog of a set of digits or deformed lines by the digital method are sometimes, if not shaky, then - quite often - they are not functional for working in new cultural conditions. At the same time, the number of methods is growing. The number of works devoted to this topic is small. Nevertheless, digital architecture is already functioning in all countries of the world, in particular BIM, its influence and culture cannot be canceled, and therefore - despite the "youth" of the subject – requires scientific research[6].

In this subsection, experiments with the design methods of famous architects will be considered. Their examples, as well as factors in the formation of digital architecture. The concept of digital architecture began to be used with the advent of the computer; in particular, with the deconstructivist style of "computer design", the model of digital design is also being dispelled by famous architects. As N.E. Sharipbek describes, digital archimetecture comes from two combined etymological words, from "digital culture" – digital, from "modern architecture" – architecture, forming "digital architecture"[7].

After all, the roots of nonlinearity are the naturalness of nature in an asymmetric creation, where it is usually achieved in nature by natural influences, whereas the "artificially" created model of nonlinearity is based on the theories of chaos, complexity and catastrophe, which are created taking into account the capabilities of a computer. calculation. Accordingly, dynamic and flexible models are considered a classic type of nonlinear form [8]. If we compare the static traditional and dynamic method of digital design, we can see by the example of N.E. Sharipbek's comparisons (Table 1)

Table 1. Differences in design methods

Analog method	Digital method
Linearity	Volume
Consistency	Chaos
Static	Dynamics
Symmetry	Asymmetry
Rhythm	Impermanence
Human	Artificial Intelligence, technology

As we all understand, traditionally the method of graphic design takes a lot of time, so the thought and activity processes associated with the environment were complex. Having software products with built-in calculation complexes, design miscalculations of any complexity are made in a short time. In this development, the formation of a "digital" or "digital" design method is aimed at presenting the methods of formation

It is worth emphasizing that today it is possible to distinguish the main methods and classifications of digital shaping:

1. The totality of objects, their systems, the ability to self-development and self-organization;
2. Formation does not follow constructiveness and functionality, but becomes self- sufficient;
3. Teamwork design is a priority.
4. Algorithms and planning are responsible for the final result.

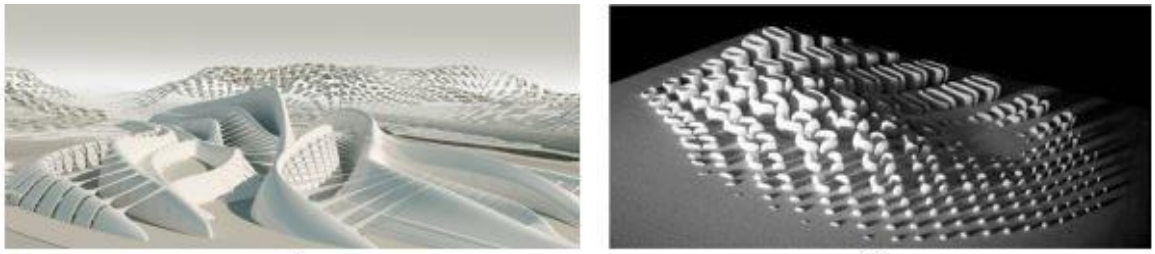
5. Formation of directions and development of new trends

Taking into account high-tech tools, the latest building materials, parametric and algorithmic design methods have a great influence on the creation of bright and complex architectural objects.

The digital approach generates a new perception of the architectural environment in which architecture cooperates with various industries. Thus, the relevance of studying the digital method in architecture, its capabilities, in search of a new image, is irreplaceable and extremely important for modern science.

As N.E. Sharipbek describes, there are seven modeling methods in digital technologies:

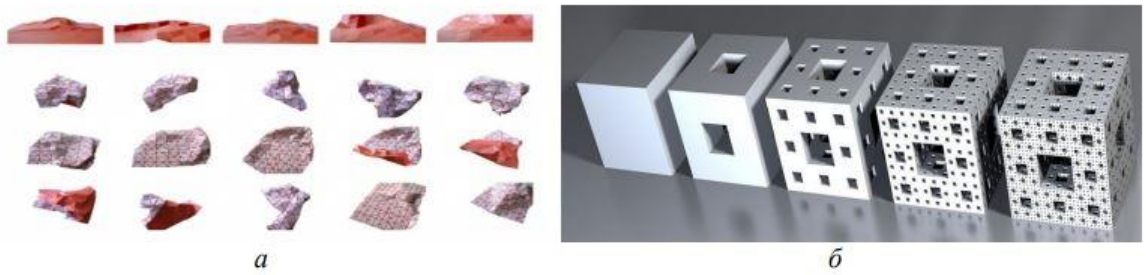
1. Parametric method - modeling taking into account elements, their interrelation, dependence on each other. This allows you to analyze the schemes in a short time (Figure 3).
2.



а *б*

Figure 3. Combinatorial method: a – center of agriculture (Kornienko D.); b – parametric quarter (P. Schumacher)

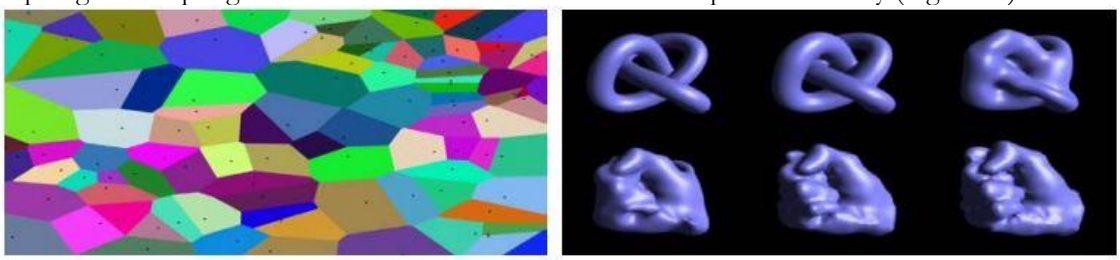
3. Scenario method - code manipulation (Figure 4).



а *б*

Figure 4. Scenario method: a – fold scenario; b – fractal perforation scenario

3. Morphing - used in computer animation, smoothly changes the geometry into another shape (Figure 5b).
4. Topological morphogenesis - continuous deformations and shape immutability (Figure 5a).



A), B)

Figure 5. a) Topological method – patterns, b) Animation – morphing method

5. Nanokinetic modeling - interactive and informative shells, that is, mechanical systems where the physical reactions of constructive systems are leading (Figure 6).

а *б*

Figure 6. Nano-kinetic method – shape adaptation: a – interactive shape; b − kinetic design

6. Analog modeling of architectural form - modeling based on analogs - phytomorphic, anthropomorphic and other objects.
7. Plasticity of digital models – transformation of models according to physical properties (air, liquids) (Figure 7)[7].

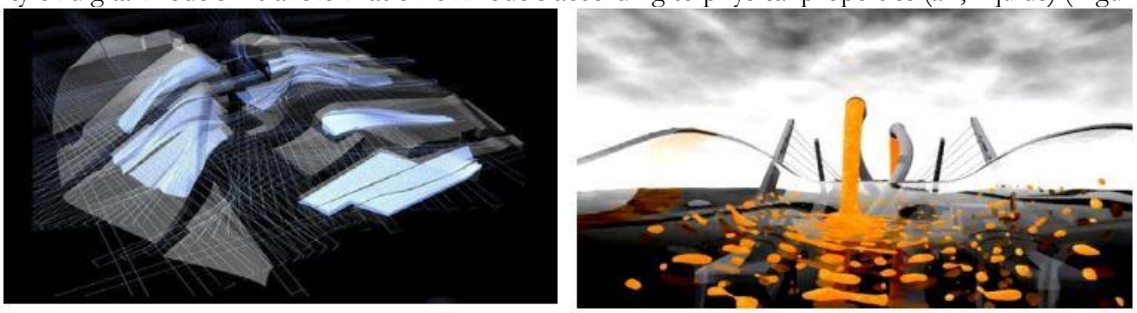


Figure 7. Plasticity

In addition, digital architecture has given impetus to new design methods, combinatorial modeling, morphing - the transformation of one object into another, plastic - the change of physical properties of an object and topological morphogenesis, which means curvature with static forms. Using computer technology, the architect has the ability to design complex shapes, analyze, modify and further implement them. Digitalization helps to link information technologies with production, industrial designs, developers and the customer[7].
Analyzing the methods of digital design, it is impossible not to mention the technology – BIM. As you know, none of the practicing architects is without mistakes when implementing their project, often the problem is born in the project documentation. BIM technology deals with solving such problems.
There can be many different dimensions in information modeling, all of which create a comprehensive methodology for modeling efficient buildings, structures and capital construction projects in general. The measurement of energy efficiency can be considered as important as the 5D vector of the modeling cost, since they are inversely interrelated. Reducing energy consumption during operation definitely leads to an increase in energy consumption during construction, reconstruction and demolition, and vice versa. Therefore, it is necessary to model the "golden mean" of the cost-energy ratio in order to obtain an effective capital construction facility for many years to come. This is the target setting of 7D-energy modeling in the general concept of BIM technology implementation (Figure 8).

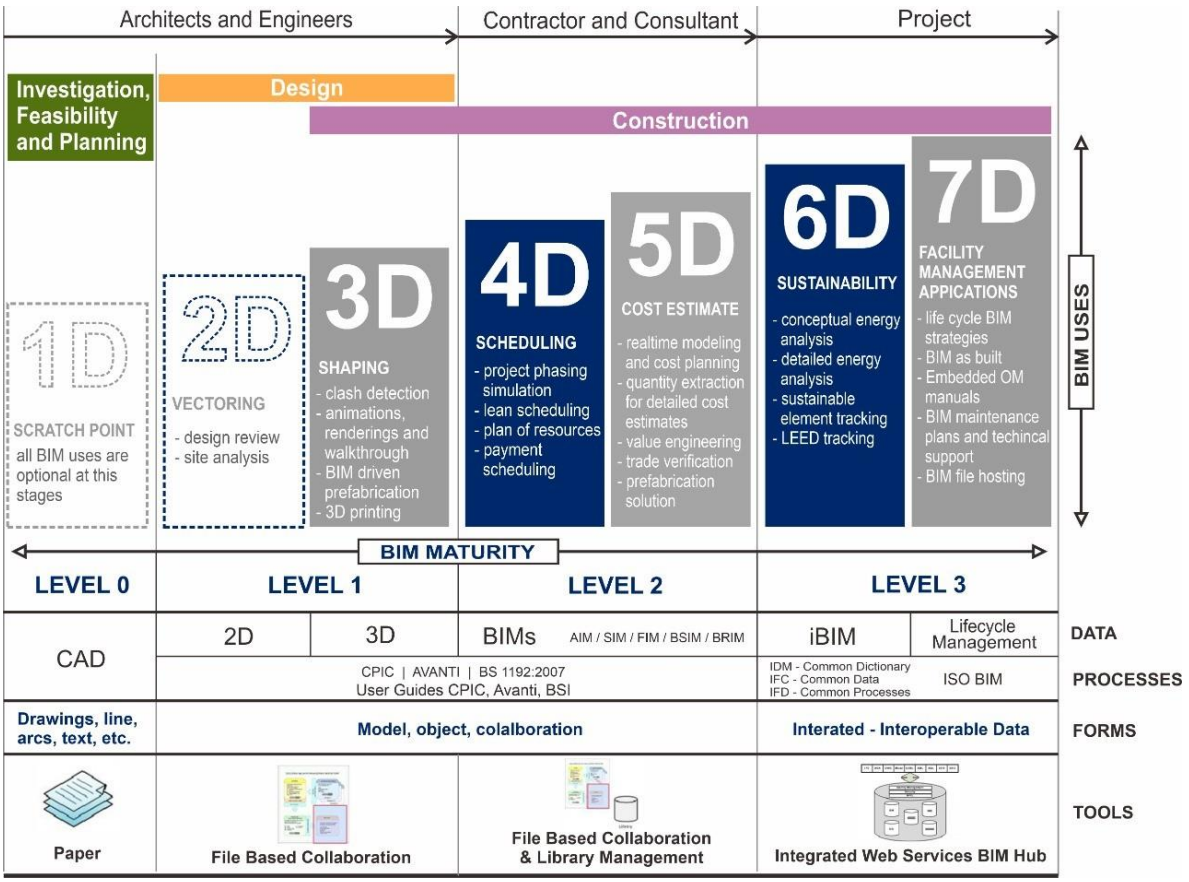


Figure 8. Scale of measurement of various stages of improvement of design technology with reference documents ranging from 1D to 7D and BIM systems

Over the past twenty-five years, many architectural programs have appeared on the market, of which there are leading and still gaining popularity among programs. BIM programs for architects and designers are generally considered more professional. According to a study by the research group "National Association of Designers of the Republic of Kazakhstan" on the topic "The level of development and application of BIM technologies in the companies of the design and research industry of the Republic of Kazakhstan", in 2020-2021 the number of users of the BIM program amounted to 85.7% (Figure 9).

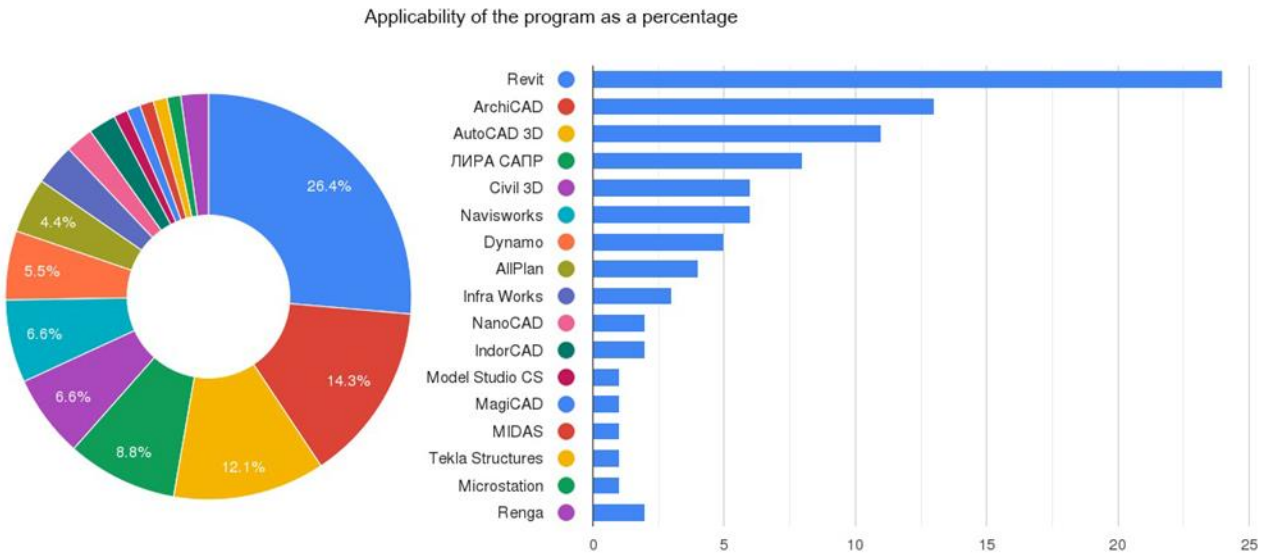


Figure 9. Names of BIM software and their applicability in the Kazakhstan market

The volume of scientific research within the framework of digital architecture is not a few works. Over the past 20 years, Masters of Architecture and researchers have promoted programming in architecture and visualization technologies, as well as new computer methods of formation and design in the digital space. However, there are not so many comprehensive studies, especially in the Russian-speaking space. A rather capacious source, the author of which is I.A. Dobritsyna "From postmodernism to nonlinear architecture. Architecture in the context of modern philosophy and science, dedicated to nonlinear architecture, which raises the problems of the dynamics of architectural theoretical thought of modernity, the variety of interaction of architectural ideology with various fields of knowledge. Ways to preserve architectural thinking as consistent and logical actions leading to the creation of a purposeful architectural solution in a situation of radical changes in culture, science and technology"[9].

The essence of digital architecture is built in such a way that it consists of an independent new form of existence, precisely in what is contained "behind the air and behind the vibrations" — in the information that we extract from physical processes during any modernization.

The work of physicists and mathematicians became the basis for a new approach to architecture. Thus, I. Prigozhin describes the emergence of dynamic unstable systems, abstract developments in nonequilibrium thermodynamics, the synergetic paradigm, also described in his writings, considers the paradox of impermanence in philosophical terms. In 1977, B. Mandelbrot, as a mathematician and founder of fractal geometry, wrote a monograph "Fractal Geometry of Nature", in which he gave examples of fractals manifested in all kinds of nonlinear dynamic environments, from symbolic dynamics to Fibonacci numbers and Pascal's triangle. The works of the American mathematician and meteorologist E. Lorenz at one time turned the idea of chaos, whose mathematical apparatus describes the behavior of some nonlinear dynamical systems. The scientific works of theoretical physicist Vitaly Ginzburg contributed to discoveries in quantum electrodynamics, elementary particle physics and other works based on the laws of nonlinear dynamics. The philosophical and theoretical understanding of nonlinearity is described by Ch. Jenks, I. Prigozhin, M. Kagan, C. Jung.

Ch. Jenks in the article "A New Paradigm in Architecture", based on the analysis of several key buildings of our time, identified their features associated with nonlinear architecture [1]. G. Lynn, as one of the founders of digital architecture, in his writings noted the principles of the formation of nonlinear architecture, which became the basis for other studies. The works of I. Dobritsyna, V. Yuzbashev and A. Rappaport are also devoted to the theories of nonlinear architecture. G. Lynn with his theory "form-motion" has made a qualitative leap in understanding an architectural digital object as a dynamic structure against the background of the formation of scientific works on complex systems, including fractal geometry and nonlinear dynamics [11].

It will not be difficult to generate a city in front of a digital tool, an extraterrestrial specialist or a novice user does not distinguish, since the possibilities of generating artificial intelligence will prevail, using examples (Figure 9) the city is modeled using generative design.

Figure 9. Sci-Fi City WIP
Source: https://giimann.artstation.com/projects/8l39v6

The design system is being radically transformed: the digital stage of the project functions comprehensively with continuous analysis of the received data and autocorrection of previous stages. Automatic coordination of the project and is brought to a new level of cooperation (Table 2)

Table 2. Cheme characteristics of digital architecture

	• Multidimensional • Independent • Diverse Form	• Modeling • Analysis • Evaluation • Calculation • Automation **Process**	
Issue	**Digital Architecture**	**Technology:** • Computer • Programs • Algorithms • Scenarios	**Project**
	Concept	**Performance** • Visualization • Layout • Animation	
	Space/ Wednesday • Real • Virtual		

Since the 60s of the XX century, all attempts to create a CAD program have been aimed at developing the possibilities of digitalization in the field of industrial design, as well as architecture and construction. Moreover, methods of digital solutions, such as fractal geometry, algorithmic and agent modeling, have had a great impact on digital architectural design in general. Architecture at the end of the XX century, on the path of powerful computer technologies, is undergoing many changes, making a huge breakthrough in the formation of a new era of digitalization. The formation

of new trends from concepts such as digital, nonlinear, parametric, deconstructivism, blobitecture and other styles of architecture is a phenomenon from the roots of the main theories that gained momentum in the 60s of the XX century: complexity theory (I. Prigozhin), catastrophe theory (R. Tom) and chaos theory (E. Lorenz) [3]. And today, with sufficient technical equipment, programs as a powerful tool capable of managing complex computing systems, an architect can generate new trends [12]

The prerequisites for the phenomenon of digital architecture are taken from six factors: science, technology and technology, culture – as globally internal factors. Interacting with these three factors, three more internal factors are created – the theories of the complexity of catastrophe and house. And indeed, since the 60s of the XX century, starting with the period of computers and ending with the forecast of Industry 4.0, this is a phenomenon of digital architecture.

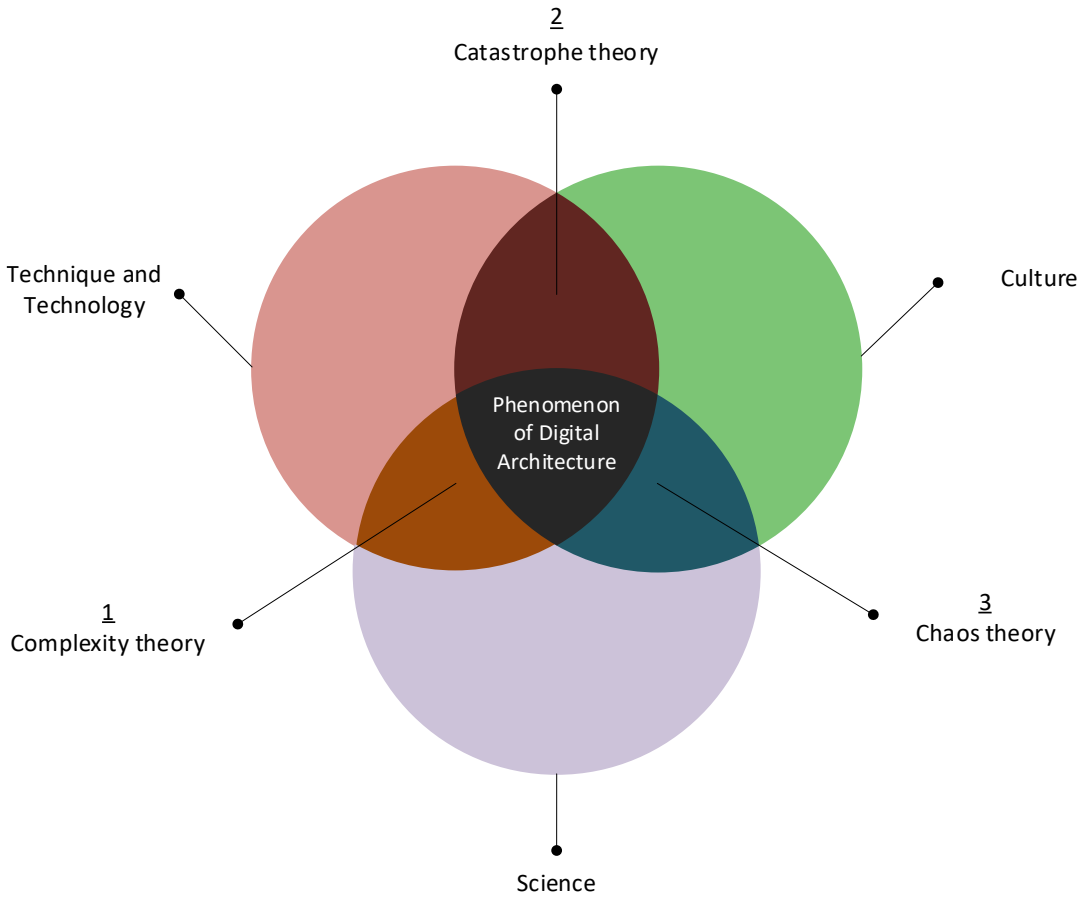


Figure 10. Factors of digital architecture development

RESULTS

Summing up, we can say that the global digital space is a single virtual information field, physically based on digital data transmission. The data transmission network, in which the majority of the population of our planet is already involved in one way or another, determines the reception and sending of its data and then both the number of involved and the degree of involvement will only increase.

The development of this field transforms the character of the form and its imitation, where the "shadow" is indistinguishable from reality. In modern architecture, the methods of shaping are being improved more and more. In fact, this is a design method that depends on the complexity of the form being created and the connection with the life cycle of the object, which takes into account all the parameters, from the search for an idea to the subsequent implementation of the building and not only.

The XXI century is the age of digitalization. Digital economy, digital media, digital crime, digital culture, digital death, including digital immortality, are becoming relevant. Digitalization, being an artificially created natural object, has

become a certain stage in the development of society. The modern world is going through a time of continuous technological revolution – computer, digital, while striving for a biotechnological system. Ethics and philosophy are developing, but they continue to lag behind the development of technology. Society develops mechanisms that it itself does not have time to fully implement, since technologies are developing exponentially, the individual can no longer easily adapt to them, information begins to go beyond the limits of probable predictability.

Mechanisms of a new phenomenon in architectural shaping based on the integration of architectural stylistics and digital culture. The influence of the "computational" approach on the formation of architecture. Bionic architecture, digital architecture, nonlinear architecture, parametric architecture, etc. The current problems of sustainable development of digitalization are considered as a factor that creates a certain "coloring" and sets a vector for a well-defined development of architecture.

All analyses of development can be viewed from the point of view of the influence of the phenomenon of digital architecture design, where it originates from the appearance of CAD graphic editors on the first electronic computers in the mid-60s-70s of the XX century. In parallel with the development by the end of the century, "digital reflection" gave a new impetus to development and received all the innovative technological trends that we observe in BIM technology, which has taken root in a special way in the digital space in various experimental design conditions [13].

DISCUSSION

Digital culture has many trends in architecture, which can be considered a source of a tool for new methods of digital design and the beginning of a revolution in both digital architecture and design. In general, the avalanche-like development of digital technologies in the field of architecture requires a systematic approach to the typologization of these areas and their adaptation not so much even to modern architectural tasks (this has already been done in many ways), but from the point of view of forecasting the development of these areas. The technologies themselves, with the appropriate prediction of the development of architecture and in accordance with this "feedback" of architectures with these technologies.

In the modern world, there is a peculiar phenomenon of digital architecture, the main distinguishing features of which are the digital way of fixation and existence within the global unified virtual information space. It is determined that digitalization has a number of serious consequences: this makes it fundamentally impossible for human consciousness to fully embrace the entire digital architecture, leaving such an opportunity only for artificial intelligence.; by providing an almost instantaneous data transfer rate to anywhere in the world, this makes us as dependent as possible on the speed and processing of the digital information space; this leads to the globalization of architectural unity in the virtual information space. At the heart of all this is the transformation of regional phenomena into global problems. This can be described as a process by which people from all over the world unite into a single society and function as a single organism, where dependence on each other will appear. This civilization is a combination of economic, technological, social, cultural and political forces.

The roots of the theory of the phenomenon of digital architecture lie in the premises of the theory of chaos, catastrophes and complexity. According to the generation of the room design, it goes even deeper by analogy with the formation of nonlinear architecture in Antonio Gaudi and Fry Otto. For example, Gaudi has a physical living organic nonlinearity in his creations, when computer models of prototypes of the formative architecture are built at the digital level, only at the virtual level, which is not natural and is not created by man “from nature” (Figure 11).

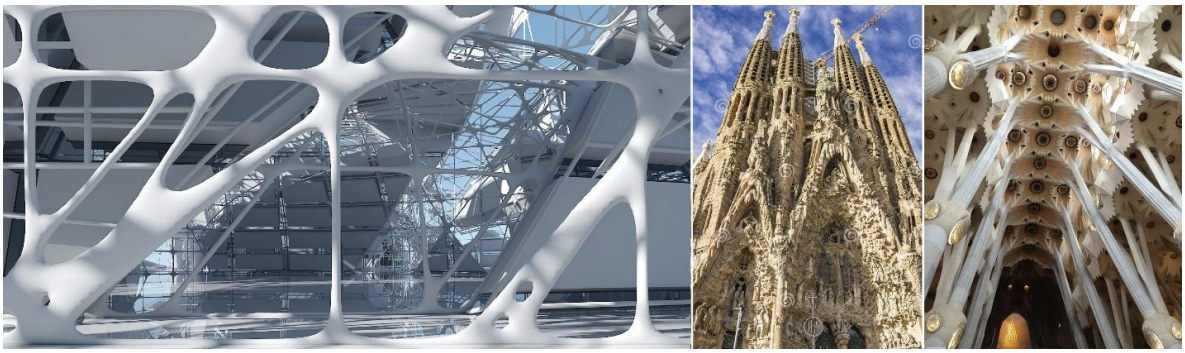


Figure 11. Background of non-linear architecture

The scientific novelty can be a combination of modern achievements of Western civilization with the traditions of world architectural research, as well as a fundamentally new approach to the study of shaping in digital architecture – by analyzing the identification of digital influences at all stages through transformations.
Previously, digital tools were considered exclusively as auxiliary tools in the architect's arsenal and did not affect the formation process itself. However, in recent decades, the role of computer programs in architecture has changed significantly. Today, the processes of shaping are controlled by two acting forces: man, and design tools. In their work, each of these factors needs different types, forms and data sources that perform a specific task in the design.
At the present stage, the relationship between computer programs and a person can be characterized as symbiotic, in which electronic computing machines (computers) facilitate the performance of tasks set by a person, while a person activates computer computing processes with his influence.
Modern architecture consists of three advanced directions: nonlinear, fractal and digital. Nonlinear architecture, as its name implies, works with complex systems in which the parameters of mathematical quantities are connected by a nonlinear dependence. This approach more accurately reflects natural forms and their inherent laws of a higher order and leads to a departure from linear representations more inherent in human thinking. These processes were made possible by the use of computers. able to work freely at such a high level of mathematical dependencies. The architecture of nonlinear dependencies is based on the geometric concepts of a curve on a plane and a hypersurface in the space of three or more dimensions[2]. The use of figures of this type in the formation of figures leads to the appearance of non-standard and complex images of structures.

CONCLUSION

In general, today we can observe the formation of a new visual paradigm that transforms human perception and thinking. An interesting study was conducted on the subjective foundations of ecological design in the context of psychedelic forms and design solutions. A significant role in such experiments is given to digital means of data transmission, analysis and storage, thanks to which many of the ideas considered in the study have reached a new level. Within the framework of psychedelic architecture, it becomes easier to develop new ideas and methods, as well as to manipulate the plasticity of objects, which directly affects the degree of their emotional impact.
Thus, without computer technology and big data management, it would be impossible to recreate the revolution in digital architecture with all its new applications and aspects. Based on this, it can be stated that digital technologies give rise to many areas, such as cyberspace, cyberworld, virtual architecture, etc., which affect the future of the architecture paradigm, where information technologies are the basis of the theory of the concept of a new era and a revolution in the development of digital architecture.
As a result of the research work, an analysis was carried out and conclusions were drawn about the role and significance of digital architecture. When writing the article, the goals of identifying the phenomenon of digital architecture, establishing relationships and their impact on architecture were noted. To achieve such a task, it is necessary to analyze and study the digital architecture at the global level. In conclusion, we reviewed the state of digital architecture at the global level.
The study showed that since the 1960s, architects have started using computer-aided design. Modern trends of digital architecture in relation to all mutually influencing factors of digitalization were also studied and identified. The positive and negative sides of digital civilization were also considered. On the basis of the theory of chaos, complexity and catastrophes, the phenomenon of digital civilization, in particular digital architecture, was revealed. Digital architecture refers to a variety of terms specific to architectural styles, such as parametricism, hi-tech, organitec, bioarchitecture, generative modeling, and much more. There are general methods of formation, which were discussed in the section "Methodology". We have considered BIM technology from 1D to 7D, it will be developed in the near future for 15 years, where there is a prospect for another Industry 4.0 design format.
The formation of buildings using digital technologies based on the parametric design method. Thanks to the creation of computer algorithms, a spatial model is formed based on a number of factors.
And when the algorithm for generating the shape of a building is written, both the above data and additional environmental factors are entered there, and thus an architecture is created that fits into this environment as much as possible, having, if necessary, appropriate plastic, natural forms.
Almaty has a complex architectural component; the city consists of buildings of different periods that need to be combined with each other. The combination of old and new in the same areas is not always bad. It is only necessary to work efficiently and scrupulously on urban space. In most cases, modern buildings are similar to each other and are

built according to the same type. There are several original, relevant and beautiful modern structures. In order to change the purpose of a historical building and fit it into a modern city, it is enough to have a little imagination and the ability to interpret architectural forms in a new way.

One of the undoubted advantages of Almaty is a large amount of greenery and beautiful landscapes that need to be protected and competently inscribed in buildings. There is an overlap of different times and styles. Local architects experimented with buildings in different decades and left their mark on each of them. The current task is to preserve valuable monuments and inspire future projects.

Of course, the public should be involved in the decision-making process on design issues. Residents and architects may have different views on the future object. Only citizens can objectively determine what is best for them. At the same time, it is important to raise the architectural culture of the population, to tell people why certain buildings are important.

In the course of the work, options were proposed that will help to better understand their architectural heritage and use digital tools for its further display. The areas of application of the digital component in the creation of regional architectures can be completely different: from the use of virtual reality to 3D printing for the detailed creation of objects, decorative elements, etc.

The process of implementing the reasonable use of technology is in full swing. At the moment we have to think and try to combine the search for regional identity, traditions and heredity, which can be expressed through digital culture. Buildings of modern architecture also pay attention to the internal content – materials, communication systems, layouts. All this should be taken into account for high-quality design in our country.

Summing up all the above, we can conclude that great opportunities and prospects are open for the development of modern regional architecture in Kazakhstan:

- selection of modern and traditional building materials or their mixing;
- the possibility of using innovative technologies in the transformation and reinterpretation of traditions and culture;
- creating a form of any complexity that accurately conveys the meaning;
- the decoration will not be limited only to the ornament;
- adaptation of traditional methods to a modern image with the help of computers;
- consideration of natural and climatic features;
- with the help of computing devices, climatic and geographical parameters will be calculated with maximum accuracy and reliability, which will allow the fullest use of the terrain;
- the possibility of preserving and transmitting spiritual and material culture and much more.

With the rapid development of technology, it will be possible to generate your own unique parameters inherent in a particular region and use them when creating architectural projects. The emergence and development of technologies in the architectural sphere give established styles a new breath and vision, reveal new approaches and methods, change the perception of the world and the feeling of objects under construction. Of course, it cannot be denied that due to inflated expectations, some breakthroughs and innovations are outdated and not as impressive as the creations of past centuries. Thus, it is the call for uniqueness and individuality that will help to make the best use of digital technologies.

ACKNOWLEDGEMENTS

I express my gratitude to my colleague in science, responsible editor Bekturganova Neilya Esengeldievna, who supports in the recommendations for the design and submission of the manuscript for publication, and I am also very grateful to my Faculty of Architecture, in particular to all professors and colleagues who inspire and motivate me.

REFERENCES

1. Prigozhin IR. Thermodynamic theory of structure, stability and fluctuations. Moscow: Mir; 1973.
2. Digital architecture, 2022. Available at: https://ru.wikipedia.org/wiki/ Digital architecture Accessed: September 29, 2022.
3. Jencks Ch.A. The language of post-modern architecture. Moscow: Stroyizdat; 1985.
4. Dolgova A. Stop reinventing the wheel. How to rethink the process of creating a typical housing using blockchain; 2022. Available at: https://strelkamag.com/ru/article/a-new-approach-to-rethinking-housing-production Accessed: September 29, 2022.
5. Sharipbek NY. The role and importance of digital culture in the creation of modern regional architecture. Almaty: International Educational Corporation; 2022.

6. Chelnokov AV, Kornienko DA. Methods of shaping in digital architecture. Bulletin of PDABA. 2013. 6(183). Available at: https://cyberleninka.ru/article/n/methody-formoobrazovaniya-v-digitalnoy-arhitekture Accessed: September 29, 2022.
7. Schumacher P. A new global style for architecture and urban design. Digital Cities. 2009. 79(4):14-23. https://doi.org/10.1002/ad.912
8. Dobritsyna IA. From postmodernism to nonlinear architecture: Architecture in the context of modern philosophy and science. Moscow: Progress-Tradition; 2004.
9. Meerovich MG & Ivanova AS. A new paradigm in Architecture: from Charles Jenks' Forecast to "Virtual Reality". Architecton: Izvestiya Vuzov. 2018. 3(63):1-17.
10. Yelkina EE. Digital culture: Concept, models and practices. Inform Soc: Educ, Sci, Cult & Technol Fut. 2018. 2:195-203.
11. Igumnova AS. Digital architecture. Opportunities and spatial experience. Cult & Art. 2018. 2:66-73.
12. Goryova II, Zorin AL. Digital culture in the information society. Cultural Heritage of Russia. 2020. 2. Available at: https://cyberleninka.ru/article/n/tsifrovaya-kultura-v-informatsionnom-obschestve Accessed: September 29, 2022.
13. Salingaros N. Anti-architecture and deconstruction. The triumph of nihilism. Yekaterinburg: Cabinet Scientist; 2017.