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CONCEPTUAL MODELING IN ENVIRONMENT DESIGN: SYSTEM BASICS

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INTRODUCTION

Thesis is devoted to the study of theoretical problems and systemic foundations of conceptual modeling in the design of the environment as a field of inter component communication.

The relevance of research

One of the urgent directions of the country's development is to improve the quality of life of citizens. An important aspect in this direction is the creation of a comfortable living environment. At the same time, the habitat must be considered as an open system, which is influenced by many factors. For example, the process of intensive urbanization, which leads to an increase in the influence of the anthropogenic environment on humans. On the other hand, the strengthening of the humanitarian principle in society as a whole, when special attention is paid to the development of the individual, accordingly, human needs become the focus of attention. The change in social behavior and worldview under the influence of information technology and the goal of the sustainable development strategy, according to which the satisfaction of modern society with its needs should not deprive future generations of the same. Also, it is necessary to find a balance between regionalism and globalization when choosing the means of organizing the surrounding space. Separately, it is necessary to note the shift in the social paradigm towards the assessment of knowledge as the main economic resource of an innovative economy, which requires, among other things, their effective application, i.e. development of methodological competencies in the process of continuous education. The very process of creating a comfortable environment, at the same time, is a process of cyclic communication between the designer (designer or architect) and the user of the design activity through the design object. It can be argued that the importance of developing additional mechanisms for managing this type of communication increases in accordance with the request of society and should be built within the framework of a systematic approach to the object.

Since 2018, the implementation of national projects has begun in the Russian Federation, focused on the formation of an actual living environment, education, culture,

recreation, etc. Some of them, from the position of environmental design, should be specially noted. One of the most professionally significant is the federal project "Formation of a comfortable urban environment" of the national project "Housing and Urban Environment"[1]. Measures for its implementation should improve the quality of the urban environment by 1.5 times by 2030. The federal project "Ensuring a Qualitatively New Level of Development of Cultural Infrastructure (Cultural Environment)" of the national project "Culture", the main goal is to increase the number of visitors to museums, development centers, art schools, libraries, clubs, cinemas, etc. by at least 15%, due to improving the accessibility and quality of the environment of the institutions themselves[2]. The federal project "Development of tourism infrastructure" of the national project "Tourism and hospitality industry" declares the tasks, among other things, the creation of tourist clusters with high quality design of the spatial environment[3]. In this regard, there is a need for an in-depth study of the conditions for the formation of the environment, understanding of the internal relationships that affect the satisfaction of the needs of the target audience. It is a systematic understanding of this issue that will create conditions for an adequate state request for managing the communication process between the designer, the user and the object of project activity. An increasingly important role in this context is beginning to play such a direction of project activity as "Environment Design". The development of professional methodology in this area and the professional development of specialists will contribute to the successful implementation of the strategic goals declared by the state.

At the same time, there is a need to expand and deepen scientific ideas in environmental design, which will increase its effectiveness in solving the tasks set by the state and society. Thus, the involvement of design, as an active participant in the transformation of the environment, requires scientifically based updating of its conceptual apparatus and methodology, including such a system approach tool as conceptual modeling. It is conceptual modeling that provides a description of the design object as a

[1] https://minstroyrf.gov.ru/trades/natsionalnye-proekty/natsionalnyy-proekt-zhilye-i-gorodskaya-sreda/
[2] https://culture.gov.ru/about/national-project/about-project/
[3]https://www.economy.gov.ru/material/directions/turizm/nacionalnyy_proekt_turizm_i_industriya_gostepriimstva/fp_razvitie_turisticheskoy_infrastruktury/

system in order to understand its component composition, properties, principles of interaction and development opportunities to facilitate further communication with the target audience and the designer's search for reasonable and sustainable design solutions.

Meanwhile, the issues of theory in environmental design are still not sufficiently developed, many definitions and methods have been introduced into the professional field, borrowed mainly from architectural science, but there is no comprehensive methodology adapted for the specialty “Environment Design”, and practical design skills do not have the proper scientific justification. The field of application of conceptual modeling, which is basic in the work of a designer and allows obtaining sustainable and socially demanded environmental concepts, also remains little explored. Accordingly, when developing project proposals to improve the quality of the human environment, the whole range of problems and contradictions is not always considered, which leads to unreasonable replication of design techniques, without taking into account the context. This is all the more counterproductive since, from a methodological point of view, environmental design, like all design sciences, is based on a synthesis of the methods of an engineer, artist and scientist, but the latter are not sufficiently used in developing its theoretical basis. At the same time, the systematic approach underlying the actual design methods has undergone significant development in recent decades, its interpretation has become more complicated towards a cybernetic, homeostatic, informational, categorical approach, which is of particular interest and has great potential for clarifying the environment design methodology. The rooting of the environmental design methodology in the general scientific field can be used in the context of the search for new heuristic algorithms for conceptual modeling that allow practical design activities to be carried out adequately to modern conditions, correlating professional tasks with environmental quality criteria.

Thus, in connection with the relevance of activities to improve the quality of the environment and the variability of the needs of the target audience, an important task is to actively expand the practice of using conceptual modeling in the design of the environment, which will provide a productive tool for influencing the environment as a complex self-developing system and form mechanisms for indirect control of it in order

to increase its comfort and attractiveness for the target audience. A serious problem hindering the solution of this problem is insufficient systemic justification, inconsistency of theoretical aspects and methodological approaches in the design of the environment, which gives rise to a lack of conceptual modeling methodology, as well as insufficient knowledge of the skills and abilities of practical application of conceptual models suitable for solving the above problem.

The degree of development of the research topic.

The study of domestic and foreign literature on the topic of the dissertation showed that fundamental research on the organization of conceptual modeling in the design of the environment was practically not carried out. The specific nature of the design object does not allow, however, to directly borrow the numerous and qualitative methods proposed by researchers in the field of industrial design and based on the principle of communication, which, however, is preserved in the design of the environment as an integral professional feature. Meanwhile, to date, a significant number of scientific papers have appeared on the environmental approach as the dominant design paradigm, a complex multidimensional and interdisciplinary phenomenon, which allowed their authors to identify and explore the prerequisites, resources and priorities of environmental design as a separate type of design creativity, as well as some processes flowing within its framework and approaches to their implementation.

The foundations of the theory of the environmental approach are laid down in the works of O.I. Genisaretsky, A.E. Gutnova, A.P. Zinchenko, V.A. Ikonnikova, M.A. Konika, V.A., Nikitina, M.V. Posokhin, A.G. Rappaport, M.R. Savchenko and others who studied this phenomenon in architecture and design, its philosophical, theoretical and methodological base. Further development of the environmental approach went in several directions at once, through building the interaction between architecture and design on a scientific basis. Studies of socio-cultural functions and qualities of the urban environment in their works were continued by: M.G. Barkhin, A.V. Bokov, A.A. Vysokovsky, V.L. Glazychev, A.E. Gutnov, A.V. Ikonnikov, G.Z. Kaganov, E.I. Kozyreva, L.B. Kogan, L.P. Kholodova and others. The rooting of the sphere of environmental design in the field of architectural theory can be traced in the works of

such researchers as: E.V. Ass, E.P. Grigoriev, A.V. Efimov, S.M. Mikhailov, G.B. Minervin, V.T. Shimko and others. A cultural approach to considering the category of “environment” as an object of design can be traced in the works of: N.I. Barsukova, S.D. Bortnikova, T.Yu. Bystrovoy, Yu.A. Kovaleva, K.A. Kondratieva, S.M. Mikhailova, I.E. Nikitina, T.V. Poidina, V.F. Sidorenko and others.

The problems of interaction “man-environment” and the cognitive functions of perception of the architectural and spatial environment are reflected in the works of G.B. Zabelshansky, J. Gale, A.V. Krasheninnikov, K. Lynch, S. McQuire, G.I. Revzina, V.F. Runge, K. Ellard and others. In this context, the works of design and architecture theorists who have studied the formation of user qualities of the environment are of interest: P.M. Ershova, V.I. Iovleva, I.S. Karimova, K.V. Kiyanenko, G.A. Lanshchikova, G.I. Lola, N.F. Metlenkova, S.M. Mikhailova, V.F. Sidorenko, V. Papanek and others, as well as works on psychology and sociology of such authors as D.G. Bagdasarova, E.V. Garin, P.M. Ershov, A. Maslow, M.A. Max-neef.

A separate block can be distinguished from studies on the specifics of design as a form of interaction between the components “author - user - object”, this direction is being developed by such authors as: N.S. Aganina, L.A. Barash, N.I. Barsukova, T.Yu. Bystrova, E.V. Zherdev, N.Yu. Kazakova, I.S. Karimova, K.A. Kondratieva, E.N. Lazarev, G.N. Lola, G.A. Lanshchikova, S.M. Mikhailov, V.V. Saakov, Yu.A. Simakova, V.F. Sidorenko and others. The contradictions that arise in connection with inter component interaction, which distinguish the design of the environment from other design specialties due to the system complexity of the design object, substantiating the specifics of its design methodology, were studied in their works by such authors as B.G. Barkhin, A.V. Bokov, V.G. Vlasov, V.L. Glazychev, Z.Z. Ziyatdinov, I.S. Karimova, Yu.I. Karmazin, G.A. Lanshchikova, G.B. Minervin, M.V. Pankina, V.F. Sidorenko, L.P. Kholodova and others.

The issues of the general theory and methodology of design in architecture and design were dealt with by such domestic researchers as: B.G. Barkhin, A.V. Bokov, T.Yu. Bystrova, V.G. Vlasov, O.I. Genisaretsky, H.S. Gafarov, A.V. Efimov, E.V. Zherdev, Yu.I. Karmazin, E.V. Kokorina, S.V. Kurasov, A.N. Lavrentiev,

N.F. Metlenkov, G.B. Minervin, Yu.V. Nazarov, N.N. Nechaev, V.F. Sidorenko, V.N. Tkachev, V.T. Shimko, D.N. Shchelkunov and others; The works of foreign researchers also deserve attention: J. Broadbent, T. Goldby-Smith, B. D. Council, N. Cross, V. Margolin, G. Simon, A. Hatchwell and others.

At the same time, the research of Kr. Alexander, B. Archer, B.G. Barkhin, G. Broadbent, O.I. Genisaretsky, J.K. Jones, J. Zeytun, N.N. Nechaeva, A.V. Ryabushina, P. Hill, G.P. Shchedrovitsky and others. Current research in that area by T.Yu. Bystrovoy, P.V. Kapustina, Yu.I. Karmazin, N. Cross, N.F. Metlenkova, S.K. Sarkisova, O.P. Tarasova, V.T. Shimko and others. In this context, such scientists as N.S. Aganina, V.E. Barysheva, O.B. Druzhinina, K. Dorst, L.M. Ptitsina, O.P. Tarasova, P. M. Khakuz, O.R. Khaliullina, A. Hatchew, N.G. Yakunichev. At the same time, the studies of N.I. Barsukova, V.I. Iovleva, S.P. Lomova, N.F. Metlenkova, M.V. Pankina, V.F. Sidorenko, N.G. Yakunichev.

Analysis of the degree of study of the topic allows us to draw several conclusions. At the moment, the environmental approach has a developed categorical and conceptual apparatus, however, the scientific community does not offer a direct definition of the concept of “environment as an object of conceptual modeling”, which could be used as a model for analysis. From the point of view of the user component, a lot of work is devoted to the study of human needs and features of the perception of the environment, and it is only necessary to clarify the qualities of the environment that are responsible for meeting basic needs from the standpoint of conceptual modeling. Studies on the interaction of the components “author - user - object” allow us to accept the designer (author) as a component that regulates contradictions in the interaction of an object and a user, while the object itself, being a complex system, requires the author to use special methodological approaches in its conceptual modeling. Based on studies of the general theory and methodology of design, as well as the potential for integrating general scientific methods into them, it can be argued that the issues of conceptual modeling quite regularly come to the attention of the scientific community, and also, most scientists note the important role of this activity at the initial stage of design for the final quality designed environment.

The relevance of the study is further confirmed by the scientific work of the last decade, which is carried out in the direction of the theoretical substantiation of the architectural and design of the habitat: I.B. Volkodaeva (2022), E.S. Gagarina (2019), E.A. Martemyanova (2019), L.M. Ptitsina (2012), M.A. Chervonnaya (2014).

At the same time, in the works of these scientists, the problems associated with aspects of conceptual modeling directly in the design of the environment are not sufficiently studied, and the methodology for this type of activity is not presented.

Thus, **scientific problem** is insufficient study of the object and the mechanism of conceptual modeling in the design of the environment, which is confirmed by the lack of a holistic productive methodology for conceptual modeling, which could improve the quality of design, and, accordingly, indirectly affect the achievement of environmental comfort and the development of methodological competencies of the designer as a researcher and designer.

The debatability of the issue and the fundamental nature of the foundations of conceptual modeling in the design of the environment made it possible to put forward **scientific hypothesis:** systemic and, developed on its basis, general scientific approaches to conceptual modeling, in combination with the refinement of the modeling object in the design of the environment and the study of the mechanism of interaction between the components of conceptual modeling, will allow, based on the management of the process of conceptual modeling, to ensure the formation of a productive methodology that is significant for the process of project activities with to improve the quality of the environment.

The object of study – environment design as a field of communication and a field of integration of inter component interactions.

The subject of study – system bases of conceptual modeling in environment design.

The target of the research is to substantiate and develop a methodology for conceptual modeling in environment design by studying the essential aspects of conceptual modeling based on a scientifically based approach.

To achieve this goal, the following **tasks** were set and solved:

− identify the theoretical aspects of the design of the environment as a field of communication in terms of the object, user, influence factors, methods and place of conceptual modeling in it, justify the relevance of the study;

− explore conceptual modeling as a general scientific activity and determine its main parameters in environment design;

− identify the basic characteristics of the environment as a design object; offer a definition of the concept of “conceptual modeling object in environment design”;

− form a list of user needs that can be satisfied with the tools available to the environment design; develop a model of user qualities of the environment from the position of conceptual modeling;

− explore the mechanism of interaction between the user, the object and the designer as the interaction of the components of conceptual modeling in the design of the environment; reveal and describe the basic principles of the desired mechanism;

− identify and describe the content of the most significant contradictions between the components of conceptual modeling in the design of the environment, as well as the possibility of regulating these contradictions;

− develop a model of the process of conceptual modeling in environment design; perform a critical analysis of the tasks and results of the desired process; develop a management model;

− propose a methodology for conceptual modeling in environment design, based on the study; test this method.

The theoretical basis of the study the fundamental provisions of a number of scientific areas served: the environmental approach and methodology of the theory of design and architecture, the general theory of systems, the theory of homeostatics, the theory of dynamic information systems.

As a methodological basis a systematic approach was presented in the elemental, evolutionary, structural, functional, resource, homeostatic, communication aspects, categorical methods and methods of intelligent circuitry. The work is based on the experience of research, teaching and project activities in the field of environmental design.

Compliance of the dissertation research with the cipher of the scientific specialty 5.10.3. – “Types of arts (Technical Aesthetics and Design)”. The dissertation research corresponds to the code of the specialty in the areas of research: p. 53 “General Theory and History of Design”; p. 58 “Communicative aspects of design”.

Scientific novelty of the research results is that for the first time in Russian art history and design theory, the subject of special scientific research was conceptual modeling in environmental design from the standpoint of general scientific methodology.

For the first time, a definition of the concept of “an object of conceptual modeling in the design of the environment” has been proposed. For the first time, an information model of user qualities of the environment has been developed from the standpoint of conceptual modeling, as well as a model of the mechanism for the functioning of the components of conceptual modeling in the design of the environment. For the first time, the inter component contradictions of conceptual modeling in the design of the environment have been investigated and a system of models has been developed that reflects the process of conceptual modeling, as well as a model for managing this process.

Thus, a systematic approach to the subject of research has made it possible to develop a unique methodology for conceptual modeling in environmental design, which is significant for the process of project activities in terms of direct and indirect management of it in order to improve the quality of the habitat.

Theoretical significance of the dissertation research is to develop the theoretical and methodological foundations of environment design, systematically reflecting the significant aspects of conceptual modeling and the possibility of managing it, based on current general scientific approaches.

The practical significance of the work is determined the possibility of applying the results obtained in the practice of environmental design, as well as in other areas of design, in particular, within the framework of such procedures as creating productive design concepts, organizing the design process and intensifying creative search by area, identifying and resolving contradictions between components in the environment as an object design with the aim of overall improving the quality of life and increasing the comfort of the living environment.

A number of results and conclusions of the dissertation research can be used in the educational process to update and develop individual disciplines of environmental design, dedicated to the theory and practice of design design, conceptual modeling of environmental objects, design design methodology, research and creative; work within the framework of special courses for undergraduates, teachers of higher education and additional education.

Approbation of the research results. The main conclusions and theoretical provisions of the dissertation research were presented at scientific events at the international, all-Russian and regional levels, including: VII International Scientific and Practical Conference “Actual Problems of Design and Design Education” (2023, BSU, Minsk, Republic of Belarus), All-Russian scientific and methodological conference “University complex as a regional center of education, science of culture” (2023, OSU, Orenburg), All-Russian conference on natural and human sciences with international participation “Science of St. Petersburg State University - 2022” (2022, St. Petersburg State University, St. Petersburg), All-Russian Round Table “Modern Research Methods in the Humanities” (2022, Bashkir State University, Ufa), III International Conference “Issues of Expertise in the Field of Culture, Art and Design” (2022, UrFU, Yekaterinburg), XIII International Scientific Conference “Modern Architecture of the World: Main Processes and Directions of Development” (2022, RAASN, Moscow Architectural Institute, NIITIAG, Moscow), II International Scientific and Practical Conference “Dialogues on the Protection of Cultural Property” (2022, UrGAHU, Yekaterinburg), IV Interregional Scientific and Practical Conference “Modern Public Spaces as a Tool for the Development of the Urban Environment” (2022, SPbGASU, St. Petersburg),All-Russian Conference on Natural Sciences and Humanities with international participation “Science of St. Petersburg State University - 2021” (2021, St. Petersburg State University, St. Petersburg), II Russian Aesthetic Congress (2021, UrFU, Yekaterinburg); National (All-Russian) Conference on Natural Sciences and Humanities “Science of St. Petersburg State University - 2020” (2020, St. Petersburg State University, St. Petersburg); International Scientific and Practical Conference “Messmacher's Readings - 2020” (2020, A.L. Stieglitz SPGHPA, St. Petersburg); II Interregional

scientific and practical conference “Modern public spaces as a tool for the development of the urban environment” (2020, SPbGASU, St. Petersburg); 13th International Conference on Design Principles & Practices (2019, St. Petersburg State University, St. Petersburg). An educational and methodological complex (a work program of the academic discipline and applications) was developed as part of the competence-oriented curriculum of St. Petersburg State University 22/5592/1 “Conceptual modeling of environmental objects 54.04.01 Design, profile Design of the environment”.

The obtained theoretical and practical results have found application in the educational process when reading the training courses “Theory and practice of design”, “Conceptual modeling of environmental objects", "Preparation of a scientific and creative project” in the main educational program of the master's program “Environment Design” in the direction of preparation 54.04 .01 “Design” at St. Petersburg State University from 2010 to the present.

The following provisions are put forward for defense:

- The essential features of the environment as a self-developing system, the diversity of human needs as the main factor of influence initiating its changes, and the potential of a systematic approach in project activities, together, determine the relevance of developing a methodology for conceptual modeling in the design of the environment as a tool for building a meaningful normative-prognostic system of models that determine the structure system, the properties of its elements and cause-and-effect relationships inherent in the system and essential for achieving the goal of modeling.
- The integral components of conceptual modeling in environmental design are the components of the object: area (material, temporal, cultural), purpose (functional, technological, aesthetic), content (objective, process, semantic) and use (life-supporting, purposeful, identical).
- The model of the mechanism of interaction between the components of conceptual modeling in the environment design proposed in the study is based on the inter component relations of direct and inverse constraints in a star-shaped closed chain of components (“Object: area”, “User: use”, “Object: purpose”, “Designer: design”), “Object: content”), which allows for effective control of the specified mechanism by influencing inter

component contradictions that arise in the process of competition between them for the basic resource.

- The proposed system of models that reflect the process of conceptual modeling in the design of the environment is different in that it is based on the mechanism of mutual regulation of conflicting pairs of components “Purpose” – “Area” (“Architectural block”) and “Use” – “Content” (“Designer block”) of conceptual modeling in the design of the environment unfolding as a competition for the resource “problem statement”, which allows you to identify and describe the results of the components (Spatial model, Target model, Content model, User model) and the results of the blocks (Architectural model and Designer model), as well as the nature of the interaction of these components of opposites, depending on the type of feedback cross-link. When connecting additional components, it is possible to control this process in order to obtain the resulting Environment Model.
- Based on the obtained scientific results, a methodology for conceptual modeling in the design of the environment has been developed, which includes four stages [1) the study of interaction components, 2) the study of the interaction of components as a self-developing system, 3) the study of the influence of the environmental problem on the components and managing the interaction between the components, 4) conflict management between blocks of interaction components], which makes it possible to obtain at the initial stage of design the conceptual models of the design object, the most significant for the effective implementation of the project and its quality: Descriptive model, Predictive model, Architectural model, Design model, Environmental model.

Publications. Based on the results of the research, 21 papers were published, including 7 articles in scientific journals recommended by the expert council of the Higher Attestation Commission of the Russian Federation with a total volume of 6.15 pp. (author's contribution – 6.15 pp):

1. Tolstova, A. A. Consumer qualities of the environment from the point of view of design: information model / A. A. Tolstova // Design. Materials. Technology. - 2021. - No. 1 (61). - P. 43-49.

2. Tolstova, A. A. Environment as an object of design: definition of the concept by the method of two-level triadic decoding [Electronic resource] / A. A. Tolstova // Architecton: news of universities. - 2021. - No. 2 (74). – Access mode: http://archvuz.ru/2021_2/16/

3. Tolstova, A. A. The mechanism of functioning of artistic design in the design of the environment: intercomponent relations of contradiction / A. A. Tolstova // Art education and science. - 2021. - No. 4 (29). - P. 57-66.

4. Tolstova, A. A. Environment as an object of design: a mechanism for regulating intra-system contradictions / A. A. Tolstova // Academic Bulletin UralNIIproekt RAASN. - 2022. - No. 1 (52). - P. 90-94.

5. Tolstova, A. A. Conceptual modeling in environment design: content and management model / A. A. Tolstova // Art education and science. - 2022. - No. 2 (31). - P. 57-69.

6. Tolstova, A. A. Methodology of conceptual modeling in the design of the environment as a field of design / A. A. Tolstova // Architecton: Izvestiya vuzov. - 2022. - No. 3 (79). – Access mode: http://archvuz.ru/2022_3/15/

7. Tolstova, A. A. Conceptual modeling in environment design: essential characteristics and expert potential / A. A. Tolstova // Academic Bulletin UralNIIproekt RAASN. - 2023. - No. 1(56). - P. 99-103.

The structure of research work.

The dissertation research consists of an introduction, three chapters, a conclusion, a bibliography and an appendix. The materials of the work are presented on 204 pages. The list of sources used includes 192 names.

Appendix 1 on page 32 contains illustrative material on the research topic.

Appendix 2 on 7 pages contains annotations of the work program of the academic discipline “Conceptual modeling of environmental objects” in the direction of training 54.04.01 “Design” and the draft work program of the discipline “Conceptual modeling in environment design: application methodology (for higher education and additional professional education)”.

CHAPTER 1. THEORETICAL ASPECTS OF CONCEPTUAL MODELING IN THE DESIGN OF ENVIRONMENT AS A FIELD OF COMMUNICATION

The essential features of the environment as a self-developing system, the dynamics of changes in human needs and the inconsistency of methodological approaches in the design of the environment necessitate the search for a tool to resolve the existing contradictions. In design, in general, and in environmental design, in particular, conceptual modeling has a high productive potential in this aspect. A serious obstacle, however, is the gap between the established practice of modeling in environmental design and the theoretical foundations of general scientific modeling. Analysis of methodological approaches to conceptual modeling in environment design and determination of its essential characteristics as a system activity will allow to determine the boundaries of integration of modeling methods into environment design and their typology. This will provide a deeper insight into the essence of conceptual modeling, which, in turn, will more accurately define the role of conceptual modeling in environmental design, its principles and main directions.

1.1. Environment as an object of design activity and user needs that initiate its changes

All types of project activities exist in the paradigm of the environmental approach, which is based on the position that the properties of an object are generated by the properties of its environment, and the structural unit of environmental design is a behavioral situation that is inseparable from the material structures that provide it. Because of this, there is a high need to study the environment as an object of design and the needs of the user initiating its changes, the generation of which is continuous. A serious obstacle, however, is the inconsistency of the conceptual apparatus of the subject area, as well as the variety of options for typologies of human needs. If we assume that on the basis of a review and analysis of the definitions of the category "environment" in the scientific literature in project activities and the concepts formed on its basis, it is

possible to identify the basic characteristics of the desired object; and on the basis of a comparative analysis of scientific classifications of needs, to form a list of them that can be satisfied with the tools of project activities, this will more accurately determine the design object and the factors of influence initiating its changes.

At the initial stage, it is necessary to conduct a brief analysis of the information field of the specialty in order to clarify the main characteristics of the environment identified by the scientific community over the past 40 years.

The task of selecting sources for reviewing the development of the problem in the scientific literature is to generalize the definitions of the category “environment” and to identify the variety of definitions of the concepts that have arisen on its basis, as well as the range of their interpretations.

The criteria for selecting sources included in the review were: the author's contribution to the theory of environmental design and design, a look at the environment from the point of view of its potential design, as well as the angle of professional interest in the object of study. The criteria for the analysis of the selected sources were: the ability to consider the definition as a model for the further formation of a methodology for conceptual modeling in the design of the environment; interdisciplinary approach; qualities indicated within the concept under study; highlighting the dominant quality present in the environment.

The general scientific definition of the category “Habitat and activities of mankind” is the natural world surrounding a person and the material world created by him[4]. The origins of the environmental approach in architecture and design, its philosophical, theoretical and methodological base were: O.I. Genisaretsky, A.E. Gutnov, A.P. Zinchenko, M.A. Konik, V.A. Nikitin, M.V. Posokhin, A.G. Rappaport, M.R. Savchenko and others. In their works, there is a comprehension and evaluation of different ideas about the environment and the environmental approach. The environment in them is presented as a self-developing, complexly organized and not fully comprehended socio-cultural phenomenon.

[4] Big Encyclopedic Dictionary [electronic resource]. 2000. URL: https://rus-big-enc-dict.slovaronline.com/47494-ENVIRONMENT%20WEDNESDAY (Accessed: 01/22/2021).

Further development of the environmental approach went in several directions at once, through building the interaction between architecture and design on a scientific basis[5]. Studies of socio-cultural functions and qualities of the urban environment in their works were continued by: M.G. Barkhin, A.V. Bokov, A.A. Vysokovsky, V.L. Glazychev, A.E. Gutnov, A.V. Ikonnikov, G.Z. Kaganov, L.B. Kogan, L.P. Kholodova and others. The main quality of the environment in the interpretation of this direction is the human orientation of all environmental components.

Another, significant for this study, is the direction that is being actively developed at the Moscow Architectural Institute at the Department of Design of the Architectural Environment. Among the representatives of this trend, in which the environment is considered as a set of subject, spatial and process factors, combined into a set according to the laws of artistic unity, one can list such personalities as: E.V. Ass, E.P. Grigoriev, A.V. Efimov, S.M. Mikhailov, G.B. Minervin, V.T. Shimko and others.

Important, in the context of this work, is the cultural approach to the consideration of the category "environment", in which it is interpreted much more widely than is traditionally accepted in the design arts. This group of authors includes: N.I. Barsukova, S.D. Bortnikov, T.Yu. Bystrova, Yu.A. Kovalev, K.A. Kondratieva, S.M. Mikhailov, I.E. Nikitina, T.V. Poydin, V.F. Sidorenko and others. Keeping the general trend of anthropocentric interpretation, the human needs themselves are considered by these researchers from the position of D.S. Likhachev highlighting in the environment the importance of the importance of culture for both the spiritual, moral life of a person and his sociality[6].

Environmental issues that consider a person as a biosocial being and emphasize the natural and natural-anthropogenic components of the environment is another significant area, whose researchers include: A.G. Bolshakov, V.I. Iovlev, A.V. Kinsht, E.M. Mikulin, V.A. Nefyodov and others.

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[5] Kholodova L.P. Architecture and design of the architectural environment [Electronic resource] // Architecton: university news. 2017. No. 4 (60). URL: http://archvuz.ru/2017_4/11 (date of access: 02.02.2021).

[6] Likhachev D.S. The past - the future: Art. and essays. L.: Nauka, 1985. 50 p.

The social significance of the environment in its variability is the object of study by N.F. Metlenkov, who develops the theory of socio-spatial development as a direction that brings the environmental approach to a new level[7]. The dynamics of environmental knowledge itself is consistently dealt with by K.V. Kiyanenko, according to whom, the influence of the logic of the development of socio-cultural life, in itself, gives rise to a variety of areas of research and interpretations of the definition of the category "environment" and this process is not fully completed[8].

The generalization and systematization of scientific conclusions consisted in the need to first present the origins of the environment approach and demonstrate the formation of the definition of the category "environment", and then identify the current trends in the modern view of this issue, when a lot of clarifying concepts appeared within the category "environment", for which new definitions are constructed. For further evaluation of the selected sources, a table has been compiled, which includes the most characteristic for different directions and significance for the scientific field definitions of the category "environment" (Table 1.1.1) and the concepts that arose on its basis (Table 1.1.2).

Table 1.1.1. Theoretical origins of the environment approach (basic categories)

Category / Concept	**Definition**	**Author**
environment as an object of project activity	... the environment acts as a natural, self-developing formation, the design artification of which leads to the secondary reification of the problematized and project-conceptualized content.	O.I. Genisaret[9]
environmental paradigm	... the environment as a historically defined stage in the deployment of architecture, which has its own socio-cultural determinism and specific forms of	V.A. Nikitin[10]

[7] Metlenkov N. F. Socio-spatial creativity of the architect // Architecture and construction of Russia. 2016. No. 3 (219). pp. 2-3.
[8] Kiyanenko KV The circle of environmental knowledge and its segmentation in the theory of architecture [Electronic resource // Academia. Architecture and construction. 2019. No. 3. URL: https://cyberleninka.ru/article/n/krug-sredovogo-znaniya-i-ego-segmentatsiya-v-teorii-arhitektury (date of access: 01/21/2021).
[9] Genisaretsky O. I. Methodological and humanitarian-artistic problems of design: author. dis. ... Doctor of Arts: 17.00.06. M., 1990. P. 13.
[10] Nikitin V. A. Environmental intentions and the movement of architectural paradigms // Urban environment: problems of existence. M. : VNIITAG, 1990. P. 143.

	manifestation in certain historical periods.	
about the nature of the essence of the environment	… the environment is built on the basis of the category of mutual penetration, diffusion of the organism and its environment, striving to overcome their alienation and distance...	A.G. Rappaport[11]

Table 1.1.2. Directions developing the environment approach (clarifying concepts)

Category / Concept	**Definition**	**Author**
shaping the urban environment	Wednesday – the phenomenon is not only and, most importantly, not so much physical as social.<…> She is the bearer of both material and spiritual culture.	M.G. Barkhin[12]
environment (urban environment)	It is the correlation, conjugation, interconnectedness of the subject-spatial environment to the interpersonal interactions that take place in it that we will call the environment ...	V.L. Glazychev[13]
urban environment	A concept that allows us to consider the urban environment not as a geometric abstraction, but in its humanization, habitation, in relationship with the forms of human activity and behavior...	A.V. Ikonnikov[14]
environment in design work	... an emotionally and sensually assimilated and acceptable part of space for being, the unity of the material and spatial conditions for the implementation of any process, phenomenon, event and features of this phenomenon itself ...	G.B. Minervin[15]
architectural environment	… a part of our environment, which is formed by architecturally (artistically) substantiated volumetric-spatial structures, equipment and landscaping systems, united into integrity according to the laws of artistic unity…	V.T. Shimko[16]
specificity of the environment as a design object	… the environment is a direct, immediate creation of the optimal life reality that exists not “above” or “near”, but together with its user.	

[11] Rappaport A. G. Environment and architecture // Urban environment: problems of existence. M. : VNIITAG, 1990. P. 167.
[12] Barkhin M. G. Architecture and man. M. : Nauka, 1979. P. 81.
[13] Glazychev VL Socio-ecological interpretation of the urban environment. M.: Nauka, 1984. S. 96.
[14] Ikonnikov A. V. Urban environment and design in its structure // Urban environment. Design. Architecture. M. : VNIITAG, 1990. P. 3.
[15] Minervin G. B. Design: basic provisions, types of design, features of design design, masters and theorists. M. : Architecture-S, 2004. P. 152.
[16] Shimko V. T. Architectural and design design. Fundamentals of the theory (environmental approach): M .: Architecture-S, 2009. P. 22.

environment in design theories	Wednesday – it is a single system that ensures its purpose and the functioning of a person in it during a given cycle.	N.I. Barsukova[17]
	…a part of the space that has been mastered, understandable and acceptable for living…	N.I. Barsukova[18]
environment in the context of sustainable development	The environment approach is possible with a broad understanding of the environment, covering the entire set of interrelated natural, natural-anthropogenic, anthropogenic and socio-economic objects and factors that ensure human life in general.	A.V. Kinsht[19]

General trend identified in the analyzed works, from the point of view of the interpretation of the object of study is such that the definition of the category "environment" by all authors is formulated through a synthesis of the qualities of the anthropocentricity of the environment, variability, integrality of all components and the dynamics of its self-development. Accordingly, it is proposed on the basis of the fundamental definition of the category "environment" (as an object of project activity) proposed by O.I. Genisaretsky, in which the environment is considered as a self-developing system and the place from where projects are initiated and where they are carried out, the dominant quality of the studied phenomenon is considered to be systematic. Also, the diversity in the definition of clarifying concepts within the category of "environment" is established. The considered definitions demonstrate the interdisciplinarity of the approach and allow us to highlight the main qualities of the concept under study: spatiality, subject content, humanization, process, interconnectedness, emotionality, sensuality, integrity, aesthetic expressiveness, mastery, natural and anthropogenic essence, sociality. However, none of the considered definitions

[17] Barsukova N. I. Design of the environment in the design culture of postmodernism of the late XX - early XXI centuries: author. dis. ... Doctor of Art History: 17.00.06. - M., 2008. P. 29.

[18] Barsukova N. I. Axiological foundations of the theory and methodology of environmental design [Electronic resource] // Vestnik OSU. 2011. No. 9 (128). P. 25. URL: https://cyberleninka.ru/article/n/aksiologicheskie-osnovy-teorii-i-metodologii-sredovogo-dizayna (date of access: 22.01.2021).

[19] Kinsht A. V. Environmental approach and the environment in architecture and urban planning: an ecological view [Electronic resource] // Vestnik TGASU. 2017. No. 3 (62). P. 46. URL: https://cyberleninka.ru/article/n/sredovoy-podhod-i-okruzhayuschaya-sreda-v-arhitekture-i-gradostroitelstve-ekologicheskiy-vzglyad (date of access: 01/27/2021).

can be used as a model for studying the concept of “environment as an object of conceptual modeling” due to their ambiguity and interdisciplinarity.

In order to conduct further research on the theoretical aspects of environment design as an area of communication between user - object - designer, it is necessary to consider options for systematizing human needs that initiate both the design activity itself to change the environment and form the image of its result.

From the point of view of environment design, of particular interest are the classifications of human needs carried out in the framework of research in psychology, sociology and marketing, including the works of such authors as D.G. Bagdasarova, E.V. Garin, P.M. Ershov, A. Maslow, M.A. Max-Neef and others. Practical approaches to the formation of a habitat based on anthropocentrism can be found in the works of individual architects and designers, for example, V.I. Iovleva, I.S. Karimova, K.V. Kiyanenko, G.A. Lanshchikova, G.I. Lola, S.M. Mikhailov, V. Papanek, V.F. Sidorenko, when, based on the analysis of needs, options for the formation of an adequate quality of the habitat are proposed. Separately, the social significance of the environment in its variability is the object of study by N.F. Metlenkov.

Selection criteria the sources included in the review were: the possibility of identifying different points of view on the systematization of human needs, as well as their persuasiveness and originality of the classifications themselves. The criteria for the analysis of selected sources, from the point of view of the ongoing study, were: the principles of classification and the potential for its use in terms of conceptual modeling in environmental design.

For the environmental approach, in which the concept of customer needs was originally interpreted by A.P. Zinchenko as a “quasi-subject of the cooperative activity of an architect and a consumer”, special attention is paid to the analysis of the target audience[20]. So, K.V. Kiyanenko, when studying the development of the environment paradigm, notes that it is based on the principle that “the need is not predetermined and cannot be identified using traditional sociological methods and techniques.<…> it is

[20] Zinchenko A.P. Need as a basis for the process of designing an object-spatial environment // Man and the environment: psychological problems: Tez. conf. in Lohusalu, Jan. 1981 Tallinn: EOOP USSR. 1981, p. 61.

formed and realized by the client during the dialogue with the architect"[21]. However, it should be noted that the very concept of comfort is inextricably linked with the technological, physiological and psychological needs of a person, his biosocial nature, the study of which will allow creating socially demanded and psychologically comfortable spaces.

From the point of view of S.M. Mikhailov, today the principle of "ergocentrism" continues to develop in architectural activity, coming from a person, taking into account his psycho-physiological, socio-cultural and artistic and aesthetic features and requests, which receive equal importance with functional-utilitarian, physiological and ergonomic components[22]. In turn, the emergence of new needs is a continuous process and, from this point of view, the interactivity of the environment becomes significant – its ability to dialogue with a person[23].

Design, for its part, has always been focused on the person. Thus, in the work of V. Papanek, which has become a kind of professional manifesto, human needs that are significant from the point of view of design are divided into three semantic groups: survival, identity and goal setting[24]. At the same time, the author warns against substitution in the project analysis of true needs (economic, psychological, spiritual, social, technological, intellectual) with desires implanted by custom and fashion. An identity is interpreted as the need to realize the need for security, thereby asserting its fundamental importance for a person, through belonging to a group (territorial, social, ethnographic, professional, etc.).

Dynamics of spatio-temporal human needs based on the analysis of daily, seasonal and life cycles is also in the field of professional attention. V.I. Iovlev puts forward a hypothesis that needs change over time - in accordance with social, personal, age and other factors. At the same time, the needs alternate in accordance with the changing needs

[21] Kiyanenko K. V. Paradigms of social knowledge and justification in architecture. Sotsiologicheskie issledovaniya. 2018. No. 9 (413). P. 34.
[22] Mikhailov S. M. The design of a modern city is a complex organization of the subject-spatial environment (theoretical and methodological concept): author. dis. ... Doctor of Art History: 17.00.06. M., 2011. 57 p.
[23] Mikhailov S. M., Mikhailova A. S. Ergocentric model of shaping as a doctrine of post-industrial architecture and design // Architecture and Construction of Russia. 2018. No. 1 (225). pp. 66-69.
[24] Papanek W. Design for the real world; trans. from english. G. Severskaya. 3rd ed. M. : Publisher D. Aronov, 2010. 416 p.

of the individual and can be systematized on the basis of a certain type of functioning of the environmental space. These types of environmental space are named by the author as "topoi", the harmonious alternation of which causes “topological needs”. Thus, the researcher substantiates the personalized regularity of the alternation of types of the architectural environment: personal, recreational, industrial, public, and this makes it possible to assert that “the creation of new spatio-temporal formations (topoi) directly or indirectly stimulates the development of healthy, environmentally positive human needs”, that is generates new needs[25].

On the basis of another theoretical platform, relying on the neo pragmatism research tradition, G.N. Lola suggests that product design is always more than a “commodity” and the user’s motivation lies in “the desire to be involved in a certain state and in a certain environment”, and product design recipients can be divided into two conditional categories “simple” and “complex”[26]. From the point of view of a “simple” consumer, when being involved in a certain environment, the following needs are typologically defined: in similarity (resemblance to members of the group), in belonging (the desire to enter a new environment), in functionality (the optimal way of life), stability (preservation of the usual way of life). From the standpoint of a “complex” consumer: the need for novelty (acquisition of new experience), for the assertion of one's own image (individuality), for self-identification, for the intellectual experience of the form. According to the author of this typology, such a systematization of needs, taking into account their synthesis and mixing in real life, will allow us to get away from a high degree of abstraction in the analysis of the target audience towards the personification and targeting of the project proposal in the process of creating a new quality of being.

Indirect confirmation of the above point of view can be found in the review of V.F. Sidorenko to the study of the concepts of modern design, conducted by V.R. Aronov: “modern theorists and designers represent a person as a point of intersection of

[25] Iovlev V. I. Eco Cyclicity of architectural and topological human needs // Actual problems of architecture, urban planning and design: theory, practice, education: Proceedings of the International Scientific Conference, Volgograd, September 23–29, 2018; comp. and resp. ed. N. V. Ivanova. Volgograd: Volgograd State Technical University, 2018. P.43.

[26] Lola G. N. Design code: methodology of semiotic discursive modeling. SPb. : Beresta Publishing House, 2016. P. 79.

information flows, impressions, sensations. These flows challenge the identity of a person who finds himself alone in asserting his own self-identity, uniqueness, integrity.[27]. The design project becomes a space of communication, which, due to its proportionality to a person, targeting and aesthetic expressiveness, complements and humanizes the surrounding anthropogenic environment. Increasing the level of abstraction, according to I.S. Karimova, we can say that in a social society, design takes on the role of "a catalyst for the interaction of its material and spiritual foundations"[28]. In this regard, the philosophical justification of the design methodology proposed by G.A. Lanshchikova and V.V. Kovtun, which allows us to single out "...two functional aspects of reflexive-structural processes in design design: moral and value and technological-target" equivalent for understanding the design methodology, which is justified by fundamental differences in determining the sources of human needs[29].

To complete the review of the architectural and design view on the issue of consumer qualities of the environment, one can excerpt from the current methodology of environmental creativity, authored by a team of researchers from the Department of Design of the Architectural Environment of the Moscow Architectural Institute, who see the development of the specialty in the emergence of neurodesign, a complex meta-subject scientific and practical discipline, which consists in "... the study of distant milestones in the development of the human personality, transferring humanity from a number of "consumer" phenomena to "creative", consciously determining the movement of natural entities"[30].

The last statement makes it legitimate to conduct an additional analysis of needs, from the point of view of the human sciences. From a psychological standpoint, the most famous is the theory of the hierarchy of needs by A. Maslow. Made up of steps: physiological needs, need for security, need for belonging, need for respect, need for

[27] Sidorenko V. F. Aronov V. R. Concepts of modern design. 1990-2010. Moscow: Artproekt, 2011. 224 p // Art History. 2011. No. 3-4. P. 595.
[28] Karimova I. S. Objective and subjective in the design of the environment: monograph. Blagoveshchensk: Publishing house of AmSU, 2012. P. 111.
[29] Kovtun V.V., Lanshchikova G.A. Philosophical reflection of design-design methodology // Omsk Scientific Bulletin. 2014. No. 2 (126). P. 100.
[30] Shimko V. T. and others. Architectural and design. The specifics of environmental creativity (prerequisites, methods, technologies): a textbook for universities. M. : Architecture-S, 2016. P. 231.

knowledge, aesthetic needs, need for self-actualization[31]. However, the hierarchical structure itself is today recognized as insufficiently convincingly proven, from the point of view of the motivation for the transition from one stage to another, and, for this study, only the list of needs is of interest, and not the pattern of their occurrence in a person.

Another prominent researcher in this area is Manfred Max-Nief, whose interpretation of basic human needs is divided into: food, protection, affection, understanding, participation, idleness, creativity, personality, freedom[32]. However, unlike A. Maslow, these needs, according to the author, are not strictly hierarchically organized and represent an open matrix, the composition of which depends on the level of development of society, culture, history and other factors. Both proposed interpretations, which can rather be attributed to the field of philosophy, cannot be directly used to develop a methodology in environmental design, although they provide a deep understanding of the motivation in the behavior of the target audience.

From the point of view of the social economy, which is also closely related to the design of the environment, it is interesting to pay attention to the hierarchy of needs of E.V. Garin, which is also a pyramid of needs: innate, acquired (imitative complex), in the realization of needs at the expense of other people, in the realization of the needs of other people, in the generation of needs. At the same time, “the motivation for the transition to the needs of a hierarchically higher level is the dissatisfaction of hierarchically lower needs”, in contrast to the interpretation of A. Maslow, in which this happens the other way around – only when the need of a lower order is fully realized[33]. In this system, it is precisely the structured motivation for the appearance of needs that is important for the design of the environment in terms of creating conditions for interpersonal interaction within society.

To clarify the types of existing classifications of needs, you can use the study of D.G. Bagdasarova, who structured the types of scientific approaches, among which she

[31] Maslow A. Psychology of being. M. : Academic project, 2022. 274 p.
[32] Max-Neef M.A. Human Scale Development. The Apex Press, 1991. 114 p.
[33] Garin E.V. Hierarchy of human needs [Electronic resource] // Vectors of well-being: economics and society. 2014. No. 2 (12). P. 177. URL: https://cyberleninka.ru/article/n/ierarhiya-potrebnostey-cheloveka (Accessed 20.02.2021).

singles out: psychological, economic, objective, subjective, personal, philosophical, sociological. For us, the latter is of interest, when "needs are determined by areas of activity (needs for communication, work, rest, education, etc.) and functional roles"[34]. From the point of view of functional roles, these are dominant needs, for the satisfaction of which there are enough essentials, and secondary (the need for luxury goods). Also, the author refers to the functional roles - stable needs and situational, i.e. formed under a certain scenario for the use of space. This classification is close to the design of the environment, however, it considers a person only as a social being, which clearly impoverishes the portrait of the participants in any environment process, and therefore can be used mainly to clarify the functional solution.

The general trend revealed in the analyzed works, in terms of the interpretation of the object of study, is such that, despite the great scientific interest in the issue under study, there is no single classification of human needs due to their diversity, and scientific proposals are the result of applying a certain professional approach to achieving a higher goal. Thus, the analysis revealed three enlarged classification options. In the first one, represented by architectural science, needs seem to develop the Vitruvian triad "Firmitas – Utilitas – Venustas", interpreting it in relation to a person – functionality, manufacturability, aesthetic expressiveness. In the second, socio-psychological, human needs are divided into biological and social, with more or less detailed detail within each group. The third option has a philosophical justification and, as separate groups, highlights the material and spiritual needs. At the same time, the process of generating needs is continuous and can only be partially predicted.

Thus, the presented review of the scientific literature allows us to draw the following conclusions:

- one should perceive the issue of forming a categorical-conceptual apparatus of environment design as an open system;

[34] Bagdasarova D. G. Theoretical analysis of scientific approaches to the classification of the need sphere of personality // Strategy for sustainable development in anti-crisis management of economic systems: Proceedings of the V International Scientific and Practical Conference. 2019. P. 371.

- the environment as an object of design can be interpreted as having systemic characteristics of the environment and human activities in the aggregate of its spatial, process and subject characteristics that meet both the practical and aesthetic needs of society;
- an enlarged interpretation of the needs of V. Papanek, in which survival, identity and goal-setting are identified as basic needs, takes into account the main types of human needs that can be satisfied by means of environmental design, and also combines the most significant classes of needs identified by other researchers;
- demand generation is a continuous process that can be partly predicted.

Summing up, it is proposed to make an additional generalization from the position of environment design as an area of communication between the designer, the object and the user. If we consider project activity in the design of the environment as determined by the goals of social development and sociocultural factors, then the difficulty that was discovered in the course of the analysis of the categorical and conceptual apparatus of the specialty is that it is impossible to fully manage the environment, which is a self-developing system, in the aggregate of its spatial, process and subject characteristics that meet both the practical and aesthetic needs of society. On the other hand, the very request of the target audience aimed at meeting the needs for survival, identity and goal setting is also in dynamics, there is a constant generation of needs and this process is continuous.

Thus, indirect confirmation of the relevance of researching the resources of the third participant in the communication process, the designer, has been obtained, in terms of conceptual modeling methods in project activities that can be used to resolve the identified contradictions of the object: between external factors of influence and self-development of the environment as a system, as well as the user: between specification of the request of the target audience and the variability of human needs (Fig. 1.1.1).

Consequently, the prospects for further research lie both in the plane of researching methods for organizing the process of design activity, and in identifying the place and role of conceptual modeling in it.

1.2. Methods of organizing the process of design activities in the design of the environment and the place of conceptual modeling in it

Modern design activities include architectural, urban planning, design and other types of activities that differ not so much in the goals of forming a functionally ordered and aesthetically expressive environment, taking into account sociocultural and professional factors of influence, but in ways of moving towards these goals, that is, methods and means specific project activity. Conceptual modeling, however, is a significant component of this process. However, in terms of environment design, there is no clear definition of methods for organizing modeling and an algorithm for their application. If we assume that a comparative analysis of theoretical studies in the field of organizing project activities, taking into account the identification of the place of conceptual modeling in it, will allow us to determine the boundaries of this type of activity in the design of the environment, as well as potentially acceptable methodological tools, then this will provide a deeper insight into the specific features of conceptual modeling in environment design.

In this context, it seems appropriate to analyze the project activity as a process in order to identify the place of modeling in it and its relationship with other stages.

The issues of the general theory and methodology of design activities in architecture and design were dealt with by such domestic researchers as: B.G. Barkhin, A.V. Bokov, T.Yu. Bystrova, V.G. Vlasov, O.I. Genisaretsky, H.S. Gafarov, A.V. Efimov, E.V. Zherdev, Yu.I. Karmazin, E.V. Kokorina, S.V. Kurasov, A.N. Lavrentiev, N.F. Metlenkov, G.B. Minervin, Yu.V. Nazarov, N.N. Nechaev, V.F. Sidorenko, V.T. Shimko, D.N. Shchelkunov and others; The works of foreign researchers also deserve attention: J. Broadbent, T. Goldby-Smith, B. D. Council, N. Cross, V. Margolin, G. Simon, A. Hatchwell, and others.

To solve the problem, for starters, it is proposed to consider an interdisciplinary scheme of the process of project activities to create a product – the “Double Diamond” diagram. The starting point in it – the task, is the point of expanding the context and divergent search for problems, which is then replaced by the process of convergence –

the choice of a solution. In this diagram, the process of creating a product or solution is reduced to four main stages: discovery or research (divergence), focus (convergence), development (divergence), implementation (convergence) (Fig. 1.2.1)[35]. If we compare the "Double Diamond" diagram and the structure of design thinking proposed by G. Simon[36], which also has an interdisciplinary character, it should be noted that the first two stages (empathy and focus), as well as the last two (prototyping and testing) in both schemes almost completely coincide, however, the central node of the "Double Diamond" diagram receives additional decoding, and Namely, there are stages of generation and selection of ideas[37]. Thus, we get a scheme that already consists of three blocks of divergence (analysis) and convergence (synthesis), aimed at different aspects of project activities with the participation of the target audience. This allows the design process to create a product to be considered in an interdisciplinary aspect, as based on the alternation of analysis and synthesis operations, directed in the first phase to an existing object to be transformed, in the second phase – directly to the project and in the third phase - to adapt the design idea to reality (Fig. 1.2.2). At the same time, it is the first two stages that can be interpreted, in general terms, as conceptual modeling.

In order to compare the resulting scheme for organizing activities to create a product from the standpoint of design thinking with a systematic approach, we can compare it with the current, at one time, domestic design methodology - design programming, which treats an object as an open system. In this case, the main task is not to study the needs of the target audience, but to understand the system of relationships that affect their formation, which allows us to explore the essential foundations of design as a project activity, its root causes. The design programming methodology included three stages: goal setting and problematization, conceptualization and forecasting, scenery and planning[38]. At the same time, it was the alignment of strategy and tactics when working

[35] British design council. The "Double Diamond" Design Process Model. [Electronic resource] URL: http://www.designcouncil.org.uk/about-design/how-designers-work/the-design-process (accessed 09/23/2022).
[36] Hatchuel A. et al. Towards Design Theory and expandable rationality: The unfinished program of Herbert Simon // Journal of management and governance. 2001. T. 5. № 3/4. P. 260-273.
[37] Lewrick M., Link P., Leifer L. The design thinking playbook: Mindful digital transformation of teams, products, services, businesses and ecosystems. John Wiley & Sons, 2018. 352 p.
[38] Kuzmichev L. A., Sidorenko V. F., Shchelkunov D. N. Methods of artistic design. Design program. M. : VNIITE, 1987. 171 p.

with an object in this methodology that was considered as the basis for organizing design. Despite the time that has passed since its appearance, most researchers note that "the theoretical and methodological foundations of design programming laid down by domestic specialists are still relevant and can be effectively used"[39]. It is important to note that the design programming algorithm, at the same time, practically coincides with the design thinking algorithm, being also divided into three stages of alternating analytical operations of analysis and synthesis. For example, the stage of focusing directly corresponds to the stage of problematization (Fig. 1.2.3).

If we continue the analysis of the structure of the design process directly in the design of the architectural environment, then, from the position of V.T. Shimko, here you can also see the following stages: goal setting, problematization, thematization, metaphorization, formation and harmonization, which almost completely coincides with the structure of design programming, design thinking and a detailed scheme of product creation activities (Fig. 1.2.4). At the same time, the first four stages (two stages of alternating analysis and synthesis operations) are focused on the development of a "design idea" – a way to resolve emerging contradictions in the environment as a design object, and the last two – directly on the creation of a draft design. The very essence of identifying a design idea, according to V.T. Shimko, consists in defining a technological or fundamental organization, that is, a design concept, a future project, as well as an artistic idea consisting in the search for an environmental image[40]. Therefore, for the convenience of further analysis, it is possible to single out the first two stages in the design process in the design of the architectural environment by analogy with the product creation diagram and, thus, determine the boundaries of the inclusion of conceptual modeling in the initial stage of design activity and the mechanism for its implementation based on the operations of analysis and synthesis .

[39] Barysheva V. E., Druzhinina O. B. VNIITE design programs of the 1960s-1980s as the origins of modern design thinking methodology // Decorative Art and Object-Spatial Environment. Vestnik MGHPA / Mosk. state artistic-industrial acad. them. S.G. Stroganov. 2019. No. 2-1. P. 283.

[40] Shimko V. T. and others. Architectural and design. The specifics of environmental creativity (prerequisites, methods, technologies): a textbook for universities. M. : Architecture-S, 2016. 240 p.

However, from the point of view of the scientific community, there is an insufficient degree of research into the very stage of conceptual modeling, despite its importance. So, the need to increase professional attention in this direction is emphasized by N.F. Metlenkov, interpreting conceptual modeling as "a research and creative process of identifying relevant concepts of self-development of the socio-spatial content of situations"[41]. N.N. Nechaev notes that "project modeling must be understood as the leading moment and the "activity" basis for the development of reality itself", as a means of cognitive activity. Accordingly, the "creative" function of modeling itself should be considered as a process of transformation and generation of a new reality, and conceptual "cognitive" modeling, thus, "acts as a derivative and special case of creative modeling, including design modeling" [42].

Thus, having determined the place of conceptual modeling in project activities, it is necessary to investigate what tools the designer has for this. It can be argued that the interaction of the scientific component with the creative and engineering component is one of the basic principles of project activity. This issue is constantly in the focus of attention of the expert community, including in terms of the study of design modeling methods. Priority, based on various methodological platforms, is periodically given to one component of the activity or their synthesis.

Without touching on the analysis of the genesis of this scientific problem, it is advisable to dwell on the works of some researchers that are significant for the formation of the design of the environment. B.G. Barkhin, substantiating the potential for the interaction of different approaches in determining the place of architectural design methodology in the education system, noted that science and art "act as mobile, complementary sides of the creative process", connecting the scientist's desire for a system and the artist for harmony[43].

Yu.I. Karmazin, already at the present stage of development of scientific research on the content of architectural creativity, complements the principle of interaction

[41] Metlenkov N. F. Paradigmal dynamics of the architectural method. M.: ASROS, 2018. P. 298.
[42] Nechaev N. N. Modeling as creativity: methodological and psychological foundations for the formation of professional design activities // Bulletin of the Moscow State Linguistic University. 2009. No. 563. P. 24.
[43] Barkhin B. G. Methods of architectural design. M. : Stroyizdat, 1993. P. 39.

between different scientific approaches, considering the built-in methodology in architecture as “not only a synthesis of methods: a philosophical and ideological method, an artist’s method, an engineer’s method, a scientist’s method, but also others methods ... determined by the problems of reality”[44].

The opposition between scientific methods and the creative process is analyzed by V.F. Sidorenko. Exploring the interaction of artistry and design in design creativity, he singles out as the main way of knowing the world – design, understood as a method of socio-cultural reproduction in the conditions of scientific and technological progress, which is at the same time an “activity mode of artistry”, that is, a way of artistic thinking and a creative ability to transform the world[45]. Thus, in his works, a systematic methodology in the field of organizing activities to achieve known goals is opposed to the creative act of goal setting. Accordingly, based on the phenomenological method of analysis, without the help of theoretical constructions, the design method is determined by V.F. Sidorenko as a problematization of a new image of the world, a new concept. E.V. Kokorina, on the contrary, suggests using the modeling method based on a systematic approach as a methodological basis for developing the potential of visual means and the creative abilities of designers[46].

Nigel Cross, in his work “Designerly Ways of Knowing”, distances himself from the statement about the fundamental importance of the analysis of the sources of the formation of an artistic image and proposes to accept the following paradigm: people, processes and products become the sources of knowledge in design studies[47]. The study of the essence and features of the relationship of these basic components is, in his opinion, the theoretical basis of the design of morphology.

Developing an interdisciplinary approach to studying the possibilities of convergence and interpenetration of methods of architectural and design design,

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[44] Karmazin Yu. I. Formation of philosophical and scientific-methodological foundations of the creative method of the architect in professional training (Concept): author. dis. ... Doctor of Architecture: 18.00.01. M., 2006. P. 24.

[45] Sidorenko V.F. Genesis of design culture and aesthetics of design creativity: author. dis. ... Doctor of Arts: 17.00.06. M., 1990. P. 9.

[46] Kokorina E. V. Theoretical foundations of design modeling // Bulletin of the Voronezh State University. Series: Problems of Higher Education. 2015. No. 2. P. 41-47.

[47] Cross N. Designerly Ways of Knowing / Nigel Cross. London : Springer Verlag, 2006. – 114 p.

V.G. Vlasov comes to the conclusion that the potential of the design methodology lies in the fact that, along with the creative component, it is mostly based on the methods of "forecasting and system modeling of the space-time environment"[48]. Thus, ensuring the integration of artistic and scientific approach.

Analyzing different types of cultural paradigms: "artistic" Romance and "engineering" Anglo-Saxon, which influence each other, as well as architecture and design, A.V. Bokov goes further in this matter, arguing that it is the interpenetration of different types of consciousness: artistic, engineering and scientific that is the source of the existence of modern design culture, which has found its expression in the design of the environment[49].

Recently, it is the scientific methodology of design that has repeatedly become the subject of research by domestic and foreign specialists. H.S. Gafarov, analyzing the third wave of strengthening the role of science in design, notes that today, under the influence of many external socio-technological factors and with the expansion of the design sphere itself, methodology is becoming a separate subdiscipline of research[50].

An analysis of the world experience in the development of design science suggests that its methodology has long been influenced by the general theory of systems by L. von Bertalanffy, in the context of which it is possible to universally and compactly describe any complex objects at the structural, functional and simulation levels. Until now, one of the scientific approaches to design, of which J. Broadbent is a prominent representative, remains analysis through the "prism of evolutionary systems". That is, methodological reflection continues to play the most important role in design, aimed at developing a new generation of design methods focused on working with complex dynamic systems, for example, society[51]. Confirmation of this can be found in the study of T. Golsby-Smith, who notes the high level of complexity and system integration of

[48] Vlasov V. G. Design architecture and the XXI century [Electronic resource] // Architecton: Izvestiya vuzov. 2013. No. 1 (41). URL: http://archvuz.ru/2013_1/0/ (date of access: 23.09.2022).
[49] Bokov A. V. Colleagues-rivals: architecture and design in Russia // Academia. Architecture and construction. 2018. No. 3. P. 5-12.
[50] Gafarov H. S. Disciplinary structure of modern Western design studies (DESIGN STUDIES): problems of stratification and taxonomy. // Actual problems of design and design education: materials of the II International pract. conference (Minsk, April 19–20, 2018). Minsk: Belarusian State University, 2018. P. 3-23.
[51] Broadbent J. A Future for Design Science? // Chaoyang Journal of Design. 2004. № 5. P. 27-42.

environmental design objects, such as spaces for living, working, playing and learning.[52]. The same theoretical platform was occupied by Victor Margolin, who noted the importance of interdisciplinary research based on the philosophy of technology, general systems theory and cultural studies[53].

N.F. Metlenkov, the author of the concept of socio-spatial developmental modeling, clarifies that often even the principles of the "system approach" are transferred to the environmental approach, which today is the dominant design paradigm[54]. This is due to the fact that systematization has not only an ordering property, but often takes on a creative role. The patterns revealed as a result of systematization indirectly lead the researcher to their violation, the emergence of extraordinary and paradoxical solutions. T.Yu. Bystrova based on the analysis of the development of the Russian school of design and the identification of its inherent systemic approach to the object, notes that "in the conditions of the "new normal", people are in dire need of a well-thought-out subject environment adapted to their changing needs, which can only be provided by system design", based based on high-quality evidence-based methods[55].

There is another point of view that design is an irregular network rather than a logically structured process, and should be the basis for networked problem solving and complex interdisciplinary collaboration[56]. R. Buchanan points out the danger of being trapped in one system theory or another if one ignores ideas that may come from consideration of other points of view[57]. In this scientific paradigm, N.S. Aganina proposes to consider the environment – anthropocentric approach, which treats the object as open

[52] Golsby-Smith T. Fourth Order Design: A Practical Perspective/ // Design Issues. Vol. 12. №1 (Spring, 1996). P. 5-25

[53] Margolin V. Design History or Design Studies: Subject Matter and Methods. // Design Issues. 1995. № 11 (1). P. 4-15.

[54] Metlenkov N.F. Environmental architecture // Architecture and construction of Russia. 2018. No. 4 (228). pp. 2-3.

[55] Bystrova T.Yu. System method in design: formation of the Russian version // Academic Bulletin UralNIIproekt RAASN. 2021. No. 2 (49). P. 50

[56] Dorst K. Frame innovation: Create new thinking by design // She Ji: The Journal of Design, Economics, and Innovation. 2015. № 1 (1). P. 22-33.

[57] Buchanan R. Systems Thinking and Design Thinking: The Search for Principles in the World We Are Making // She Ji: The Journal of Design, Economics, and Innovation. 2019. № 5 (2). P. 85-104.

non-systems, design activity as a conflict with the surrounding reality, and the artistic method as the basis for design[58].

From this position, the specificity of the design principle in the design of the environment, due to the environmental approach, is to use the problematic method of modeling the main conflicts and the artistic method of resolving them. So, the problematic method, as a form of setting and using problems in thinking, which allows obtaining productive and reasonable results, is paid attention to by such scientists as N.S. Aganina, V.E. Barysheva, K. Dorst, O.B. Druzhinina, L.M. Ptitsina, O.P. Tarasova, P. M. Khakuz, O.R. Khaliullina, A. Hatchwell, N.G. Yakunichev. This method can be characterized as "a universal act of finding, "birth" of a problem, an attitude to finding new problems in the form of questions that have not yet been voiced"[59]. The design task itself, in this case, is perceived as a problem, and its solution is achieved through the identification and resolution of contradictions between the intended purpose of the design object and the context in which it is located. B.G. Barkhin, in his work "Architectural Design Methodology", wrote that the problematic method proceeds from the task of designing the system "human – environment" – environment approach, "what reveals the humanistic content of architecture"[60]. And he recommended building the algorithm of the problematic method or problematization on the basis of the theory of K.R. Popper, in whose study, problem situations in science were proposed to be resolved through the cyclic application of the method of "assumptions and refutations"[61]. At the same time, the direction of the search is determined through "the perception of the task as a problem, i.e. collision of contradictions between the circumstances of the future life of the object and the operational characteristics of its structures"[62].

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[58] Aganina N. S. Methodology of Soviet design: "ideological gene" in systemic, complex and environmental approaches // Decorative arts and object-spatial environment: Vestnik MGHPA / Mosk. state artistic-industrial acad. them. S. G. Stroganov. 2014. No. 4. P. 16-32.

[59] Khakuz P. M., Gura A. Yu. On the content of the concept of "Problematization" [Electronic resource] // Society: philosophy, history, culture. 2016. No. 11. P. 25. URL: https://cyberleninka.ru/article/n/o-soderzhanii-ponyatiya-problematizatsiya (date of access: 04/10/2021).

[60] Barkhin B. G. Methods of architectural design. M. : Stroyizdat, 1993. P. 131.

[61] Popper K. The Logic of Scientific Discovery. Taylor & Francis, New York. 2005. 544 p.

[62] Shimko V. T. Architectural and design. Fundamentals of the theory (environmental approach): M. : Architecture-S, 2009. P. 159.

In addition to the problem method, participatory design methods are actively used in the environmental approach, which makes it possible to characterize it as a "weak design" strategy, when an active user becomes, in fact, a co-author of the designer. Accordingly, the creative space of architecture and design, determined by the environmental approach, as defined by O.I. Genisaretsky can be called figurative environments, which are characterized by "a plurality of living spaces, which distinguishes them from the only "Newtonian" space of classical culture; value fullness, non-emptiness; the correlation of different spaces and the associated possibility of their subjectivization (by different social subjects); connectedness, combining indistinguishability in the small and distinguishability in the large, due to which the figurative environments, while remaining continuous, continuous, still have a distinct discrete structure; a kind of integrity grasped simultaneously in the perception of any situational fragment of the environment"[63].

Thus, as a result of the analysis, the inconsistency of the modern modeling methodology in design was revealed, which, on the one hand, is based on the theory of systems, and on the other hand, tends to work with open non-systems and interdisciplinary interaction. Thus, the environmental approach, focused on the individual aspects of human life and the formation of the emotional state of the environment, is characterized by a combination of problematic and artistic methods, as well as combining the knowledge of professionals and users based on participatory methods. A systematic approach is aimed at revealing the integrity of an object and identifying the variety of types of connections in it. Today, when modeling in the design of the environment, a synthesis of methodologies takes place, which allows, on the one hand, to preserve the creative, creative component of the project activity, and, on the other hand, to identify the prerequisites for visible reasons that trigger the process of changing the space with the help of design and predict possible consequences. The environmental approach is used to model problems and generate artistic solutions, while the systematic approach to the environment is used to model its internal goals and contradictions.

[63] Genisaretsky O. I. Methodological and humanitarian-artistic problems of design: author. dis. ... Doctor of Arts: 17.00.06. M., 1990. P. 30.

For ease of perception, on the basis of a universal interaction scheme, it is proposed to systematize the obtained data on conceptual modeling in the design of the environment through the following sequence of stages: energy source, interacting elements, interaction, result, effect.

At the first stage, the source of energy (resource) that starts the modeling process is the design task, sociocultural and professional factors of external influence in the context of the environmental approach.

At the second stage, elements of interaction are located – methods of an engineer, artist, scientist and other methods, justified by the specific nature and interdisciplinarity of tasks when working with complex multicomponent objects, the use of which and the proportional relationship depend on the features of the methodological approach to solving design problems.

At the third stage, there is an interaction of methods in the process of goal-setting and problematization, that is, the development of an organizational idea based on a systematic approach. Then, at the stage of thematization and metaphorization, the development of a figurative idea based on an artistic approach.

At the fourth stage, a result should be obtained - a conceptual model, as a realization of a strategic goal.

At the fifth stage, it is possible to determine the effect of introducing a conceptual model into project activities - the validity, complexity, artistic uniqueness of the design solution (Fig. 1.2.5).

The participants in the design process as communication within the framework of the environmental approach are the designer (designer), the subject (user), the object (environment), through the change in the characteristics of which it is proposed to describe the designated stages. The goal-setting and problematization stage, at which a systematic approach is applied, the designer works according to the “transparent box” principle, the subject is an active user, whose participation is limited to the examination of the results of the designer’s work, and the final product is an “organizational idea”. This stage should become a resource for adapting the design of the environment to external factors and clarifying the design task. It can be represented through the

operations of analysis, synthesis and evaluation. At the same time, it is taken into account that participatory methods should be additionally used to regulate the process in line with the participatory design strategy. The model obtained at this stage, from the point of view of the object, is a tool for researching and packaging information about the object and a tool for project examination. From the designer's point of view, it is a tool for developing methodological competencies and design thinking. From the user's point of view, it is a tool for researching the root causes, forecasting and programming the needs of the target audience.

The stage of thematization and metaphorization, at which it is proposed to consider the work of a designer according to the “black box” principle, using an artistic approach for external regulation based on feedback, preserves the unknown secret of creativity until the end. From the point of view of the supporters of the artistic approach, design is a creative and, accordingly, completely unknown and uncontrollable process, the partial regulation of which is possible through the application of the methods of the artist and engineer. In this paradigm, sensual assimilation of space occurs through the perception of the subject; and the final product is a “figurative idea”. The model obtained at this stage, from the point of view of the object, is a tool for searching for a figurative theme (idea) of the project. From the point of view of the designer, it is a tool for developing artistic competencies and creative thinking. From the user's point of view, it is a tool for shaping the emotional and sensory state of the subject's personality.

It is worth noting that it is the stage of goal-setting and problematization within conceptual modeling, based on the application of a systematic approach, in terms of identifying both the results of the impact of external – socio-cultural and internal – professional factors on the object, and conducting an examination for the compliance of project ideas with current trends in the development of society, has the highest potential for further research based on a scientifically based approach.

As a result, based on the analysis of modeling methods in the design of the environment as a project activity, the importance of developing its methodological base and the potential for using environmental and system approaches in terms of building conceptual models that will become the basis for creative thinking by the author, user and

expert discussions are revealed. At the same time, the place that conceptual modeling occupies in the process of design activity is not clearly defined, we can only say that all activities before the development of a design solution are related by most authors to conceptual modeling. At the first stage, goal-setting occurs, based on the principle of analysis, and problematization, based on the principle of synthesis. This stage is based on the application of the problematic method within the framework of the environmental approach and the methods of the systematic approach. Second phase – includes thematization and metaphorization, and is based on the application of the artistic method within the framework of the environmental approach.

To continue the study of the essential characteristics of this phenomenon, it is necessary to identify the key features of conceptual modeling as a general scientific activity and, after that, to clarify its main parameters and role in the process of environmental design.

1.3. Conceptual modeling in environment design: basic parameters

The professional goals of design are not only to create a material, spatial, visual and empirical environment, but also to manage design risks through expert activity, based on the application of research and modeling methods. In this regard, it is important to determine the characteristics of the conceptual modeling tools necessary for the designer to examine the causes and consequences of certain social processes, as well as to obtain measurable results from the standpoint of various criteria. A serious obstacle in this case is the insufficient degree of research into the essential characteristics of conceptual modeling from a professional and general scientific point of view. If we assume that the definition of the essence of conceptual modeling and its role in the design of the environment as a field of communication, as well as the identification of internal and external factors influencing the principles of conceptual modeling in the design of the environment, together, will allow us to conclude that further research of its theoretical, methodological and methodological aspects, this will allow to use his expert potential

more fully both for modeling the properties of an object and for a project created with the aim of modifying it.

The results of the current stage of the study are published in the article “Conceptual Modeling in Environment Design: Essential Characteristics and Expert Potential”[64].

In a historical perspective, the research of Kr. Alexander, B. Archer, B.G. Barkhin, G. Broadbent, O.I. Genisaretsky, J.K. Jones, J. Zeytun, N.N. Nechaev, P. Hill, G.P. Shchedrovitsky and others. The local scientific problem is that today there is not enough fundamental research in this area in domestic science. The works of T.Yu. Bystrovoy, P.V. Kapustina, Yu.I. Karmazin, N. Cross, N.F. Metlenkova, S.K. Sarkisova, O.P. Tarasova, V.T. Shimko and others. At the same time, N.I. Barsukova, V.I. Iovleva, S.P. Lomova, N.F. Metlenkova, M.V. Pankina, V.F. Sidorenko, N.G. Yakunichev.

The ideas of forming a systemic picture of the world have an ancient history, but they began to be actively studied only at the beginning of the twentieth century by A.A. Bogdanov. However, for a number of reasons, most researchers associate the emergence of a systematic approach with the work of another scientist, namely L. Von Bertalanffy. The system itself, from the position of L. von Bertalanffy, is a construction consisting of parts that are in interaction, the result of which is not reducible to a simple sum of these parts[65]. At the present stage, the development of systems theory continues by rethinking the law of L. von Bertalanffy, the technology of A.A. Bogdanov, works by I. Blauberg, V.N. Sadovsky, A. Urmantsev, E.G. Yudina and others, as well as “development of models based on dialectical logic and the theory of nonlinear dynamics”[66]. From a general scientific point of view, a model is always a systemic reflection of the original and a means to achieve the goal, and modeling, in turn, is the study of objects of knowledge on their models. Two types of models can be distinguished:

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[64] Tolstova A. A. Conceptual modeling in environment design: essential characteristics and expert potential // Academic Bulletin UralNIIproekt RAASN. 2023. No. 1(56). pp. 99-103.

[65] Von Bertalanfy L. General System Theory. Foundations, Development, Applications: [Electronic resource] N. Y., 1968. 289 p. URL: https://monoskop.org/images/7/77/Von_Bertalanffy_Ludwig_General_System_Theory_1968.pdf (accessed 24.02.2023).

[66] Vasiliev Yu. S. et al. System Theories and System Analysis: Origins and Prospects [Electronic resource] // SAEC. 2021. No. 1. P. 25. URL: https://cyberleninka.ru/article/n/teorii-sistem-i-sistemnyy-analiz-istoki-i-perspektivy (date of access: 03/01/2023).

concept models and project models, the latter are traditionally the result of design as an activity, and the former are developed at the stage of idea formation and are the object of this study. At the same time, traditionally, the model is understood as the process of identifying and formalizing new theoretical knowledge[67]. In which take part: the subject – the initiator of modeling, the object of modeling, the environment in which the modeling process takes place and the desired model itself (Fig. 1.3.1). On an enlarged scale, modeling can perform the following cognitive functions: descriptive (explaining phenomena), prognostic (modeling future properties) and normative (desirable from the point of view of the modeling subject)[68]. From the position of environment design, the descriptive model is the result of a complex analysis of the object, and the prognostic and normative models are combined into one model-concept and a prototype of the forecast, as a future-oriented action, where it is proposed to understand the action as the resolution of the contradictions of the design object associated with its new, user quality[69].

From the point of view of environmental design, goal setting as a process "is inseparable from design and provides for the foresight of the object of the forthcoming activity, transformed according to its results"[70]. However, modeling is always not only purposeful, but also a structured activity, which requires a combination of logic and intuition, and many models can be built for one object, depending on the purpose of its knowledge. From the point of view of the organization, the modeling process is based on analysis and synthesis, as the methods of scientific research operations, and this is the reason for certain recommendations for its implementation. So, when dividing the object of study in the process of analysis into parts, depending on the purpose of modeling, it is necessary to observe the principle of completeness and simplicity. That is, on the one hand, the components of the model should fully reflect the essence of the object and the cause-and-effect relationships between them, and on the other hand, it is necessary to consider only the components that are essential for the purpose of modeling, that is,

[67] Novik I. B. On the modeling of complex systems. M. : Thought, 1965. 335 p.
[68] Novikov A. M., Novikov D. A. Methodology. M. : KRASAND, 2014. 632 p.
[69] Vartofsky M. Models: Representation and scientific understanding. M. : Progress, 1988. 507 p.
[70] Tarasova O. P., Khaliullina O. R. The structure of design activities in the design of the object-spatial environment // Design and Technologies. 2019. No. 70 (112). P. 25.

relevant[71]. At the same time, if in the process of analyzing an object, it is divided into its constituent parts in order to explain them, then in the process of synthesis the acquired knowledge is aggregated into a whole on the basis of emergence, which makes it possible to obtain a new quality of the system that is irreducible to the properties of its constituent parts.

The most common qualitative methods of general scientific modeling used in practice in design include: structural-graphic, morphological and predictive methods.

Conceptual models using various modifications of the graph method include: linear, cyclic, hierarchical, matrix, network structures. Linear structures are used to create an object's timeline. Cyclic structures – to analyze the change of phenomena inherent in the object. Hierarchical structures – to create a "relevance tree" of an object, a "fishbone" diagram, etc. Interaction matrices and network structures – to create a functional diagram of an object.

Morphological methods include: the method of morphological maps used to model options for eliminating object problems; SWOT analysis adapted for the purposes of testing the concept of the development of an object and identifying a problem (problem field) in the design of the environment.

Predictive methods include methods of individual and collective expert assessments, extrapolation methods, associative methods, leading information methods, foresight methods.

Separately, it should be noted that synergistic methods have a high potential for stimulating design thinking in modeling: heuristic dialogues, business games, brainstorming modifications, including those combined with the analogy method in Synectics.

However, in the case of expert activity in the design of the environment, it should not just be about modeling, but about conceptual modeling. Accordingly, it is proposed to understand the concept as the leading idea, a certain way of understanding, interpreting a phenomenon[72]. If we turn to the dictionary of scientific research methodology, then the

[71] Peregudov F. I., Tarasenko F. P. Introduction to system analysis. Moscow: Higher School, 1989. 367 p.
[72] Philosophical encyclopedic dictionary. M. : INFRA-M, 2009. 568 p.

conceptual model is a meaningful model, in the formulation of which, theoretical concepts and constructs of a certain subject area of knowledge are used[73]. From the point of view of design as social communication, a conceptual model is a causal model used to explain and predict the behavior of an object. This model is focused on identifying the main relationships between the components of the object under study, determining how a change in some factors affects the state of others[74].

Thus, it seems possible to synthesize the following definition: conceptual modeling in the design of the environment is the construction of a meaningful descriptive-normative model that determines the structure of the system, the properties of its elements and the cause-and-effect relationships inherent in the system and essential for achieving the goal of modeling.

Having revealed the essence of the process of conceptual modeling in the design of the environment, it is necessary to move on to determining its significance for design and expert activities. Yu.I. Karmazin, studying the system of knowledge about the content, features and prerequisites of creativity, as well as modern scientific and theoretical paradigms, notes that "the conceptual approach to the solution of the problem contributes to the correct alignment of forces and means and reorientation of any trends in the development of the process under study in the right direction"[75]. Thus, he comes to the conclusion that scientific methods, based on a systematic approach and conceptual position, make it possible to obtain a qualitatively new result of project activity, along with creative and engineering methods. This is consistent with the principle of abstraction underlying conceptual modeling, which is that only through idealization can one reach the problematic level of design. The conceptual model itself, as a form of searching for regulatory and predictive solutions, is carried out through an analysis of the interaction of components. Accordingly, in methodological terms, conceptual modeling at the initial stage of design should be a "priority algorithmic action, with the possible manifestation

[73] Methodology of scientific research. Terminological dictionary. Kharkiv: NUA Publishing House, 2016. 124 p.
[74] Plotinsky Yu. M. Models of social processes. M. : Logos, 2001. 296 p.
[75] Karmazin Yu. I. Formation of ideological and scientific-methodological foundations of the architect's creative method in professional training: dis. ... dr. architecture: 18.00.01. M., 2006. P. 317.

of creative breakthroughs”[76]. Consequently, conceptual modeling in this interpretation precedes creative and search actions, allowing you to designate the “boundaries” of further activity and determine the "problem field" for finding artistic solutions.

I.V. Iovlev, identifying the role and importance of conceptual modeling in design activities, compares it with a “trigger” that sets in motion and determines the order of the creative design process[77]. Signs of the work of this mechanism are “problem”, that is, the need to solve any user, technological or other task; the presence of a dominant idea - the author's intention; futurism, in the sense of forecasting the development of an object, and “manifest”, understood as a creative declaration. This interpretation, in contrast to the previous one, equates the result of conceptual modeling with the development of a design concept, combining scientific and creative approaches.

Researcher of the dynamics of the architectural method N.F. Metlenkov, proposes the introduction, as a mandatory, separate pre-project research stage - the stage of conceptual modeling, at which “developing socio-spatial modeling” should be organized to identify the actual “step” in the development of the transformed social space of the situation. Under ""ocio-spatiality”, in this case, is understood the type of socio-spatial activity of a person in a particular situation. That is, the necessity of constructing a conceptual model of self-development of the situation in the process of research and design activities before the start of preliminary design is substantiated. Understanding by conceptual models “theories of design purpose, the application of which to reality and the study of the results of such an application can provide new information of a goal-setting nature that is missing for design” [78].

Thus, on the basis of the considered theoretical provisions, it is possible to determine not only the place of conceptual modeling as a separate stage of scientifically based design activity, but also to identify its mission - obtaining additional information about the goals of the social and spatial development of the design object.

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[76] Karmazin Yu. I., Kozlov A. G. On the formation of the method of pre-project comprehension // Privolzhsky scientific journal. 2017. No. 2 (42). P. 141.

[77] Iovlev V. I. Conceptual mechanism of architectural design [Electronic resource] // Architecton: news of universities. 2021. No. 1 (73). URL: http://archvuz.ru/2021_1/23/ (accessed 23.09.2022).

[78] Metlenkov N. F. Paradigmal dynamics of the architectural method. M.: ASROS, 2018. P. 201.

Further, in order to substantiate the principles of conceptual modeling in the design of the environment, it is necessary to determine the value orientations of the specialty that influence them. As the analysis has shown, the essence of conceptual modeling - this is the identification and resolution of the problems of the design object, which are associated with its new user qualities. So, according to S.P. Lomov, modeling processes in design go not only according to the "man - thing - person" scheme, they are included in the "man - situation - action" scheme, that is, it is not the material and technical equipment of life processes that is modeled, but a new quality of life[79]. Accordingly, if the manifestation of human needs has certain patterns, then system communications largely depend on the design object. In general, they can be reduced to the following formula proposed by M.V. Pankina: the social nature of design gives rise to duality, which is due to its main function - "to solve the contradiction that exists in people's daily lives, between the existing state of the environment, its desired image and qualities"[80]. This problem of contradiction between the real and the ideal, which generates the cyclicity of project activities to improve the quality of the living environment, in terms of meeting the needs of the target audience, and reflects the direction in which conceptual modeling should be carried out.

In the study of the world experience in the formation of the concepts of modern design, V.R. Aronov pays special attention to the design of the environment and notes that the designer's focus is on the space of interaction and communication of a person with the external environment, in other words, the "interface", as an intermediate environmental link that provides a controlled interactive contact of a person with the environment[81]. This is due to the place of environmental design at the intersection of architecture and industrial design within the framework of the environmental approach, which consolidated the principles of the so-called "soft design".

Developing this position, the design of the environment, according to the exact definition of I.S. Karimova can be interpreted as a type of social communication in which

[79] Lomov S. P. Formation of design thinking in the system of design education // Pedagogical journal of Bashkortostan. 2010. No. 5 (30). pp. 7-11.
[80] Pankina M. V. Duality as a design essence of design // Fundamental research. 2015. V. 16. No. 2. P. 3630.
[81] Aronov V. R. Concepts of modern design. 1990-2010. M. : Artproekt, 2011. 224 p.

the following components are presented: “the communicant, in the role of which is the designer, who forms the message in the form of an environmental object, the transmitted object is the object-spatial environment created in accordance with the social task, and the recipient is the subject of the environment representing a certain level of social relations”[82]. At the same time, the main goal of design is to correspond to human measurements[83].

V.F. Sidorenko, reflecting on the aesthetics of non-identity, and opposing the objectivity of the fact to the subjectivity of perception, expands the communicative field, including various points of view that arise due to contradictions in the needs of the target audience. The design project in his view is interpreted as “a model of true reality, and a person's point of view on the world, this is both a concept and a dialogue with other points of view”, when “the designer must give the opportunity to fully reveal each point of view in the dialogue of the parties and, thereby, expose the conflict and the inner meaning of the situation”[84].

According to N.I. Barsukova, the field of dialogue expands to the general context of culture, when “the energy-information impact of the material-subject environment on a person allows us to interpret the environment as a single information-energy system, complementary and interdependent”, where all elements are interconnected, and where "anthropic-semantic integrity" is formed[85].

N.G. Yakunichev, in addition to communicative qualities, highlights the interdisciplinarity of design, the need to comprehend and organize heterogeneous material, analyze the intersections of different approaches and methods to resolve problems and contradictions that are significant for the design object. As part of a productive modeling technique, in this context, “the search for short links between

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[82] Karimova I. S. Design of the environment as a subject of social communication // New ideas of the new century: materials of the international scientific conference FAD PNU. / Federal State Budgetary Educational Institution of Higher Education Pacific State University. 2011. T. 1. P. 486.

[83] Barash L. A. Axiological aspects of design in the light of inter-subject relations // Historical, philosophical, political and legal sciences, cultural studies and art history. Questions of theory and practice. 2011. No. 4-2. pp. 16-18.

[84] Sidorenko VF Genesis of design culture and aesthetics of design creativity: author. dis. ... Doctor of Art History: 17.00.06. M., 1990. P. 25.

[85] Barsukova N. I. Design of the environment in the design culture of postmodernism of the late XX - early XXI centuries: author. dis. ... Doctor of Art History: 17.00.06. M., 2008. P. 41.

different sides of a problem situation, as a rule, creates the basis for the emergence of innovative solutions"[86].

According to V.T. Shimko, conceptual modeling is based on the manifestation of design consciousness as a prerequisite for design thinking inherent in the emergence, development and strengthening of design forms of creativity. The presence in the designer's arsenal of professional methods of conceptual modeling is considered, in this vein, as necessary for the emergence of a design idea, on which the novelty and prospects of author's proposals, the features of their further development depend.

Accordingly, the breadth of interpretations of the issue under consideration makes it possible to identify the value orientations on which the principles of conceptual modeling in the design of the environment should be based: anthropocentricity, processivity, problematicity, complexity, interdisciplinarity, interconnectedness, integrity.

In conclusion, in order to evaluate the effectiveness of the use of conceptual modeling, it seems appropriate to consider the design of the environment as a single system, which includes the user, object and designer, from the standpoint of their influence on the process under. To do this, it is necessary to supplement the previously obtained components of the environment and the consumer request (Fig. 1.1.1) with the third component – professional factors in the design of the environment as design modeling. This can be done using the method of categorical symbolism "Hexagram" by highlighting two opposite – ascending and descending aspects of the system, which have a positive or negative impact on its development. It is proposed to accept that the main aspect that ensures the relevance of modeling in design activities, in general, and in environmental design, in particular, is its social significance, and the aspect that makes modeling difficult in project activities is the insufficient degree of study of its essential features.

Next, we decipher each of the aspects with three components. So, the following components can be attributed to the upward flow: a request from the target audience in

[86] Yakunichev N. G. Design methods at the present stage of organizational changes in the subject environment // Design. Materials. Technology. 2019. No. 2 (54). P. 7.

the form of a design assignment; social development goals that require project activities to comply with various strategies and criteria; professional modeling goals, including the creation of an environmental object and, at the same time, its expertise. However, for each of the positions expressed by this trio of categories, there are specific resistances. The following characteristics of the components can be attributed to the downstream: the variability of the needs of the target audience, which requires the study of the system of relationships and root causes that initiate the design task; the environment as a self-developing system that deforms the goals of social development; the variety and inconsistency of methodological approaches to modeling in project activities make it difficult for peer review.

At the next stage, for the convenience of perception, it is proposed to place the components in the ascending and descending triangles, while placing the strongest components in the triad at the vertices from the point of view of this study, i.e. qualitative features of modeling in environment design: professional goals of modeling, on the one hand, and inconsistency of methodological approaches, on the other. As a result of the analysis of the obtained model, it can be argued that for the qualitative implementation of the professional goals of modeling in the design of the environment, it is necessary to develop a methodological base in terms of methods of description, forecasting and expert evaluation. To carry out project activities in accordance with the request of the target audience, it is necessary to investigate and model its root causes. For an adequate response of project activities to the goals of social development, it is necessary to investigate and model the environment as a self-developing system and identify the main mechanisms for its formation (Fig. 1.3.2).

Consequently, the development of the conceptual modeling methodology, in addition to increasing the professional competence of the designer, will become a tool for studying both cause-and-effect relationships on the part of the design task and compliance with the goals of social development in accordance with changes in the environment as a self-developing system.

Thus, we can draw the following integral conclusion: in the process of design activity, the role of conceptual modeling is to determine the problem field for developing

a design idea between the descriptive (descriptive), predictive and normative (desirable) state of the environmental object from the point of view of the target audience. The main directions of conceptual modeling in the design of the environment, at the same time, are the examination of the essential parameters of the environment as a design object, as well as the analysis of the user component that initiates the design task.

Based on the value orientations of the specialty, identified as a result of the analysis of the theoretical base, the principles of conceptual modeling include:

- the principle of problematicity (consideration of the task for design as a problem associated with a conflict between the existing state of the environment and its expected qualities);
- the principle of cyclicity (preservation of feedback between the subsequent and previous stages of modeling);
- the principle of complexity (equal attention to all components of the environment: space, processes and content);
- the principle of interdisciplinarity (the use of different scientific approaches that are significant for the purpose of modeling);
- the principle of integrity (interdependence and interconnectedness of all modeling components).

Based on the general scientific approach to the object of study, the definition of conceptual modeling in the design of the environment is synthesized as a process focused on building a meaningful descriptive-normative model that determines the structure of the system, the properties of its elements and the cause-and-effect relationships inherent in the system and essential for achieving the goal of modeling.

Based on the analysis of the essence and content of conceptual modeling, as well as options for its inclusion in the process of project activities, the place of conceptual modeling at the pre-project stage is indicated in order to examine the problem field and form an organizational idea; it is proposed not to include in it the development of an artistic and imaginative idea, as a creative process that does not require strict methods and algorithms.

As a result of the study, the importance of further development of the methodological base of conceptual modeling in the design of the environment, in terms of developing a methodology for constructing conceptual models, which should become the basis for creative reflection by the author, user and expert discussion, was revealed.

Further study of the theoretical, methodological and methodological aspects of conceptual modeling in the design of the environment is proposed to be carried out in accordance with the interpretation of the environment as a single information and energy system of complementary elements proposed by N.I. Barsukova, as well as from the point of view of an in-depth study of the mechanism of functioning of the system "author - object - user" in the design of the environment, as equivalent components of the communication process. For these purposes, it is necessary to develop the methodological base of conceptual modeling in order to study the environment as a self-developing entity, as well as the root causes of the formation of user requests for its change.

Conclusions on the first chapter

The relevance of the design of the environment from the standpoint of the goals of social development and the request of the target audience for a comfortable living environment is determined. It was revealed that in order to comply with the declared relevance in the design of the environment, it is necessary to apply modeling methods to study the environment as a self-developing system, as well as the potential for changes in human needs that are significant for the design of the environment.

The diversity and inconsistency of the methodological approaches used in the design of the environment for these purposes are described, it is established that their synthesis has a high potential for achieving the goals of modeling. The process of project activity in the design of the environment is structured and the place of conceptual modeling is established in it. The potential of using methodological approaches to achieve the goals of modeling at different stages is determined.

Conceptual modeling as a general scientific tool is investigated. On the basis of which the place, role, principles and main directions of conceptual modeling in the design

of the environment are determined. The need for further research using general scientific methods to eliminate the contradictions between the relevance of modeling as a research and expert activity and the lack of research into the essential features of the subject of modeling has been established.

CHAPTER 2. ESSENTIAL ASPECTS OF CONCEPTUAL MODELING IN ENVIRONMENT DESIGN

The idea of the essential aspects of the phenomenon under study is an important part of the analysis of any phenomenon. Conceptual modeling in environment design will not be an exception. Only the identification of essential aspects will make it possible to form a system of models and proceed to the construction of a methodology in order to manage conceptual modeling. This task can be productively implemented from the standpoint of a categorical-system methodology, which provides a description of the qualitative characteristics of the object of study in their interconnectedness and interdependence. The objects of the study were the components of the environment as an object of conceptual modeling obtained as a result of a two-level decoding of the concept, the user qualities of the environment from the position of conceptual modeling, as well as the mechanism of interaction of conceptual modeling in the design of the environment and the resulting contradictions between the opposite components.

2.1. Definition of the concept of "conceptual modeling object in environment design" and the system of concepts for describing the subject area

Explanation of the essence of things is the most important part of scientific research, along with the features of the development of an object in a historical perspective or empirical analysis and identification of quantitative characteristics. It is the definition of categories and concepts of the main objects of scientific work that is the basis for obtaining a high-quality scientific result.

At present, the issues of creating a comfortable living environment are being actively discussed, and the design has the necessary flexibility and quick response to changing conditions[87]. To manage conceptual modeling in environmental design, which

[87] Ziyatdinov Z. Z., Churlyaev B. A. Identification of architectural design: scientific apparatus, essences and foundations of development [Electronic resource] // Architecton: university news. 2020. No. 3 (71). URL: http://archvuz.ru/2020_3/2 (date of access: 02.02.2021).

is significant from the point of view of forming a productive and responsible approach to this task, it is necessary to clarify the content of the object of conceptual modeling in environmental design, which will allow, through further construction and analysis of conceptual models, to obtain a unique and sustainable final product.

The previous stages of the study showed that the existing definitions of the category “environment” and the concepts synthesized on its basis do not allow us to consider them as a model for the further formation of a methodology for conceptual modeling in the design of the environment, since they relate to related areas of project activity, and in the information field of “design environment”, there is insufficient knowledge of this issue. At the same time, the dominant qualities present in the environment as a whole are distinguished by the majority of researchers – spatial components, process content, subject content.

Based on the analysis carried out, it can be concluded that it is necessary to eliminate this gap and develop a scientifically based definition of the concept of “an object of conceptual modeling in the design of the environment”, which could become a model for studying the object of study, as well as the development of the conceptual apparatus. This will allow further targeted comprehensive research of conceptual modeling in environmental design, taking into account the high system complexity of the project activity object, with the aim of subsequent development of a methodology for conceptual modeling in environmental design.

As a hypothesis, we can consider the statement that a detailed definition of the concept of “an object of conceptual modeling in the design of the environment” will allow, from the point of view of scientific research, to identify a set of significant criteria (qualities) of the object for further systematic research, the purpose of which is to develop a methodology for conceptual modeling in the design of the environment.

Thus, the aim of the study is – to identify the basic aspects of the concept of “an object of conceptual modeling in the design of the environment” on the basis of understanding the nature of the phenomenon under study and to construct a scientifically based definition, as well as to supplement the conceptual apparatus of the specialty.

The results of the current stage of the study are published in the article "Environment as an object of design: definition of the concept by the method of two-level triadic decoding"[88].

When conducting research on the environment as an object of creation, the authors used various scientific and methodological approaches: so O.I. Genisaretsky used a system-categorical, iconological and symbolological approach; V.A. Nikitin and A.G. Rappaport – philosophical and epistemological approach; V.L. Glazychev metoprofessional and ecosystem approach; A.V. Ikonnikov – sociocultural approach; N.I. Barsukova – cultural, ethical and systematic approach; G.B. Minervin and V.T. Shimko – environmental approach and methodology of design theory and architectural composition theory; A.V. Kinsht – ecological and environmental approach. Based on this, it can be argued that in the field of "environment design", which is basically not only design art, but also an interdisciplinary field of activity, a wide range of scientific methods and approaches can be used to conduct research.

Thus, the further choice of research methodology is justified by its heuristic potential and compliance with the interpretation of the environment as a whole as a complex self-developing system. So, the environment as a design object is a complex system with the corresponding features: structuredness, interconnectedness of parts, subordination of its organization to a specific goal[89]. Therefore, based on the theoretical base and studies of O.I. Genisaretsky, it will naturally continue to work in line with the system-categorical approach chosen by him. At the present stage, these principles have taken the form of a methodology called – categorical-systemic, in which the emphasis is on the organization of systems of categories, understood as "special cognitive units that mark reality in such a way that it allows you to use categories to organize thinking"[90].

In this vein, for solving the problem of constructing the definition of a concept, a great perspective is an interdisciplinary information-dynamic approach based on the

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[88] Tolstova A. A. Environment as an object of design: definition of the concept by the method of two-level triadic decoding [Electronic resource] // Architecton: university news. 2021. No. 2 (74). URL: http://archvuz.ru/2021_2/16/

[89] Peregudov F. I., Tarasenko F. P. Introduction to system analysis. Moscow: Higher School, 1989. 367 p.

[90] Bosch G. D., Razumov V. I. Methodology of scientific research (in candidate and doctoral dissertations): textbook. M. : INFRA-M, 2020. P. 64.

synthesis of philosophy, mathematics and physics, in which philosophy is represented precisely by the above-mentioned categorical-system methodology. This scientific approach began to take shape within the framework of homeostatics, as a science of systems with internal contradictions, in order to study the methods of their self-regulation, and the "environment" as a category is a self-regulating system, which was shown by the analysis of scientific literature carried out at the previous stage. An important difference of this approach is that in addition to working with categories and systems, it also refers to information, which is a fundamental property of matter, and its role in the existence of systems, and a dynamic approach to the object of study allows us to consider it in development, cause-and-effect relationships and subordination. Accordingly, the information approach to the description of a real object assumes the structure of this real object in the form of a digraph and the function as a process of information functioning on this digraph[91]. Aspect in which it is potentially possible to apply this approach – it is a structural one that justifies the representation of the object of study in a categorical scheme and the execution of special operations on the resulting digraph, including decoding[92] .

It is important to clarify that in general, the development of categorical thinking unfolded mainly along the path of synthesis and concentration in the systems of categories of Pythagoras, Aristotle, Kant, Hegel and other thinkers. At the same time, the tendency of deciphering categories, which is opposite to the synthesis of categories, during which the basic category is refined using a set of homogeneous categories, has not been sufficiently worked out, and this is what distinguishes the information-dynamic approach from a number of others. That is, any category is able to reveal its essence, i.e. become ontologically meaningful only as part of at least one connected cycle of three or more categories, or designate a complex of already ontologically meaningful categories[93]. This additionally makes this approach productive for application, since the research task is to

[91] Razumov V. I., Sizikov V. P. Fundamentals of the theory of dynamic information systems. Omsk: Omsk State University, 2005. 214 p.
[92] Bosch G. D., Razumov V. I. Methodology of scientific research (in candidate and doctoral dissertations): textbook. M. : INFRA-M, 2020. P. 66.
[93] Razumov V. I., Sizikov V. P. Fundamentals of the theory of dynamic information systems. Omsk: Omsk State University, 2005. 214 p.

identify the basic aspects of the concept of “conceptual modeling object in the design of the environment”, for which it seems necessary to decipher it.

Scientific methods chosen within the framework of the information-dynamic approach to the study of the object – these are the “Two-level triadic decoding of the base category” method and the “Category mutation” method. In the case of the study of the “environment as an object of design”, we can talk about the decoding and mutations of the concept, which can be worked with using the same algorithm.

At the first level of application of the method “Two-level triadic decoding of categories”, the desired concept is deciphered by a triad of concepts that most fully (with necessity and sufficiency) reflect its essence (decoding concepts of the first level). Further, the deciphering concepts of the first level are subjected to a similar deciphering. The resulting two-level triadic interpretation of the concept is a detailed model of the object and can serve as the basis for constructing the definition of the concept that names it, and the definition obtained as a result of applying the method, for its part, reflects the features of the arrangement of concepts in the scheme. As a result, the object under study is characterized comprehensively with a reflection of its qualitative characteristics.

With the subsequent application of the “Category Mutations” method, the second-level concepts are rearranged according to the algorithms developed in the theory of dynamic information systems, which makes it possible to introduce new concepts for the first obtained triads, thus expanding the conceptual apparatus of the specialty.

So, the basic concept that names the object of study is “the object of conceptual modeling in the design of the environment”. At the first stage, the formation of a triad that reveals the content of the concept should be based on the definition obtained, based on the analysis of scientific publications, in which the universal characteristics of the environment are highlighted as a design object, in general, and the specific qualities of the environment, as a design object, in particular. Accordingly, it was found that the environment as a design object can be interpreted as a human environment with systemic characteristics and human activity in the aggregate of its spatial, process and subject characteristics that meets both the practical and aesthetic needs of society. This makes it

possible to identify the primary triad of homogeneous concepts that most fully reflect the essence of the object: “spatiality”, “purpose”, “fullness”.

It is necessary to further explain the logic of reasoning. First, the object of conceptual modeling in the design of the environment – it is always space: anthropogenic, natural or natural-anthropogenic origin. This is connected with the origins of environmental design, which arose within architecture as a spatial art form. Secondly, space becomes an object of design only when there is a need for its intended use, i.e. purpose, which is also a common feature necessary for any type of project activity. Thirdly, the quality that is basic and initially highlights the environment as an object of design – it is the fullness of space. It was the emptiness, lack of address, indifference to the person of urban spaces in the 70s of the last century that gave rise to environmental design, originally understood as a material shell humanizing the architectural and urban planning ensemble.

So, the first level of deciphering made it possible to single out a triad of concepts: “spatiality”, “purpose” and “fullness” (Fig. 2.1.1). At the second level, each of the received concepts is also deciphered into a new triad. In order to achieve typological correspondence of decoding concepts of the second level, it is proposed to consider each concept of the first level, from the point of view of dynamic information systems, as a triad – substance, energy, information, which can be compared with human needs for life support, goal-setting and identity.

The concept of “spatiality”, for the environment as an object of design, can be represented by the following qualities: “material spatiality”, “temporal spatiality”, “cultural spatiality”. These qualities make it possible to identify three contexts for the perception of the environment as a design object. “Spatiality material” – reflects the physical qualities of the environment and the order of coexistence of stationary objects that form it, which can be expressed through the features of forms, boundaries, surfaces. It is a visually and tactilely perceived part of our environment providing a variety of qualities. spaces associated with its real essence. “Temporal Spatiality” – complements the physical fourth dimension, demonstrates the continuity of historical development and continuity in the construction of the event frame associated with its energy essence.

Reflects: the duration of existence, the sequence of events, the features of cyclic phenomena (updates of the object, seasons, time of day, etc.). In addition to two specific concepts, it seems possible to introduce a third one – "cultural spatiality". This is the most complex component, since this space is conceptual, perceptual and tends to expand as a result of each cultural act. This quality is formed by cultural processes, while it itself is both a condition and a regulator of these processes, forming the qualities of space associated with its information essence. Reflects: regional features, values (ideals and traditions), cultural characteristics of a particular user group. The introduction of this quality makes the concept of "spatiality" the most complete and thus completes its deciphering. It is important to note that the proposed decoding at the first level is consistent with the basic qualities of the environment identified during the analysis of scientific literature, and demonstrates the integration of the design of the environment as a class into the general field of project activity, primarily architecture.

The concept of "purpose", for the environment as an object of design, can be represented by the following qualities: "functional purpose", "technological purpose", "aesthetic purpose". These qualities make it possible to single out three levels of goals when working with the environment as with an object. "Functional purpose" – designates the purpose of the environment, and is also responsible for the qualities associated with the life support of a person, as an individual, and society as a whole. Reflects: the main, secondary and possible purpose of the environment in terms of its function. The next level will be "technological purpose" that provides the quality of goal setting, when the definition of a sequence of actions, the creation of conditions and equipment for their implementation come to the fore. At this level, there are many contradictions between environmental tasks that create a field for applying the problematic method and finding a balance when choosing a project strategy. The quality that closes the triad is "aesthetic purpose", which creates conditions for the emotional coloring of the environment, which makes it possible to ensure its identity in the sense of belonging. This quality reflects: spatial composition, color scheme, scale. The triad obtained as a result of deciphering the quality of "purpose" makes it possible to identify in the design of the environment the basis laid down by the theory of industrial design.

The concept of "fullness", for the environment as an object of design, is deciphered as: "objective fullness", "process fullness", "semantic fullness". These qualities close the study of the object and decipher the levels of perception of environmental content. Subject content, as the most visible design component of environmental design, allows placing the quality "subject content" in the first place of the triad. This quality carries an important meaning – the visual embodiment of all design ideas is therefore often perceived as the most important, being in fact only a reflection of the previous aspects of the environment as a design object. The quality of "subject fullness" includes: equipment from household to engineering, navigation system, landscape design. "Process fullness" occupies the second place in this triad, since it is precisely the understanding of the tasks, conditions and equipment of the activity that allows you to work with the content components of the environment and, thus, form its new quality – scenario organization. The quality "fullness of the process" reflects: the processes are intuitive, targeted, event-driven. This triad is closed by "semantic fullness", phenomenological understanding of the environment, its symbolism. This quality reflects: archetypes, architectural and artistic style, metaphors. Thus, the need for identity is provided, since symbolism is the highest level of human perception of the environment and is the most difficult to design, since it entirely depends on the personal experience and emotional expectations of each individual. This triad of qualities, in general, demonstrates the synthesis of the architectural and design origins of environmental design and completes the identification of the main components of the environment.

For the convenience of perception of the system of concepts and relationships between them obtained as a result of triadic decoding, they are assigned numerical values (Fig. 2.1.2).

Thus, understanding the nature of the phenomenon "an object of conceptual modeling in the design of the environment" and identifying attributes that are significant for it, within the framework of the procedure for sequential triadic decoding of the basic concept, allows us to construct the following detailed definition: the object of conceptual modeling in the design of the environment – it is an integral system that has signs of

material, temporal, cultural spatiality; appointment of functional, technological, aesthetic and fullness of the process, subject, semantic.

As a result, a two-level linked cycle of subordinate concepts is obtained, each of which is necessary, and all together they are sufficient to designate the environment in the considered quality: the object of conceptual modeling in design. That is, if the developed model is interpreted in terms of the theory of dynamic information systems, then the resulting digraph – it is an environment as a structural system, and the process of conceptual modeling in design is presented in the form of information distributed between structural units in accordance with their numerical designation.

Further, in the study, it is necessary to apply the "Category Mutation" method, which allows, based on the introduction of new concepts to designate newly obtained triads, to obtain and analyze two additional aspects of the "object of conceptual modeling in the design of the environment", as a result of which we propose a system of concepts for describing the subject area .

So, when testing the hypothesis (aspect No. 2), new concepts were obtained: "comfort", "organization", "expressiveness", which name the qualities of the environment that correspond to the basic needs of the user (life support, goal-setting, identity) (Fig. 2.1.3). In turn, when mixing interacting components on the basis of a mathematical algorithm (aspect No. 3), new concepts were obtained: "structurality", "belonging", "productivity", which it seems possible to interpret as qualities of the environment corresponding to design tasks (volume-spatial solution , interaction with the context, the effectiveness of solving the problem). Thus, the result of applying the "Category Mutations" method made it possible to develop an additional conceptual apparatus (Fig. 2.1.4), (Table 2.1.1).

Table 2.1.1.: "Category mutation method" interpretation of the basic mutations of the triad "conceptual modeling object in environment design".

schema index	**Triadic complexes of auxiliary concepts**	**Synthesized concept**	**Interpretive correspondence (interpretation)**

aspect 1	[00] material [01] temporary [02] cultural	[0] spatiality	complex spatiality
	[10] functional [11] technological [12] aesthetic	[1] purpose	complex purpose
	[20] subject [21] process [22] semantic	[2] fullness	complex fullness
aspect 2	[00] material [10] functional [20] subject	Comfort	user need for life support
	[01] temporary [11] technological [21] process	organization	user need for goal setting
	[02] cultural [12] aesthetic [22] semantic	expressiveness	user need for identity
aspect 3	[00] material [22] semantic [11] technological	Structurality	volumetric-spatial tasks of the designer
	[01] temporary [20] subject [12] aesthetic	Identity	designer's contextual tasks
	[02] cultural [21] process [10] functional	Productivity	designer's goals

Thus, based on the verification of the obtained definition as a hypothesis, a clarifying concept No. 2 was synthesized: the object of conceptual modeling in the design of the environment from the position of the user has the qualities of material, functional, subject comfort; organization of time, technological, process; cultural, aesthetic, semantic expressiveness. Also, based on the analysis of the mixing of components in practice, a clarifying concept No. 3 was synthesized: the object of conceptual modeling in the design of the environment from the position of the designer has the qualities of structural material, semantic technological; affiliation of temporal, subject, aesthetic; cultural, process, functional productivity.

Thus, the hypothesis was confirmed that when considering the “object of conceptual modeling in the design of the environment” as a basic concept and as a result of identifying, deciphering, rearranging and folding its main qualities, it became possible to study additional aspects of the object of study that are significant for its development. Namely, to identify the composition and sequence of directions of conceptual modeling in the design of the environment.

It is important to note that all of the above qualities were previously considered by researchers and are found in different combinations in the definitions of the “environment”, however, they were not built into a single system and only indirectly related to the environment as an object of conceptual modeling in design.

We can say that a system of concepts for describing the subject area has been constructed on the basis of understanding the nature of the phenomenon under study and clear methodological tools. The detailed definition of the concept of “conceptual modeling object in environment design” obtained in a detailed definition differs from similar ones in that it reflects the essence of the object, includes its most fundamental qualities, reflecting the directions of project activities, as well as the relationship and hierarchy of qualities, which allows you to isolate the object of conceptual modeling in environment design from similar but not identical objects.

The scientific value of the results consists in clarifying the conceptual apparatus of the specialty environment design, in the field of describing the environment as an object of conceptual modeling. Also, the contribution to scientific methodology in general can be identified, since the study demonstrates the productivity of applying the categorical-system methodology for structuring analytical work in the field of design arts. For the first time, the method of the theory of dynamic information systems was applied in the field of design in order to study aspects of the object of study that are significant for its development.

The proposed definition, as well as the system of concepts for describing the subject area, are a categorically and mathematically substantiated apparatus and can serve as models for identifying the main components in the environment as an object of

conceptual modeling in design in the implementation of research and practical activities, both in competitive and educational work, and as well as interacting with the customer.

Prospects for the application of the obtained results in science require further research. The analysis of the obtained definition as a model makes it possible to single out elements and subsystems in it for a more detailed study of the components of conceptual modeling in the design of the environment. However, since the design of the environment is considered as an area of communication between the designer, the object and the user, it is necessary to study the user qualities of the environment from the position of conceptual modeling in line with the methods of categorical-system methodology.

2.2. Information model of user qualities of the environment from the position of conceptual modeling

From the standpoint of the relevance of research within the framework of state programs to create a comfortable living environment, the assessment of the qualitative characteristics of the environment that satisfies human needs is of great importance. This is true in relation to all stages of project activity, and, first of all, to conceptual modeling. Accordingly, it seems necessary to explore the interdependence of the user qualities of the environment and human needs, which trigger the design process aimed at creating comfortable conditions for individual use and interpersonal interaction. Since the paradigm of the environmental approach was consolidated, for this purpose, participatory methods are actively used, experts in this field are: D.J. Buckles, G. Sanoff, A.V. Strelnikova, E.A. Shuklin, J.M. Chevalier and others. However, it is not advisable to completely shift the responsibility for the decisions made to the target audience. The qualification of a specialist should allow for a preliminary comprehensive analysis of the user qualities of the environment and, in accordance with this, to clarify the content and format of the participatory design. In this context, of interest are works on psychology, sociology and marketing by such authors asD.G. Bagdasarova, E.V. Garin, P.M. Ershov, A. Maslow, M.A. Max-Nif, as well as design and architecture theoristsIN AND. Iovleva, I.S. Karimova, K.V. Kiyanenko, G.A. Lanshchikova, G.I. Lola, N.F. Metlenkova,

S.M. Mikhailova, V.F. Sidorenko, V. Papaneka and others. Based on their analysis carried out at the previous stage of the study (see paragraph 1.1.), the author proposes to include among the basic human needs that can be met using environmental design tools: life support is a subgroup of primary needs associated with the biological essence of man; goal-setting, which allows us to consider the entire functional process of life in its continuity and incompleteness; identity is a subgroup of social needs.

Local scientific problem consists in the insufficiency of scientifically based ideas about the qualitative characteristics of the environment as an object of conceptual modeling that correspond to the identified needs. It can be assumed that the identification of regularities in the process of cognition of human needs, from the point of view of conceptual modeling in the design of the environment, will make it possible to single out their separate qualitative characteristics and carry out both their identification and description.

The research task is to present the consumer qualities of the environment from the point of view of conceptual modeling in the design of the environment in the form of a multi-level information system that reflects their development as the acquisition of new qualities; typology and description of these levels.

The results of the current stage of the study are published in the article “Consumer qualities of the environment in terms of design: information model”[94].

To achieve the set task, general scientific methods that are part of the categorical-system methodology, invariant to subject areas, allowing you to work with categories and implemented in the format of special categorical schemes, can serve as productive. The category “quality” of the environment as an object of use, from the point of view of conceptual modeling in the design of the environment, within the framework of the methodology chosen for the study, will be interpreted in such a way that it “will allow at the level of a specific categorical model to characterize the object as integral, special (i.e. standing out from the environment, isolated, separate), a given object in given

[94] Tolstova A. A. Consumer qualities of the environment from the point of view of design: information model // Design. Materials. Technology. 2021. No. 1 (61). pp. 43-49.

circumstances and in a given environment, with all its distinctive richness of properties and predictable changes"[95].

By scientific method, within the framework of the chosen methodology, the "Final information flow" was chosen, which from a research point of view is "an organized information image that characterizes the object under study along with the process of its research"[96].

The main unit of information representation in the "Final information flow" is the information criterion, which fixes any new cognitive information about the object. Information criteria have a certain sequence, which reflects, on the one hand, the process of cognition of the object, on the other hand, the process of development of the object itself, the order in which it acquires new qualitative characteristics.

Accordingly, the environment in the "Final information flow" model is represented as a system object, the user qualities of which, from the point of view of conceptual modeling in the design of the environment, develop in strictly defined directions. The categorical model "Final information flow" allows obtaining new data about the nature and qualitative user characteristics of the environment, as well as about their features. All these aspects are reflected by the three parameters of the model - logical level, logical limit and transformability, which ensure the adequacy of the procedure for identifying and describing the object of study.

The logical level denotes the depth of the informational interaction of the researcher with the object. This is an indicator of the search for a fundamentally new one. The discovery of a new qualitative characteristic means the emergence of a new information criterion and, accordingly, an increase in the logical level, which reflects the next step in the evolution of the object of study (in Fig. 2.2.1: logical level is the length of one section of the "Final information flow" figure). The logical limit is the limited number of qualitative characteristics of the object that it has on the corresponding logical level. If logical level denotes how far the cognitive process has gone, then logical limit

[95] Razumov V. I. Categorical-system methodology in the training of scientists: educational. Omsk: Omsk State University, 2004, p. 47.
[96] Bosch G. D., Razumov V. I. Methodology of scientific research (in candidate and doctoral dissertations): textbook. M. : INFRA-M, 2020. P. 104.

shows how diverse information transformation processes can be here (in Fig. 2.2.1: logical limit is the distance from the starting point of the “Final information flow” to the corresponding logical level). Transformability is the possibility for information transformations inherent in the data of logical level and logical limit to the combinatorics of parts of the information criterion (in Fig. 2.2.1: Transformability is a circle with a diameter equal to the height of the section on each logical level).

The method is implemented in the following sequence:

1) selection of elementary attributes (qualities) in the object;

2) revealing the logic of the appearance of selected attributes (qualities) in an object;

3) formation of an information model of the object by the method “Final information flow”.

Since the design of the environment, as a separate type of project activity, traces its history of development since the 70s of the last century, then, in the process of cognition, in order to identify logical levels, it is proposed to choose a chronological approach and explore the relationship of design to meeting needs, depending on changes in the socio-economic paradigms - this is taken as an information criterion. For each logical level, in accordance with the analysis of the scientific literature, it seems possible to identify three groups of needs: goal setting, life support and identity, which can be satisfied by the qualitative characteristics of the environment, the nature of which depends on the logical level at which they are considered. At the same time, goal-setting is proposed to be considered a primary need, since it is the presence of a goal that is the hallmark of any system, including the environmental one. And the needs associated with life support (the primary needs of the individual) and identity can change their position in the triad in accordance with the purpose of the environment, which can vary from mundane to spiritual. Accordingly, the changing quality of the human environment, which satisfies the three identified basic needs, can be taken as a logical level.

To determine the first logical level, it is necessary to consider the object of study from the side of the tasks set for the design in the formation of the environmental approach, at the origins of which were O.I. Genisaretsky, A.P. Zinchenko, V.A., Nikitina, A.G. Rappaport, M.R. Savchenko and others during the transition from an industrial

society to a post-industrial one. The mission of the environmental approach was to create additional functional order and aesthetic expressiveness of the urban environment, that is, the real content of space indifferent to a person[97]. Accordingly, at logical level 1, let's call it “initial”, in order to fulfill the need for “goal setting”, the environment had to correspond to public goals and strategic development programs. The need for “life support”, from the point of view of design, in accordance with the level of development at that time of the industrial society, was interpreted as the possession of the environment by the quality of safety, allowing all participants in environmental processes to maintain life and health. The need for “identity” – was comprehended through the quality of regional identity, which allows creating an individual code in a monotonous architectural space: recognizability, contextuality of design solutions, emotional fullness of the environment.

To determine the second logical level, it is proposed to consider changing the tasks of environmental design in the era of post-industrial development, when the priorities of the service economy come to the fore, in order to increase the level of life comfort, which, despite the attractiveness of such an installation, has certain disadvantages, as it contributes to the formation of the so-called consumer societies[98]. In the space of environmental design, this period coincides with a variety of research areas in the cultural, ecological, and architectural direction. Scientists such as N.I. Barsukova, A.V. Efimov, S.M. Mikhailov, V.A. Nefedov, V.T. Shimko and others. Accordingly, at logical level 2, let's call it “transitional”, the need for “goal setting” is considered through compliance with collective goals, when the needs of the local community come to the fore. The need for “life support” can no longer be satisfied only by the quality of security, and is becoming an expanded – accessibility, in line with the values of an inclusive society. The need associated with “identity” also expands its interpretation and is provided by the

[97] Zinchenko A.P. Need as a basis for the process of designing an object-spatial environment // Man and the environment: psychological problems: Proceedings. conf. in Lohusalu, Jan. 1981 Tallinn: EOOP USSR. 1981. P. 60-63.

[98] Slinkova O. K. Evolution of service in the context of a humanitarian approach // Economic and Management Congress: Collection of articles based on the materials of the International Scientific and Practical Event of the National Research University "BelSU", Belgorod, November 11–12, 2021. Belgorod: Belgorod State National Research University, 2021, pp. 372-377.

quality of the environment, which can be described as a social identity necessary to increase the psychological comfort of a person.

The third logical level, and the final one within the framework of this analysis, is proposed to be considered from the point of view of current trends, when the service economy was replaced by the knowledge economy, which transformed the architectural and design paradigm towards a sustainable development strategy, awareness of responsibility for the future, and put in the forefront the need of the individual for self-development[99]. Research in this direction is carried out by such specialists as N.S. Aganina, T.Yu. Bystrova, G.V. Esaulov, N.F. Metlenkov, L.M. Ptitsina and others. In the knowledge paradigm of the world order, reflected in the Design of the WDS 2017 Declaration, adopted in Montreal, design is seen as an activity that solves environmental and social problems and contributes to the preservation of culture[100] [101]. Another fundamental document is the 2008 Quebec Declaration on the Conservation of the Spirit of Place, which has become part of a series of measures and activities carried out by ICOMOS to preserve and promote understanding of the spirit of the place, namely its existence, social and spiritual nature[102] [103]. Accordingly, on logical level 3, let's call it "advanced", the need for "goal setting", in this vein, is appropriate to interpret through such a quality of the environment as personal goal setting, which denotes the personal context of goal setting in the environmental space, its ultimate individuality. In other words, the personification of the process of mastering all the qualities of the environment, in order to create conditions for creative self-realization. The need for "life support", at this level, provides such a quality of the environment as sustainability in the sense of viability, the preservation of the present and future of the environment under the influence

[99] Tyukavkin I. N. Knowledge Economy [Electronic resource] // Bulletin of SamGU. 2014. No. 6 (117). URL: https://cyberleninka.ru/article/n/ekonomika-znaniy (date of access: 12/25/2021).
[100] Design declaration. [Electronic resource] URL: https://www.designdeclaration.org/declaration/ (date of access: 12/8/2021).
[101] Kataeva E. A. etc. Strategic directions for the development of modern design in the light of the ideas of the Summit-2017 // Academic Bulletin UralNIIproekt RAASN. 2018. No. 1 (36). pp. 73-78.
[102] Quebec Declaration on the Preservation of the Spirit of Place [Electronic resource] / Adopted in Quebec, Canada, October 4, 2008. URL: https://obzor.westsib.ru/data/files/kvebek.pdf (date of access: 12/8/2021).
[103] Esaulov G. V. About identity in architecture and urban planning // Academia. Architecture and construction. 2018. No. 4. P. 2-18.

of external influences[104] [105]. The need for “identity” is provided by the quality of cultural identity – endowing the space with meanings and associations associated with the “spirit of the place”.

Thus, the qualities of the environment that meet the needs of the target audience underwent changes at each logical level in the process of analysis (depending on the level of development of society), which made it possible to reveal their inner essence. The next step in the study is to study the logical limits, which will allow not only to determine the composition of qualities, but also to trace the features of the interaction between them.

Each logical limit reflects a limited number of logical levels and their carriers that can be observed in the environment, that is, its qualitative characteristics. So on logical limit 1, when the design of the environment arises as a field of activity, the qualities that the environment has as a system that are significant for meeting human needs are compliance with public goals, security, and spatial identity. By the end of the 20th century, on logical limit 2, they are supplemented by compliance with the goals of collectives and communities, accessibility, social identity. At the present stage, designated as logical limit 3 - the environment, as a system object of conceptual modeling in design, can get its characteristics already on the basis of the interaction of nine qualities, since the previous ones have been added: compliance with the user's personal goals, sustainability, cultural identity (Fig. 2.2.1).

Further analysis can be carried out based on the transformability parameter, which allows you to explore combinations of qualities on each logical limit. Since the design of the environment works with spatial, procedural and subject characteristics, it is possible to use tools specific to these three semantic blocks of design and conceptual modeling to ensure each quality of the environment.

For example, consider the need for “life support” in conceptual modeling, at the initial stage of project activity in the design of the urban environment, for logical limit 3

[104] Esaulov G. V. Sustainable architecture - from principles to development strategies [Electronic resource // Bulletin of TGASU. 2014. No. 6 (47). URL: https://cyberleninka.ru/article/n/ustoychivaya-arhitektura-ot-printsipov-k-strategii-razvitiya (date of access: 06/16/2022).

[105] Leizerova A.V., Bagina E.Yu. To Understanding Sustainability in Architecture // International Research Journal. 2017. No. 3 (57) Part 2. P. 150-152.

based on the transformability 3 parameter. The qualities of the environment that are responsible for meeting this need are safety, accessibility and sustainability. Accordingly, it is possible to obtain the number (list) of objects: security at the levels of space (zoning and design solutions), processes (delimitation of traffic flows) and content (lighting, color coding, etc.); accessibility at the levels of space (creation of smart objects), processes (development of regulations) and content (organization of a navigation system); sustainability at the level of space (creation of design solutions capable of self-sustaining and self-regulation), processes (energy saving, recycling) and filling (rejection of disposable items in favor of reusable and made from recycled materials), etc. Further detailing can be carried out in sufficient detail. Thus, the transformation (transformation) of the information received at logical level 3 and logical limit 3 makes it possible to obtain a list of conceptual solutions and objects of environmental design, the combination of which will make it possible to realize the need for life support, considered from the point of view of the information criterion. The development of the qualities of the environment, realizing the need for goal setting and identity, must be done for each specific design object, using the results obtained when working with instrumentation as an algorithm for conducting a search.

Thus, having built the process of cognition of an object based on an analysis of the level of development of society, from the moment the design of the environment emerged as a design discipline to the present, three information criteria (initial, transitional and advanced) were identified, which is the minimum necessary to describe the user qualities of the environment with conceptual modeling positions that are significant to meet the needs of the target audience. Accordingly, the “Final information flow” acts as a specifically organized system of these information criteria, and the environment is represented as a system object, the consumer qualities of which, from the point of view of conceptual modeling in design, develop in strictly specified directions. All these aspects are reflected in the three parameters of the model, which ensure the adequacy of the procedure for identifying and describing the object of study, which allows you to obtain new data on the nature and user qualities of the environment, as an object of

conceptual modeling in design, responsible for meeting the needs for goal setting, life support and identity.

Accordingly, the hypothesis was confirmed that the identification of the regularity of the process of cognition of human needs, from the point of view of conceptual modeling in the design of the environment, will allow us to highlight their separate qualitative characteristics and carry out both their identification and description.

When constructing this categorical model, it was possible to obtain refined qualitative characteristics of the environment, from the position of conceptual modeling, in accordance with the changing needs of society. This classification has an applied character and meets the objectives of the environment design, unlike other studied options.

The novelty of the results lies in the fact that the user qualities of the environment from the point of view of conceptual modeling in design are presented in the form of a multi-level information system that reflects their change (development) as the acquisition of new attributes, which made it possible to develop their typology and description of these levels. However, from the point of view of the completeness of the results obtained, there remains a potential for development: both in the direction of clarifying the qualitative composition of the environment in shorter time periods of analysis, and interpreting the qualitative characteristics themselves for countries with socio-cultural conditions other than in the Russian Federation.

As a result of the study, based on the needs in the implementation of which the design of the environment can productively participate, the logical levels in the development of design were determined at which the social paradigm changed, which influenced changes in the interpretation of these needs. For each logical level, the main qualities of the environment are proposed and interpreted, the combination of which and the transformation to the level of structural elements in accordance with the directions of design efforts (space, processes and content) allows us to identify the ways and specifics of further research and conceptual modeling.

The scientific work done has made it possible to contribute to the development of the theory and methodology of environment design, in particular, to solving the problem

of choosing adequate methods for studying the subject area by demonstrating the productive potential of relevant general scientific approaches; and also to clarify the conceptual apparatus of the specialty, in the field of describing the user qualities of the object of conceptual modeling in the design of the environment.

Thus, the theoretical basis for further research can include the result obtained, according to which the objects of conceptual modeling in the design of the environment are provided with the following user qualities:

- need for life support – the qualities of safety, accessibility, stability;
- need for goal setting – compliance with collective, public, personal goals;
- need for identity – qualities of regional, social, cultural identity.

The proposed information model can serve as an algorithm for identifying the main user qualities in the environment as a design object in the implementation of practical activities: in competitive and educational work, as well as in participatory design. Further, the author is supposed to conduct a qualitative analysis of the mechanism of interaction obtained as a result of the study, the components of the object and the user component in conceptual modeling in the design of the environment.

2.3. Model of the mechanism of interaction between the components of conceptual modeling in the design of the environment

The procedural essence of design in general and environment design in particular, underlying conceptual modeling, is its dialogic nature. This is a dialogue between the author and the user of the design activity through the design object. However, in the design of the environment, the design object itself is a complex multi-component system that combines spatial, subject and process characteristics. The relevance of the study, therefore, is due to the need to study the features of the mechanism of interaction between the designer, the object and the addressee of design in the design of the environment as components of conceptual modeling, taking into account the specifics of the object itself.

Questions project activity as a form of interaction between the components "designer – object – user", were engaged in: N.S. Aganina, L.A. Barash, N.I. Barsukova,

T.Yu. Bystrova, E.V. Zherdev, N.Yu. Kazakova, I.S. Karimova, K.A. Kondratieva, E.N. Lazarev, G.N. Lola, G.A. Lanshchikova, S.M. Mikhailov, V.V. Saakov, Yu.A. Simakova, V.F. Sidorenko and others. As a result of the analysis the need to study the communicative qualities of design, on the one hand, and the high potential for obtaining productive results when rooting the theory of design in the general scientific field, on the other hand, have not lost its relevance. From the point of view of an in-depth study of the mechanism of functioning of the "designer – object – user" system, as equivalent components, there is insufficient study of this issue, since the main attention is focused on the interaction of the "user – designer" pair, and the object is interpreted precisely as a means of communication. As a result, you can draw conclusions about the need to fill this gap in scientific knowledge.

Based on the theoretical base of the study, the mechanism of interaction between the designer, the user (the addressee of design in the design of the environment) and the object of project activity, in terms of conceptual modeling, is due to its qualities as a single information and energy system of complementary components[106]. In this regard, it is assumed acceptable to assume that the construction of a single system that includes the designer, user and object in the design of the environment, as well as the study of the functioning of the contradiction due to the redistribution of energy between them, as components of conceptual modeling, will determine the nature of the interactions between the components, the impact on which will provide the possibility of self-regulation and management of conceptual modeling.

Research objective is description of the mechanism of interaction between the components of conceptual modeling in the design of the environment through understanding and describing the nature of mutual support and limitation. Disclosure and description of the basic principles of the desired mechanism will allow us to develop a methodology for the effective management of conceptual modeling in design.

[106] Barsukova N. I. Design of the environment in the design culture of postmodernism of the late XX - early XXI centuries: author. dis. ... Doctor of Art History: 17.00.06. M., 2008. 55 p.

The results of the current stage of the study are published in the article “The mechanism of the functioning of artistic design in the design of the environment: inter component relations of contradiction”[107].

The culturological approach “allows to preserve the fundamental plurality of interpretations of the concept of design and, accordingly, to substantiate the methodological pluralism of the design practice itself”, that is, it provides an opportunity to turn not only to different research schools, but also to various philosophical directions[108]. In this regard, the choice of a productive methodology is justified by the fact that “the designer's reflexive exit to the philosophical meta-level allows him to convincingly build a holistic methodological system of project activities in design”[109]. As a productive, for analysis, we will use the categorical-system methodology, in which categorical schemes are cognitive tools for representing knowledge in a complex form. This is not reduced only to the task of increasing the epistemological capacity of knowledge, but is associated with the use of special units of organization of knowledge and the cognitive process, which are categorical schemes. “The Categorical-system methodology is based on the development of categorical schemes based on the provisions of ontology, a systematic approach”[110].

At the same time, a special stream of thinking is associated with each of the categories, but together they are coordinated by the structural and functional features of these categorical schemes. Each of the categorical schemes concentrates in itself a certain class of regularities, which with its help are transferred to the selected subject area. All elements of the scheme are perceived simultaneously, representing a specially organized unit of thinking, where the figurative-metaphorical and formal components complement each other.

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[107] Tolstova A. A. The mechanism of functioning of artistic design in the design of the environment: inter component relations of contradiction // Art Education and Science. 2021. No. 4 (29). pp. 57-66.
[108] Aganina N. S., Filonenko D. Yu. On the problem of forming the categorical-conceptual apparatus of the course "history and methodology of design design" // Technical aesthetics and design research. 2019. Vol. 1. No. 2. P. 12.
[109] Kovtun V.V., Lanshchikova G.A. Philosophical reflection of design-design methodology // Omsk Scientific Bulletin. 2014. No. 2 (126). P. 102.
[110] Razumov V. I. Methodology of scientific research // Science of man: humanitarian research. 2014. No. 1 (15). P. 165.

Symbolic methods are a special group in the Categorical-system methodology. At the same time, a symbol is understood as: “an image that connects the technology of organizing knowledge of a certain type with a metaphorical meaning; acts not only as a tool for packaging knowledge, but also as a factor ... connecting the potentials of logical and figurative ... thinking”[111]. Categorical symbolism makes it possible to study the essential aspects of objects, based on centuries of experience in the use of symbols in human cognitive activity. In the Categorical-system methodology, symbols are subject to systemic interpretation and act as the basis for constructing categorical schemes.

So, as a result of the analysis of scientific literature, it was decided to analyze the mechanism of interaction between the components of conceptual modeling in the design of the environment: designer – object – user, while the object (the object of conceptual modeling in the design of the environment), according to the definition obtained at the previous stage of the study, is deciphered by the triad of components: area, purpose and content. Accordingly, the object of research is no longer a triad (designer – object – user), but a pentad.

For the analysis of the pentad, the most productive method is the symbolic method – “Pentagram”. As a system research tool, this method has been actively used since 1990, first in the context of homeostatics and, later, as a tool for interpreting categorical systems to express a specific type of distribution of contradiction.

There are several examples of the scientific application of this method: modeling the process of communication between the museum and the visitor; study of the essence of the phenomenon of the intellectual capital of the organization and the study of the mechanism of its functioning; description of the directions of development of the region and the mechanism of interaction of regional organizations with each other[112] [113] [114]. Of

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[111] Bosch G. D., Razumov V. I. Methodology of scientific research (in candidate and doctoral dissertations): textbook. M. : INFRA-M, 2020. S. 139.

[112] Kildyusheva A. A. Modeling the process of museum communication with the tools of categorical-system methodology // Omsk Scientific Readings - 2018. 2018. P. 342-344.

[113] Nedoluzhko O. V. Study of the system of relations between the elements of the intellectual capital of an organization using the symbolic method "Pentagram" of the Chinese philosophy of wu-sin // Azimut of scientific research: economics and management. 2018. V. 7. No. 1 (22). pp. 201-205.

[114] Tikhonova A. D. Directions for the development of the region from the point of view of categorical-system methodology // Development of territorial socio-economic systems: issues of theory and practice: materials of the XVI International Scientific and Practical Conference of Young Scientists (Yekaterinburg, March 12–13,

the possible reconstructions of the pentagram, when applying the method, a combination of two orders of arrangement of elements is used: mutual generation (it is displayed by a sequential arrangement along a circle) and mutual overcoming (a combination of elements along the rays of a star inscribed in a circle)[115].

The method is implemented in the following sequence:

1) identifying features that allow you to correlate the elements of the system with the tops of the pentagram;

2) identification of an intrasystem resource in an object circulating between its elements;

3) description of relations of mutual support and mutual limitation of elements (attributes) in the object;

4) formulation of recommendations for managing the system.

So, let's imagine the system "designer – object – user" in the form of the following scheme: in the center we place a triangle - this is an object of conceptual modeling in the design of the environment in accordance with the definition obtained earlier by the method "Two-level triadic decoding of the base category", on two sides we will place a pair of interacting components – "User" and "Designer" (Fig. 2.3.1. a). At the same time, the "Designer" is the moderator of all processes in the system, and the "User" is the initiator of changes. The qualitative changes themselves are due to basic human needs that are significant from the point of view of environmental design in terms of life support, goal setting and identity[116]. In order to correctly place the triad of concepts that decipher the object of conceptual modeling in the design of the environment, it is necessary to choose a starting point in accordance with the result obtained at the previous stage of the study. Accordingly, component 0. "Area" (material, temporal, cultural) since the object of conceptual modeling in the design of the environment is always space: anthropogenic, natural or natural-anthropogenic origin. Component 1. "Purpose" (functional, technological, aesthetic) in the sense of goal setting. Component 2. "Content" (subject,

2019). Yekaterinburg: Institute of Economics of the Ural Branch of the Russian Academy of Sciences, 2019. P. 63-66.

[115] Razumov V. I. Methodology of preparation and intellectual and technological support of scientific research: author. dis. ... Doctor of Philosophical Sciences: 09.00.01. Novosibirsk, 1997. 38 p.

[116] Tolstova A. A. Consumer qualities of the environment from the point of view of design: information model // Design. Materials. Technology. 2021. No. 1 (61). pp. 43-49.

process, semantic), which is a basic feature that initially highlights the environment as a design object in the field of project activities[117]. Thus, the following variant of displaying conceptual modeling in the design of the environment in the elements of the pentagram is proposed: “0. Object: Area”, “1. Object: Purpose”, “2. Object: Content”, “3. User: Usage”, “4. Designer: Designing”. At the same time, components 3 and 4 are newly introduced components corresponding to the functional role of the user and the designer as participants in communication, which complement the previously identified components of the conceptual modeling object in the environment design (Fig. 2.3.1. b).

Since the balancing component of the system is the “Designer”, and the environment as an object of conceptual modeling is a self-regulating system, it would be reasonable to accept “systems thinking” as the resource that circulates in the system, stimulating the mechanism of interaction between the components. In this case, the leading one will be the contradiction of the components between which the main resource of the system is dispersed. This is a pair where one component shows a maximum of activity 1. “Purpose”, and the other is the most passive 0. “Area”, and the remaining components can be considered as being in a transitional state. Based on the foregoing, let's move on to describing the relationships between the components. So, the decoding of the pentagram occurs on the basis of the analysis of the following two orders of occurrence of the components: generation (the movement of the resource along the outer circle of the scheme) and oppression in the meaning of control (along the rays of the star). At the same time, the movement of the resource clockwise is optimal in terms of resource consumption, which produces the effect of normal relationships and, accordingly, leads to the strengthening of the system, and counterclockwise - vice versa.

Let's analyze the relationship of mutual support between the elements of the “Pentagram” (Fig. 2.3.2). “Area” provides direct support to “Use” by defining the conditions for the realization of needs, which leads to the generation of “Purpose” of development. Which, in turn, affects the “Design”, initiating the task, and as a result,

[117] Tolstova A. A. Environment as an object of design: definition of the concept by the method of two-level triadic decoding [Electronic resource] // Architecton: university news. 2021. No. 2 (74). URL: http://archvuz.ru/2021_2/16/

leads to the formation of “Content”, which transforms the “Area”, starting a cyclic process in the system. If we consider the variant of pathological support, then the increased attention of the designer, in terms of directing systemic thinking to work with space, weakens the attention to user requests, which provides inverse support to goal setting, i.e. the formation of directions for the development of the system and, in turn, weakens the possibilities of the designer himself, as a participant in communication, which leads to a weakening of the meaning of filling the space (process, subject and semantic).

Let's move on to the next stage of the analysis: the study of mutual control between components, i.e. restrictions vital for the existence of an object, ensuring its homeostasis and stability of functioning in the environment (Fig. 2.3.3). Thus, in the case of a normal constraint, “Area” determines the “Purpose” of the development of the system, which controls its “Content”, forcing the “Use” to remain within certain limits (correcting the user's request), which limits the “Design”, i.e. the designer as a socially responsible designer who, in turn, controls the “Area”, thereby defining the boundaries of design. In the case of a pathological limitation, when the user influences the content, bypassing the designer, then the “benefit-beauty” balance is destroyed in the direction of strengthening functionalism; further, the filling suppresses the directions of the system development, rigidly fixing them within the limits of the available components. At the same time, “Purpose” counteracts “Area”. On the contrary, when “Area” (material, temporal, cultural) limits “Design”, then the designer practically becomes deprived of the tools to change anything. The extreme option, when the designer changes his professional mission as a moderator, limits the user, striving only for self-expression in creativity, to the detriment of the social request.

Let us generalize the results obtained. It turns out that the driving force for the “Design” component is “Purpose” - goals, the presence of which supports the very existence of design. In turn, the design for the implementation of goals is reflected in the “Content” component. By influencing the space with the help of filling, the design has a depressing, controlling effect on it, subordinating it to its control. Finally, the design gets oppressed by the user. With excessive activity, the “Design” component is able to provide feedback to the “Purpose” component, for example, to focus its attention on the formation

of professional goals. As a result, there is a reverse oppression of the "User" component, which can manifest itself in a more or less decisive revision of the target audience's arsenal of requests[118].

However, with excessive activity or weakness of any component, pathological relationships arise (weakening of the system), which are less beneficial, since they require significantly higher costs to achieve their goals. Accordingly, the destruction of the mechanism of interaction between the components of conceptual modeling in the design of the environment can occur "through one component, the violation of the activity of which has exceeded the limit allowed for this system"[119]. Therefore, "from the point of view of management, the laws of the pentagram provide for some features. Firstly, in the diagnostic plan, all violations of the elements are divided into two groups - an excess or a lack (of a resource). Secondly, all the impacts that eliminate them come down to adding or taking away a resource. Thirdly, indirect influences on elements are preferable"[120].

Consider a variant of applying the control of the functioning of the mechanism of conceptual modeling in the design of the environment "designer – object – user". There is an excess resource in the Usage component. We take a part of the resource from the Purpose component and pass it to the Content component. As a result, a systemic effect is observed: "Use" transfers excess energy to the weakened "Purpose", and increased "Content" begins to more actively oppress "Use", thus restoring the normal functioning mechanism of conceptual modeling in the design of the environment. In practice, it may look like this: when applying the participatory technique, they often try to shift full responsibility for the decisions made to the user, which is not entirely true, since this causes the designer to pay too much attention to the needs of the target audience, the generation of which is not limited by anything. The action leads to an unbalance of the conceptual modeling mechanism in the design of the environment. If you use the knowledge about the possibilities of management, then part of the system thinking of the

[118] Tolstova A. A. The mechanism of functioning of artistic design in the design of the environment: intercomponent relations of contradiction // Art Education and Science. 2021. No. 4 (29). pp. 57-66.
[119] Razumov V. I. Methodology of preparation and intellectual and technological support of scientific research: author. dis. ... Doctor of Philosophical Sciences: 09.00.01. Novosibirsk, 1997. P. 19.
[120] Ibid., P. 21.

designer from the choice of directions for the development of the system, based on the analysis of the identified needs, must be transferred to the formation of the content (process, subject and semantic) of the environment as a design object based on his professional knowledge. As a result, the filling of the space proposed by the designer begins to gradually limit the needs of the target audience, which, in turn, begin to form the directions for the development of the environment (functional, technological, aesthetic) in a more constructive and systematic way. Accordingly, using the ternary expression of the contradiction, it is possible to implement a variant of indirect control, the result of which is more stable and environmentally friendly than in the case of a direct (direct) action on the component.

Thus, as a result of the study, it was possible to:

- to develop a model of conceptual modeling in the design of the environment "designer - object - user", presented as a set of five components or attributes that mutually support and mutually limit each other in the cycle of generation and reproduction;
- comprehend the nature of mutual support/limitation of the components of the object;
- propose a concept of managing the functioning and development of the object of study.

The resulting categorical model can be interpreted as an optimal contradiction distribution algorithm that ensures the homeostasis of the system. From the point of view of the interpretation of the design of the environment, N.I. Barsukova, as a single information and energy system of complementary components included in the theoretical base of the study, the results obtained do not contradict it, but, on the contrary, clarify the system "designer – object – user" as a categorical-symbolic model of interacting components of conceptual modeling in the design of the environment.

The novelty of the results lies in the extended interpretation of the "designer – object – user" system in terms of the design object, which is considered as a triad on the basis of a previous study, while not only the composition and characteristics of the components of conceptual modeling in the design of the environment are analyzed, but

also the mechanism of functioning, on the basis of identifying relationships of mutual support and limitation.

Thus, a model of the mechanism of interaction between the components of conceptual modeling in the design of the environment has been developed, which differs in that it is based on the inter component relations of direct and inverse constraints in a star-shaped closed chain of components of the conceptual modeling in the design of the environment (between “Object: area”, “Object: purpose” , “Object: content”, “User: use”, “Designer: design”), which allows effective control of the specified mechanism by influencing intercomponent (intrasystem) interactions (relationships).

The scientific work done has made it possible to contribute to the development of the theory and methodology of environment design, in particular, to solving the problem of choosing adequate methods for studying the subject area by demonstrating the productive potential of relevant general scientific approaches. Also, the contribution to scientific methodology in general can be identified, since the study demonstrates the productivity of applying the categorical-system methodology for structuring analytical work in the field of design arts. For the first time, the symbolic method “Pentagram” was applied in the field of design in order to study the aspects of the object of study that are significant for its development.

The practical value of the results lies in the potential of using the proposed model to indirectly control the process of conceptual modeling in environmental design by distributing the designer's systemic thinking between the components of the object, as well as to develop a methodology for conceptual modeling in environmental design.

Prospects for the application of the results obtained require further research. For a more complete analysis of the features of the interaction of the components of the system, it is assumed, in addition to the mechanism of support and limitation, the study of internal contradictions using the methods of categorical-system methodology and homeostatics. The cumulative result will make it possible to develop a conceptual modeling methodology adapted to the specifics of the environment design.

2.4. System of models of inter component contradictions of conceptual modeling in environment design

Relevance of the research topic due to the fact that the environment has a large number of components, elements and other components, and in real design, the criteria for its modernization come into conflict. At the same time, the involvement of the designer, as an active participant in the transformation of the environment, requires scientifically based updating of the conceptual modeling of the interaction of components in the design process. Under these conditions, it is necessary to develop and propose a mechanism for managing emerging contradictions both between the components of the environment themselves, and when bringing them into line with certain criteria for organizing space. This will make it possible to obtain a productive tool for influencing the environment as a complex self-developing system and, subsequently, to form mechanisms for indirect control of it based on conceptual modeling. The result achieved will contribute to the realization of the possibility of scientifically based creation of a comfortable living space, on the one hand, and the improvement of the skills of designers, on the other.

The duality of the design essence of environment design, which forms internal contradictions that distinguish environment design from other design specialties, substantiating the specifics of its design methodology, was studied in their works by such authors as B.G. Barkhin, A.V. Bokov, V.G. Vlasov, V.L. Glazychev, Z.Z. Ziyatdinov, I.S. Karimova, Yu.I. Karmazin, G.A. Lanshchikova, G.B. Minervin, M.V. Pankina, V.F. Sidorenko, L.P. Kholodova and others. In their works they consider the following pairs of opposite elements: utility and beauty, matter and spirit, space and content, real and ideal, art and science, etc.

However, as a result of the analysis, gaps were found in terms of studying the mechanism of contradictions between opposites both in the design of the environment, in general, and in conceptual modeling, in particular, which makes it possible to conclude that this gap needs to be eliminated. This suggests that the allocation of basic relations in conceptual modeling that determine its current functioning, potential and possible

directions of development will allow us to develop a system of models of inter component contradictions that contribute to solving problems of conceptual modeling.

The aim of the study is to explore the most significant inter-component contradictions of conceptual modeling in environmental design. The result obtained will make it possible to identify and describe their content, as well as the role of the designer's systemic thinking, which allows you to regulate these contradictions.

The results of the current stage of the study are published in the article "Environment as an object of design engineering: a mechanism for regulating intra-system contradictions"[121].

Design theorist O.I. Genisaretsky, in a lecture on the place of design in the system of strategic work, made the following important generalization: "... the entire design methodology was developed ... on the subject field: A) design and architecture ...; B) partly it included general ideas from the field of systems engineering, which talked about the design of system objects in general"[122]. This allows, for further research of inter component interactions of conceptual modeling, to continue using the actual general scientific categorical-system methodology, which appeared as a result of the development of system analysis. The circuit engineering aspect of this methodology allows you to include categories in categorical schemes and thus organize knowledge about the object, while the knowledge itself can be transformed based on the methodology embedded in the corresponding class of categorical schemes. In addition to the structure of the object of study obtained in this way, the functional aspect of the categorical-system methodology allows us to study the development of the object based on the consideration of the mechanism for moving a system resource between categories as structural nodes of the scheme.

Within the framework of categorical-system methodology, productive, in the context of this study, are methods for studying objects with internal contradictions that all complex objects have. Their knowledge makes it possible to obtain a more complete

[121] Tolstova A. A. Environment as an object of design: a mechanism for regulating intra-system contradictions // Academic Bulletin UralNIIproekt RAASN. 2022. No. 1 (52). pp. 90-94.
[122] Genisaretsky O. I. Lecture on the place of design in the system of strategic work [Electronic resource] // School of Cultural Policy. URL http://www.shkp.ru/lib/archive/second/2001-1/1 (date of access: 05/29/2021).

and accurate knowledge of the object, its functioning and development, and, in the future, to manage these contradictions, taking into account objective characteristics. The method chosen to achieve this goal was the categorical method "Universal Contradiction Scheme". At the same time, the elementary contradiction in this case is understood as: "a relation that ensures stable interaction of two elements of opposites in an object, based on the redistribution of the basic resource between them"[123]. However, the contradiction can be non-elementary if there are more than two opposites – this creates conditions for the stability of the system and its ability to self-regulate.

The method is implemented in the following sequence:

1) identification of two elements-opposites between which there is a contradiction and the basic resource circulating between them;

2) identification of maxima and minima in the values of the vital parameters of each of the opposite elements and a phase shift in their functioning, due to the receipt of a basic resource;

3) highlighting the middle element (characterized by greater autonomy), balancing the interaction of the two extreme ones (which are individually unstable);

4) determination of the coordinated interaction of all three elements in the object and a description of the nature of the contradictions between them.

In order to develop a system of models of inter component contradictions of conceptual modeling in the design of the environment and based on the model of the mechanism of interaction between the components of conceptual modeling developed by the author, it is proposed to consider the contradiction between the following pairs: 0. "Area" (material, temporal, cultural) – 1. "Purpose" (functional, technological, aesthetic) and 2. "Content" (subject, process, semantic) – 3. "Use" (life-supporting, target, identical), as between alternative trends in the development of the system (Fig. 2.4.1). "Design" is defined as the control component, and "systems thinking" is singled out as the basic resource in the model, which makes it possible to identify the dependence

[123] Bosch G. D., Razumov V. I. Methodology of scientific research (in candidate and doctoral dissertations): textbook. M. : INFRA-M, 2020. S. 121.

of the stability of conceptual models in the design of the environment on its distribution between the specified components.

Accordingly, this makes it possible to satisfy the necessary condition for the emergence of a contradiction – the presence of differences in each of the elements, at least on one basis. A sufficient condition is the unfolding of the process of mutually agreed change of elements-opposites occurring within the balance achieved in the course of the redistribution of the basic resource, which is observed due to the complexity of the approach in conceptual modeling in relation to all components of the environment.

Further, in the course of the study, maxima and minima were revealed in the values of the vital parameters of the first pair of opposite components: 0. “Area” – 1. “Purpose”. So, for Component 0.0. “Material area” diametrically opposed means of forming the appearance of an environmental object, in order to harmonize it in the process of conceptual modeling, can be a plane and a volume. Accordingly, these values can be designated as two poles. The first, “volume” is the maximum, when the environmental object reaches this parameter, that is, when the space is compressed to the state of the environment-forming object, the creative transition of the environment designer to another professional area takes place – volumetric architectural design or monumental art. The second, “flatness” is a minimum, when the continuous expansion of the boundaries of an environmental object leads to its dissolution in a larger environmental system.

For its paired Component 1.0. “Functional purpose” the search for the minimum and maximum must be carried out in terms of the degree of activity in the development of material space. Accordingly, it is proposed to contrast two design approaches of the designer to the organization of environmental processes: from the creation of a creative space – “creation”, to the formation of conditions for minimal contact, through the consolidation of the state of “contemplation”.

Next, it is necessary to identify a phase shift in the functioning of opposite elements, due to the receipt of a basic resource. Since the regularity of the contradiction lies in the fact that its movement is determined by the changes occurring within each of its opposites, which are interdependent, but differ in a number of signs, then the changes

within the opposites proceed with a phase difference. An indicator of the multidirectionality of actions is the phase shift between them. While one opposite increases, the other decreases, and vice versa. Accordingly, we get two pairs: “material plane for the function of creation” and “material volume for the function of contemplation”. Both options are due to the cyclic flow of systems thinking as a basic resource between the components. At the same time, the value of the functioning parameter of one component is extremely low, and the second is extremely high, respectively, if any of these parameters is exceeded, conceptual modeling, as a system, loses stability and the modeling object goes beyond the specialty. So, the option “material volume for the function of contemplation” in which the space already ceases to be a medium, since it practically loses its key features, and is perceived from the outside, detached – does not meet the definition of the concept of “environment design” and is in the professional field of “art design”, “monumental art”, ”speculative design”, “actionism”, etc. The option “material plane for the function of creation” also goes beyond the concept of “design of the environment”, and refers to the field of performing arts in its various manifestations from performances and game entertainment to grandiose shows.

The second subgroup of contradictory components was studied using a similar algorithm: 0.1. “Temporary area” and 1.1. “Technological purpose”. The extreme states for the component “Temporary area” seem to be possible to accept – variability and stability. Variability – denotes the most dynamic state of space-time as a system, and stability – the minimum changeable, that is, static. For the “Technological purpose” component, the search for extreme states, in terms of using system thinking as a resource for conceptual modeling, must be carried out from the position of “programming” of the process. Accordingly, it is proposed to accept the maximum – the implementation of a rigid algorithm, and the minimum – improvisation in the organization of processes. Based on the phase shift provided by the overflow of “systemic thinking”, two pairs were obtained: “stable space-time for a technological algorithm” and “changeable space-time for technological improvisation”. The first pair names a space that provides rigidly structured technological processes, for example, a factory conveyor. The second pair can

be illustrated by such an example as a technopark, which provides for maximum variability. As in the case of the previous components, both identified extreme states are outside the scope of the specialty “environment design”.

Let's move on to the analysis of the third subgroup of components that are in a state of contradiction: 0.2. “Cultural area” and 1.2. “Aesthetic Purpose”. For the “Cultural area” component, the criterion for identifying extreme states is its harmony. From this position, the most harmonious state of the component can be taken as the integrity of the cultural space, and the minimum – its deformation. For the “Aesthetic Purpose” component, it seems appropriate to base the choice on opposite approaches in design when working with environmental objects - synthesis and contrast. Accordingly, the maximum value will be the formation of a new aesthetic by means of a contrast solution when creating a new quality of the environment, and the minimum will be the “mimicry” of the design into the environment based on the aesthetics of synthesis. Thus, two pairs were obtained during the functioning of the opposite components associated with obtaining a basic resource (systemic thinking): “deformation of the cultural space for aesthetic contrast” and “integrity of the cultural space for the aesthetics of synthesis”. Accordingly, the first pair implies a radical update, and the second pair implies a total preservation of the context. Both extreme states transcend the specialty and signify architectural refurbishment and restoration, respectively.

So, in a state when the value of the parameter of the functioning of the component 0. “Area” is extremely low, and 1. “Purpose” is extremely high, the following vector of development of conceptual modeling is formed: “material plane for the function of creation”, “stable space of time for the technological algorithm”, “warping cultural space for aesthetic contrast”. Accordingly, this characterizes the result when systemic thinking is aimed at solving the purpose of the object and practically ignores spatial characteristics. In the opposite case, when the maximum amount of resource (systemic thinking) is directed to component 0. “Area”, respectively, the minimum gets component 1. “Purpose”, we get the following development vector of conceptual modeling: “material volume for the function of contemplation”, “changeable space of time for technological improvisation”, “the integrity of the cultural space for the aesthetics of synthesis”.

Further, it is necessary to consider the second pair of components-opposites: 2. “Content” – 3. “Use”. Namely, the filling of space allows for its intended use, reflecting the nature of the appearance of the design of the environment, as a “real” filling of space in order to humanize it.

The first subgroup of the study is 2.0. “Subject content” and 3.0. “Life-Sustaining Use”. For the “Subject content” component, it is permissible to take ergonomics as the maximum value, and provocativeness as indicators of the comfort level of the living environment as the minimum value. For the “Life-supporting use” component, the criterion for selecting extreme states is the need for life support, respectively, the minimum parameter in terms of personal energy expenditure will be consumption, and the maximum – overcoming. Accordingly, as a result of the study of the maximums and minimums in the values of the vital parameters of the elements, two pairs were obtained: “ergonomic subject content for the life support of consumption”, “provocative subject content for the life support of overcoming”. The first pair brings to the first place, from the point of view of the designer, the convenience and efficiency of the environment for a particular user, and the second one provokes the user to take active steps to adapt and adapt the environment, being an incentive for the self-development of the individual. These states are borderline between environmental design and speculative design, demonstrating interdisciplinarity.

The second subgroup includes – 2.1. “Process content” and 3.1. “Purpose Use”. For the “Process content” component, the main thing is the degree of assignment, when implementing user scenarios, accordingly, it is proposed to take the instruction as the maximum, and the catalyst as the minimum. For the “Purpose Use” component, the criterion is the level of satisfaction in relation to the target needs. Accordingly, the minimum that ensures the intended use of the environment is the realization of needs, and the maximum is the generation of new needs. Thus, as a result of the study, two pairs were also synthesized: “process filling instruction for the implementation of user goals”, “process filling catalyst for generating user goals”. The first pair obtained can be interpreted as a step-by-step algorithm for the target audience, and the second one is an incentive for the emergence of new needs.

The third subgroup – 2.2. “Semantic content” and 3.2. “The use is identical”. For “Semantic content”, the criterion becomes the degree of modernization, respectively, one of the extreme values can be taken as a “new meaning”, which is introduced into use not related to the context of the modeling object, and the second is the “traditional meaning” historically inherent in the modeling object. The maximum value will be legitimate to take the “new meaning”, upon reaching which the design will lose its connection with the environment, and the minimum value will be the “traditional meaning”, when approaching this vital parameter, the system will also lose stability, losing the qualities inherent in design as a type of design creativity. For the “use of the identical”, in the sense of satisfying the need for belonging, it is proposed to accept extreme values: regionalism and globalization, as alternative values. The maximum, in terms of meeting the need for identity, will be regionalism, and the minimum – globalization. Thus, in pairs in the functioning of the opposite components associated with obtaining a basic resource (systemic thinking), the following are defined: “new meanings of filling for the purposes of globalization”, “traditional meanings of filling for the purposes of regionalism”. The first pair – puts universality in the first place in conceptual modeling, and the second - the formation of targeting.

So, in a state where the value of the functioning parameter of component 3. “Use” is extremely low, and 2. “Content” is extremely high, the following vector of development of conceptual modeling is formed: “ergonomic subject content for life support of consumption”, “instruction of process filling for the implementation of user goals”, “new meanings of filling for the purposes of globalization”. Respectively – this characterizes the result when systems thinking is directed to the environment content to fulfill a user request. In the opposite case, when the maximum amount of resource (systemic thinking) is directed to component 3. “Use”, respectively, the minimum gets component 2. “Content”, we get the following vector for the development of conceptual modeling: “provocative subject content for the life support of overcoming”, “a catalyst for process content for generating custom goals”, “traditional meanings of content for the purposes of regionalism” (Fig. 2.4.2).

All the studies considered at this stage by the author of a pair of inter component interactions of conceptual modeling in the design of the environment can be characterized as self-regulating due to the cyclic redistribution of system thinking between them.

Further, in order to increase the stability of conceptual modeling, in terms of its systemic characteristics, it is necessary to consider the object of study as a non-elementary contradiction. For this, it is important to identify the middle element that balances the interaction of the two extreme elements, as an element that is more autonomous than the extreme elements and is able to regulate the process of redistributing resources between them. In this case, to improve the efficiency of component management, the subject of management must associate its position with the middle element “Design”. Accordingly, the designer performing the modeling assumes the function of redistributing the basic resource between the components of the conceptual modeling, thus regulating their functioning and development, acting as a subject of management (Fig. 2.4.3).

Thus, a system of models of inter component contradictions of conceptual modeling in the design of the environment has been developed, based on the interaction of objects-opposites. At the same time, the application of the method “Universal scheme of contradiction” of the categorical-system methodology made it possible to obtain scientific results that are significant for the object of study:

1. identify and comprehend the content of the contradictions between the components of conceptual modeling in the design of the environment, as well as realize the importance of the designer's systemic thinking, which allows you to regulate these contradictions;
2. comprehend the features of the functioning of the components in the state of maximum consumption of the basic resource (systemic thinking), thus clarifying the boundaries of the object of study, and indirectly confirming the previously obtained definition of the concept of “object of conceptual modeling in the design of the environment”;
3. get a basis for considering the object of study as a homeostatic system, which will allow us to start developing its management, that is, considering the mechanism for maintaining its internal dynamic balance, stability, balance, harmony.

Therefore, a system of models of inter component contradictions of conceptual modeling in the design of the environment is presented, characterized in that it is based on the interaction of objects-opposites in the process of competition for a basic resource (system thinking), which makes it possible to identify the relationship between the distribution of system thinking between the components of conceptual modeling and system stability (minimum and the maximum value of the vital parameter of the components, above which the system loses stability), that is, belonging to the professional field of environmental design, as well as in clarifying the place of the designer as a regulator of the environment as a system.

The novelty of the results obtained by the author lies in the fact that these pairs of opposites were previously considered by many researchers, but the contradictions between them were not subjected to detailed, scientifically substantiated study.

The developed system of models can serve as a basis for identifying contradictions between the components of conceptual modeling in the design of the environment in the implementation of theoretical and practical activities, as well as for the further development of a scientifically based methodology.

The scientific value of the study lies in the development of the theory and methodology of environment design, in particular, in solving the problem of choosing adequate methods for studying the subject area by demonstrating the productive potential of the categorical-system methodology.

It is also possible to indicate empirical prospects for applying the results obtained. The developed system of models can serve as a basis for identifying contradictions between the components in the environment as a design object in the course of practical activities. It is important to use this both in competitive and educational work, as well as when interacting with the customer. In educational activities – this will develop the skills of managing the creative process with the help of conceptual modeling; in project activities – organize the design process by managing the identified contradictions; in competitive design – will create an opportunity to justify a productive concept as a competitive advantage.

Prospects for further research are in the plane of studying the modes of functioning of the contradiction, using the method of categorical-system methodology “A simple model of a compensatory homeostat”, which will create prerequisites for the analysis of the process of conceptual modeling in the design of the environment as a controlled activity.

Conclusions on the second chapter

Based on the definition of the main features (qualities) of the phenomenon under study using the categorical methods “Triadic decoding of categories” and “Category mutations”, for the purposes of constructing a definition of the concept, a definition of the concept of “an object of conceptual modeling in the design of the environment” is proposed. The resulting definition is based on the identified fundamental components of the environment, which act as directions for conceptual modeling, which made it possible to characterize the desired concept as an integral system with material, temporal, and cultural spatiality; appointment of functional, technological, aesthetic; fullness of subject, process, semantic. A system of concepts for describing the subject area is proposed: the object of conceptual modeling in the design of the environment from the position of the user of project activities, the object of conceptual modeling in the design of the environment from the position of the designer.

Based on the typology of human needs, to satisfy which environment design tools can be applied, using the “Final Information Flow” method of the categorical-system methodology, a model of user qualities of the environment is proposed from the perspective of conceptual modeling, characterized in that consumer qualities (goal-setting, life support, identity, etc.) are presented as a multi-level information system that reflects their evolution as the acquisition of new attributes, which makes it possible to obtain data on the nature and qualitative characteristics of the environment from the position of conceptual modeling, which are responsible for meeting the needs of the target audience.

Based on the study of the mechanism of interaction between the user, the object and the designer as the interaction of the corresponding components of conceptual modeling in the design of the environment, using the categorical-symbolic method “Pentagram”, a model of the mechanism of interaction of the components of conceptual modeling in the design of the environment is proposed. The resulting model is based on the inter component relations of direct and inverse constraint in a star-shaped closed chain of conceptual modeling components in environment design (between “Object: area”, “Object: purpose”, “Object: content”, “User: use”, “Designer: design”), which allows effective control of the specified mechanism by influencing intercomponent (intrasystem) interactions (relations).

The most significant inter component contradictions of conceptual modeling in environment design have been studied; the expediency of applying the categorical method “Universal scheme of contradiction” for solving this problem is substantiated; a system of models of inter component contradictions of conceptual modeling in the design of the environment is proposed, which differ in that they are based on the contradiction between such components as: “Area” (material, temporal, cultural) – “Purpose” (functional, technological, aesthetic) and “Content” (subject, process, semantic) – “Use” (life-supporting, target, identical), arising in the process of competition between them for a basic resource (systems thinking), which makes it possible to identify the dependence of the stability of conceptual models in environmental design on the distribution of the resource.

CHAPTER 3. CONCEPTUAL MODELING IN ENVIRONMENTAL DESIGN AS A MANAGED ACTIVITY

The obtained understanding of the components of conceptual modeling in the design of the environment, the mechanism of their interaction and the contradictions between the opposite components allows us to proceed to the development of a method for managing the phenomenon under study. This problem can be productively solved on the basis of such a direction of the system approach as homeostatics, which allows you to explore the process of conceptual modeling and the possibility of managing it. On the basis of the obtained homeostatic models, it seems appropriate to develop an author's method of conceptual modeling, which makes it possible to obtain a system of conceptual models in the design of the environment and test it on model objects.

3.1. A system of models reflecting the process of conceptual modeling in environmental design

The principles of organizing the process of conceptual modeling in the design of the environment are based on the application of the problematic method. The very task of constructing conceptual models is perceived as a problem, and its solution is achieved through the identification and resolution of contradictions between the purpose of the object, its characteristics, as well as the external context. Concept formation – this is precisely the process of building temporary “bridges” between the problem field and the solution space[124].

The tasks of conceptual modeling, as a special type of science-based project activity, are the subject of research by N.I. Barsukova, V.I. Iovleva, S.P. Lomova, N.F. Metlenkova, M.V. Pankina, V.F. Sidorenko, N.G. Yakunichev. At the same time, the problem method which makes it possible to obtain productive and reasonable results in modeling, is paid attention to by such scientists as N.S. Aganina, V.E. Barysheva,

[124] Dorst K. Design Problems and Design Paradoxes / Kees Dorst // Design Issues. 2006. № 22 (3). P. 4-17.

O.B. Druzhinina, K. Dorst, L.M. Ptitsina, O.P. Tarasova, P.M. Khakuz, O.R. Khaliullina, A. Hatchew, N.G. Yakunichev.

The design object is perceived by most researchers as an open system that actively interacts with the environment, within which it is also necessary to identify and resolve possible contradictions. In both cases of resolving problems of object interaction with the external and internal context, an algorithm is used based on the application of the problem method: problem formulation, proposed solution, critical verification of the solution and elimination of the error, setting a new problem, repeating the cycle. However, based on the analysis of the degree of study of the issue, the absence of a systematic description of the process of conceptual modeling in the design of the environment was revealed, based on the problematic method, due to the interaction of its components, during which the initial state of the object is transformed into a new quality.

The hypothesis of the study suggests that if the environment as a design object is considered as a self-organizing system based, to maintain stability, on the interaction of components for the exchange of a resource, then the conceptual modeling mechanism should be based on managing this process through the resolution of emerging contradictions.

The research task is to analyze the organization of the process of conceptual modeling in the design of the environment, to present it in the form of an interaction scheme; identify the feasibility of using homeostatic methods to determine ways to increase the stability of this process; develop a model of the conceptual modeling process in environment design, determine the results the desired process and the nature of the interaction of the components.

The results of the current stage of the study are published in the article “Conceptual Modeling in Environment Design: Content and Management Model”[125].

The task of research can be effectively achieved on the basis of the basic theoretical provisions of the systemic and homeostatic approaches. Since the design of the environment is a complex multi-component object, the approach to its modeling should

[125] Tolstova A. A. Conceptual modeling in environmental design: content and management model // Art education and science. 2022. No. 2 (31). pp. 57-69.

be adequate to its complexity and multi-component nature. In homeostatics, for the first time, contradiction is associated with the internal resource of the system and the specifics of its redistribution, and is also considered as a system control mechanism.[126]. In its most general form, the system-homeostatic approach considers a contradiction as the interaction of two different elements of a system object, based on the exchange of resources, which ensures its stability in the environment.

At the first stage of the study, the desired process is presented in the form of a universal interaction scheme, and then, based on the application of the categorical method "Simple Compensatory Homeostat", a model of the process of conceptual modeling is developed, and ways to increase its stability are identified.

Thus, at first, the universal scheme of interaction makes it possible to reveal how the presence of a particular resource and the elemental composition of an object affect the process of interaction of elements, and, as a result, the result of interaction, as well as the effect on the object itself, its external environment, and others. objects.

The method is implemented in the following sequence:

1) allocation of the source of the resource;
2) selection of elements that form the content of the process;
3) identifying the interaction or reaction that the elements enter into;
4) identification of the result or product obtained in the framework of the interaction;
5) identifying an effect that indicates how the result obtained affects the object and its environment.

Further, based on the systems approach and the theory of homeostasis, the components of the conceptual modeling process were analyzed in pairs using the "Simple Compensatory Homeostat" method, which expresses how a two-component system is able to provide stability[127] [128]. The model is a pair of structural elements of the object, between which a contradiction is deployed. Each element has an input and output. At the

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[126] Gorsky Yu. M. et al. Homeostatics: harmony in the game of contradictions. Irkutsk: Reprocenter A1, 2008. 634 p.
[127] Bosch G. D., Razumov V. I. Methodology of scientific research (in candidate and doctoral dissertations): textbook. M. : INFRA-M, 2020. P. 127.
[128] Albegov E. V. et al. Homeostatics: conceptual modeling of structured sustainable systems: monograph. M.: Publishing House of the Academy of Natural Sciences, 2014. 131 p.

input, the element receives resources, at the output - the results of their transformation. The inputs to the element are regulated by adders, which receive control signals from the outputs of opposite elements.

The method is implemented in the following sequence:

1) identification of two structural elements in the object, between which there is a contradiction as competition for a common resource;

2) identification of a resource for which competition between elements unfolds;

3) determination of the results of the activities of the elements;

4) description of the modes of interaction of the elements of the object, depending on the type of feedback.

Earlier, in the dissertation work, using the categorical-symbolic method "Pentagram", the author identified the main pairs of components of conceptual modeling in the design of the environment, between which the leading contradictions unfold that determine its effective functioning and progressive development, such as: 0. "Area" – 1. "Purpose" and 2. "Content" – 3. "Use" (Fig. 2.3.1)[129]. The application of a systematic approach at the current stage of the study, from a methodological point of view, links together a symbolic expression and a block diagram representation, which will make it possible to obtain a reconstruction of the object in question, that is, conceptual modeling in the design of the environment, as an organic integrity[130].

Thus, for the selected pairs of components, based on the combination of the algorithm for applying the problematic method and the universal interaction scheme, in the course of the study, a scheme for the interaction of components in the process of conceptual modeling was developed (Figure 3.1.1). Accordingly, the resource source of the conceptual modeling process is the "Problem Statement". Interacting components are pairs 0. "Area" – 1. "Purpose" and 2. "Content" – 3. "Use", based on the analysis of which a way to solve the problem can be chosen. The interaction of opposite components is the essence of "Modeling" and verification of the chosen solution path. The result of the

[129] Tolstova A. A. The mechanism of functioning of artistic design in the design of the environment: inter component relations of contradiction // Art Education and Science. 2021. No. 4 (29). pp. 57-66.

[130] Razumov V. I. Categorial-system methodology in the training of scientists: a textbook. Omsk: Omsk State University, 2004. 277 p.

interaction is the desired Environment model, and the effect of the whole process is to acquire a new (productive) quality by the design of the environment. The process of conceptual modeling, in accordance with the logic of applying the problem method, has the ability to control due to feedback between the Environmental model and the problem statement, which allows us to consider it as cyclic.

So, in order to give stability to the process of conceptual modeling, it is necessary to consider the scheme of interaction of components using the “Simple Compensatory Homeostat” method: a) “0. Area – 1. Purpose”, b) “2. Content – 3. Use”(Fig. 3.1.2).

The problematic method underlying conceptual modeling is implemented according to the algorithm: problem formulation, proposed solution, critical verification of the solution and elimination of the error, formulation of a new problem, repetition of the cycle. Thus, the “Problem Statement”, when developing a model, is taken as a resource of the conceptual modeling process. Further, following the logic of the “Simple Compensatory Homeostat” method, it is necessary to move on to determining the results of the components' activity. Consider both pairs: a) “0. Area – 1. Purpose” and b) “2. Content – 3. Use”.

a) The first pair of interacting components are: 0. “Area” and 1. “Purpose”, combined according to primary professional criteria into an “Architectural block”. Since work with these components was originally the prerogative of architecture as a type of design activity that stands at the origins of environment design. The resource is located at the “Input” of component 0. “Area” is the “Problem of harmonization” of the environment as a design object. Which is based on five principles of harmony of the whole: 1) the repetition of the whole in its parts; 2) subordination of parts as a whole; 3) proportionality of parts and the whole; 4) the balance of the parts as a whole; 5) the unity of the whole[131]. The “output” (the result of functioning) is the Spatial model, which can be described as a model of the material, cultural and temporal space of the environment as an object of design. Information about the results of the functioning of this component is fed through the feedback channel to the “Adder” of the opposite

[131] Ganzen V. A. Perception of integral objects. - L .: Leningrad Publishing House. University, 1974. 152 p.

component, namely, component 1. “Purpose”, allowing, in accordance with spatial features, to correct existing or generate new goals.

The resource that starts the process of interaction of component 1. “Purpose” will be the “Problem of assigning the environment as a design object”, and the result of functioning – “Target model”, that is, in accordance with the basic definition of the object of conceptual modeling in the design of the environment, the model of the functional, technological and aesthetic level of goal setting. Information about the results of the functioning of this component has an impact on component 0. “Area”, influencing its modernization.

The total result of the functioning of the work of the two components is An architectural model that integrates and harmonizes the purpose and spatial dimensions of conceptual modeling in environmental design.

Thus, due to cross-feedback, mutual control between the components is carried out, that is, restrictions are formed that are vital for the existence of conceptual modeling in the design of the environment and ensure its homeostasis, in particular, the stability of the functioning of the “Architectural block”. The content of the contradictions between components 0. “Area” and 1. “Purpose”, as well as possible options for their deployment and resolution are presented in tabular form (Table 3.1.1).

Table 3.1.1

The nature of the mutual influence of the components of conceptual modeling in the design of the environment “0. Area” and “1. Purpose”.

Comp.		**Character interactions**	**Result of interaction**
0	**1**		
+	+	The situation of mutual reinforcement: the purpose of development coincides with the spatial possibilities of the environment as an object of design and uses their potential; the new quality of the space has a positive effect on the purpose, allowing the implementation of functional, technological and aesthetic goals	Progressive model: no contradictions that prevent the achievement of the goal of conceptual modeling

+	–	Situation of stability: the purpose of the use of space is contrary to its characteristics, but the space is ready for transformation and adaptation to new purposes	Isogressive model: the need to resolve contradictions
–	+	The situation of stability: the spatial characteristics of the environment dominate, limiting and correcting the directions of its use, which are transformed in accordance with the given conditions	Isogressive model: the need to resolve contradictions
–	–	Mutual weakening situation: space and purpose ignore each other, negatively impacting the conceptual modeling process	Regressive model: the need to pose a new problem and repeat the cycle

b) The second pair of contradictions are: 2. “Content” and 3. “Use”, as components of conceptual modeling in the design of the environment, exchanging information resources, united according to primary professional criteria in the “Designer block”. Since it is the work with content and user request that demonstrates the connection between environment design and industrial design, which, along with architecture, stood at the origins of this type of design activity.

The resource is located at the “Input” of component 2. “Content” is the “Problem of mastering the environment as an object of design”, “Output” is a content model that includes material, process and semantic aspects. Information about the results of the operation of this component has an impact on component 3. “Use”, allowing you to limit and correct existing, or generate new needs, depending on the content of the environment.

The resource that triggers the interaction of component 3. “Use”is “The problem of the personal relationship of the user (addressee of the design activity) to the environment as an object of design”, and the “Result” of the functioning will be the User model, which contains the qualities of the environment responsible for the realization of the user's needs in life support, goal setting and identity[132]. Information about the results of the functioning of this component is fed through the feedback channel to the “Adder” of the opposite component, namely component 2. “Content”, actively influencing its results in accordance with the user's request.

[132] Tolstova A. A. Consumer qualities of the environment from the point of view of design: information model // Design. Materials. Technology. 2021. No. 1 (61). pp. 43-49.

The overall result of the functioning of the work of the two components is the Design Model, which expresses the totality of user qualities and the content of the environment that provides them as a design object. The content of contradictions between the components, as well as possible options for their deployment and resolution, are presented in tabular form (Table 3.1.2).

Table 3.1.2

The nature of the mutual influence of the components of conceptual modeling in the design of the environment 2. “Content” and 3. “Use”.

Comp.		**Character interactions**	**Result of interaction**
2	**3**		
+	+	The situation of mutual reinforcement: the use of the environment for the purpose of fulfilling the needs for life support, goal-setting and identity coincides with the filling of the process, subject, semantic and they positively interact with each other	Progressive model: no contradictions that prevent the achievement of the goal of conceptual modeling
–	+	The situation of stability: the use of the environment does not find an opportunity for implementation, however, the environment content has a positive impact on the target audience, stimulating the adjustment of needs in accordance with the situation	Isogressive model: the need to resolve contradictions
+	–	Stability situation: the existing environment content ignores the use of the environment, which in turn stimulates the emergence of new environment content	Isogressive model: the need to resolve contradictions
–	–	Mutual weakening situation: the use of the environment does not match the content, and the content ignores the use, which has a negative impact on the process of conceptual modeling	Regressive model: the need to pose a new problem and repeat the cycle

Analyzing the result, we can conclude that the most favorable mode in both cases is the mode when both components support each other. In this case, the process of conceptual modeling in environment design functions effectively. However, progress cannot be long-term due to the fact that it is impossible to maintain the maximum rate of development of the components (0. “Area” – 1. “Purpose”, 2. “Content” – 3. “Use”), in

each pair one will definitely outstrip another and the system will go into isogress or regress mode. These modes require the participation of the designer to resolve the contradictions that have arisen between the components by directly and indirectly regulating the distribution of the intrasystem resource.

Thus, based on the application of the “Simple Compensatory Homeostat” method, the following results were obtained: the process of conceptual modeling in the design of the environment was comprehended through the content of contradictions between the components 0. “Area” – 1. “Purpose” and 2. “Content” – 3. “ Use”, unfolding as a competition for the “Problem Statement” resource, as well as the modes of interaction of these components are identified and described. From the point of view of homeostatics, the emergence and deployment of contradictions between them can be viewed as a self-developing and self-regulating system in which the problem statement circulates as a resource. The result, in this case, are two models: Architectural and Design.

Consequently, a system of models has been developed that reflects the process of conceptual modeling in the design of the environment, differing in that they are based on the mechanism of mutual regulation of conflicting pairs of components 0. “Area” – 1. “Purpose” (“Architectural block”) and 2. “Content” – 3. “Use” (“Designer block”) of conceptual modeling in the design of the environment unfolding as a competition for the resource “Problem Statement”, which allows you to identify and describe the results of the components (Spatial model, Target model, Content model, User model) and the results of work blocks (Architectural model and Design model), as well as the nature of the interaction of these components of opposites, depending on the type of feedback cross-link.

The contribution to science is to clarify the mechanism and result of the interaction of the components of conceptual modeling in the design of the environment; contribution to the methodology is to identify the potential of the systems approach and the principles of homeostatics for the theoretical study of environmental design problems.

From a practical point of view, the developed system of models can be used in the field of creating a design and architectural idea for organizing the environment, as the

core of the subsequent design process, which will contribute to obtaining a productive design solution both in educational and professional activities.

From the point of view of further research, the system of models for organizing the process of conceptual modeling in the design of the environment can become the basis for developing a model for managing this process.

3.2. Conceptual modeling process management model in environment design

From a general scientific point of view, the main task of conceptual modeling is the development of the following types of models: descriptive (descriptive), predictive (promising) and normative (desirable). At the same time, the conceptual model in the design area must adequately describe the environment as an object of design and belongs to the type of cause-and-effect models. From the point of view of the results that are significant for the evaluation of the final product, the model should be focused on identifying the main relationships between the components of the object and determining their mutual influence.

Based on the value orientations of the specialty, identified as a result of the analysis of the theoretical base at the previous stages of the study, the principles of conceptual modeling include:

- the principle of problematicity (consideration of the task for design as a problem associated with a conflict between the existing state of the environment and its expected qualities);
- the principle of cyclicity (preservation of feedback between the subsequent and previous stages of modeling);
- the principle of complexity (equal attention to all components of the environment: space, processes and content);
- the principle of interdisciplinarity (the use of different scientific approaches that are significant for the purpose of modeling);
- the principle of integrity (interdependence and interconnectedness of all modeling components).

However, a gap has been found in scientific research in terms of managing the process of conceptual modeling in order to solve the set tasks, as well as to achieve the proper quality of the results obtained. To eliminate this gap, in the dissertation work, it is proposed to clarify the algorithm for managing the process of conceptual modeling in the design of the environment, in accordance with the request of society and within the framework of a systematic approach to the object.

Research hypothesis lies in the assumption that the use of modern general scientific methods with a high heuristic potential will allow developing a model for managing the process of conceptual modeling in the design of the environment that fully and accurately reflects its content and goals. In particular, it is assumed that the use of homeostatic methods will make it possible to highlight the leading contradiction between the constituent components of conceptual modeling in the design of the environment, the impact on which will allow it to be most effectively controlled and receive conceptual models of the design object.

Based on the analysis, the objective of the study is to apply a scientifically based approach to the development of a model for managing the process of conceptual modeling in environmental design, based on homeostatic methodology.

The results of the current stage of the study are published in the article “Conceptual Modeling in Environment Design: Content and Management Model”[133].

The task of research can be effectively achieved on the basis of the basic theoretical provisions of the systemic and homeostatic approaches. The process of conceptual modeling and its management is the most important element of the environment design system, its effective implementation can be based on identifying the leading internal intercomponent contradiction and influencing it by regulating the most significant resource for the contradiction components.

Thus, the basic scientific and methodological approach in research becomes homeostatic. Homeostatic methodology suggests the possibility of managing systems by

[133] Tolstova A. A. Conceptual modeling in environmental design: content and management model // Art education and science. 2022. No. 2 (31). pp. 57-69.

influencing the contradictions that have developed between two structural elements that interact with each other.

When studying an object using the “Deployed Compensatory Homeostat” method, the center of the model was a contradiction within a pair of components, considered at the previous stage, which is the object of application of managerial influences from the side of the “Subject of control”. Management is carried out by regulating the flow of resources, as a result of which the state of one of the components of the contradictory pair changes, or both of them, which leads to a change in the qualitative characteristics of the object itself. The “Supreme Control Body” and the “Additional Activation and Adaptation Block” have an indirect impact on the “Control Subject – Interelement Contradiction” complex.

The method is implemented in the following sequence:

1) identification of the subject of management, which can control the distribution of the resource between pairs of interacting components;

2) identification of the supreme governing body, which sets the rules for the behavior of the object;

3) identification of subjects that can play the role of a block of additional activation and adaptation of the object in the environment;

4) description of the resulting model.

Let's turn to the study of the possibilities of managing the process of conceptual modeling in the design of the environment, by influencing the formation and unfolding of a contradiction in it, based on the method of “Deployed compensatory homeostat”. Control components and additional feedback are added to the models developed at the previous stage. Accordingly, in the process of conceptual modeling in the design of the environment, represented by the “Deployed Compensatory Homeostat” model, the designer can be considered as a subject that controls two blocks, between which a contradiction is expressed, and in each of which there are two components, which are also in a state of contradiction, and the total output of the blocks is directed to the desired model (Fig. 3.2.1).

The head of the general project acts as the supreme governing body, in which it is necessary to develop a conceptual model. It can be both a local design project for the organization of the environment, and a larger architectural or urban project. The project manager sets the parameters of the external and internal environment of the model under consideration, as well as the managerial capabilities of the designer directly, who carries out the modeling process. This requires additional explanation, since it is the choice of the supreme governing body in this case that presents a certain difficulty. At first glance, it seems that the "customer" of the project claims this role, but this is not so, since the customer is a kind of "trigger" that starts the process of designing the environment, which in itself is a more complex system that goes beyond the scope of the primary design task . Only the manager determines the development strategy of the project, takes into account the local and global context (social, legal, economic, cultural, natural, urban planning, etc.) of the design object, and develops a step-by-step scenario for the implementation of the design project. Deciding on the need for an in-depth study of hidden contradictions within the object, building a conceptual model and applying the problematic method are his areas of responsibility.

The controlled elements in the model are the "Architectural block" and the "Designer block", which are controlled by influencing the contradictions that develop both between these blocks and between the components within them. The main result of management is the Environmental model – a cause-and-effect conceptual reflection of a real design object.

In addition to those listed, there is a component in the scheme that provides additional support for managing the process of conceptual modeling in the design of the environment. In this capacity, individuals interested in positive and justified changes can act. For example, public councils and initiative representatives of the target audience, as well as experts in social, environmental, legal and other areas that are significant for the design object. This block, as well as the supreme governing body, has an indirect impact on the system. It acts as a kind of "catalyst", which activates the process of conceptual modeling due to the receipt of a clarifying request from the target audience, and also adapts the model to the requirements of related fields of knowledge with the help of

expertise. During the modeling process, both intermediate results and the final model are checked against this block.

Having described the main components of the scheme, it is necessary to proceed to the interpretation of relationships within the model. Thus, the environmental problem as a central inter component contradiction is the object of application of managerial influences on the part of the designer. It is carried out by regulating the flow of resources, as a result of which the state of one of the participants in the contradictory pair changes, or both of them, so that the contradiction between them remains productive, which, in turn, leads to a change in the qualitative characteristics of the entire system.

The "Deployed Compensatory Homeostat" model, as you can see, has an "Input" and an "Output". At the "Entrance" there is a managerial task, provided with certain management resources. Such a task, when building a conceptual model, is to build a working representation of the design of the environment as a system that performs descriptive (descriptive), predictive or normative (desirable) functions[134].

The output is the Environmental Model, obtained as a result of managing the process of conceptual modeling, focused on identifying and defining the main relationships between the components of the object. In addition to the total output, there are also local ones, these are the Architectural model and the Design model, which are streams of specialization of the components of an inconsistent pair. Direct links indicated in the diagram by solid lines reflect the direction of influence of the components on each other. Feedbacks have the form of broken lines and reflect the return flows of information that allow for control and timely adjustment of managerial influences, therefore, more adequate management results in general.

Before the tasks of the designer as a managing subject are considered in detail, it is necessary to consider the interaction between the "Architectural block" and the "Designer block". Since the study of the mechanism of interaction of components within the blocks was carried out at the previous stage of the study using the "Simple

[134] Novikov A. M., Novikov D. A. Methodology. M. : KRASAND, 2014. 632 p.

Compensatory Homeostat" model, we will present for clarity the interaction between the blocks in a similar way (Fig. 3.2.2).

So, in the case of studying the nature of the interaction between the blocks, we will consider the option when the feedback of the "Designer block" component will maintain the system in a stable state. With any type of feedback from the "Architectural block" component, the feedback type of the "Designer block" component will always be consistently positive. Such an assumption is valid, since the process of conceptual modeling in the design of the environment can only be launched when it is stimulated by the user. The content of the contradictions between the "Architectural block" and the "Designer block", as well as possible options for their deployment and resolution based on the method used, in this case, will be interpreted as follows:

1) the situation of mutual reinforcement: "Architectural block" coincides with the "Designer block" in terms of the potential for mutual influence and adaptation - a progressive model, which is characterized by the absence of contradictions that hinder the achievement of the goal of conceptual modeling;

2) a situation of stability: "Architectural block" blocks, "Designer block" stimulates – an isogressive model, characterized by the need to resolve contradictions.

An isogressive model can arise with a low system complexity of the environment as an object of conceptual modeling in terms of its component composition. For example, the industrial environment of an enterprise "resists" the external influences of the "Design Block" much more strongly than the flexible creative environment of a public center. At the same time, the "Designer block", in this case, initiates changes that entail the complication of the component complexity of the modeling object as a system.

So, having considered the processes that take place inside the control units and between them, it is necessary to move on to the contextual tasks of the designer, which can be reduced to the following areas:

1. resource supply area,
2. area of implementation of system communications,
3. additional support area.

1. In the field of resource provision, the main thing is to identify the leading managerial resource. Such a resource, in the process of conceptual modeling in the design of the environment, for the designer, as a managing subject, is “system thinking”, as the basis of design thinking in the sense of a specific form of anticipatory reflection of reality[135]. V.I. Iovlev, defining the conceptual content of project thinking, found that “signs of the conceptual mechanism are the presence of problems and dominant ideas for their solutions”[136]. Accordingly, it is "system thinking", as a management resource in this model, that is responsible for the distribution of the system resource “Problem Statement” between the components. The very formation of the mechanism for the cyclic redistribution of the leading resource, that is, to which block it is directed, “Architectural” or “Designer”, determines the nature of the contradiction between the blocks themselves and between the components within them. To balance this process, in the future, it is proposed to investigate the identified modes of interaction and, based on the application of the problematic method, offer possible solutions for them.

2. In the field of implementation of system communications, it is necessary to ensure the normal operation of direct and reverse communication channels. So, on the one hand, the creation of a conceptual model should consistently go from the development of the resulting models of components to blocks, and then to the final Environment model. On the other hand, it is necessary to monitor the cyclicity of this process, when each next stage affects the previous one, in order to clarify and correct it, in accordance with the newly identified characteristics of a particular model.

3. In the area of additional support, the designer should involve an expert group and representatives of the local community, as part of the participatory design practice. This is necessary to reduce, if possible, the degree of abstraction from the real object when developing a conceptual model that automatically arises when considering the object of study as a system. Thus, it seems possible to avoid the “trap” of systems theory,

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[135] Kalinina G. N., Rybalkina P. V. Design thinking and “man designing” (philosophical and cultural explication) [Electronic resource] // Man and Culture. 2018. No. 5. P. 15. URL: https://cyberleninka.ru/article/n/proektnoe-myshlenie-i-chelovek-proektiruyuschiy-filosofsko-kulturologicheskaya-eksplikatsiya (date of access: 02/07/2022).

[136] Iovlev V. I. Conceptual mechanism of architectural design [Electronic resource] // Architecton: news of universities. 2021. No. 1 (73). URL: http://archvuz.ru/2021_1/23/ (accessed 23.09.2022).

while retaining a certain algorithm of actions, which corresponds to the values of the modern profession of a designer.

Thus, in the course of the study, it was proved that the management of the process of conceptual modeling in the design of the environment can be productively carried out on the principles of homeostatics through the impact on the leading contradiction that develops and unfolds between the “Architectural” and “Designer” blocks. These blocks themselves consist of conflicting pairs of components: 0. “Area” – 1. “Purpose” and 2. “Content” – 3. ”Use”, respectively. The resource that provides the process of conceptual modeling in the design of the environment is “Problem Statement”, and the resource that allows you to manage its distribution is “Systems Thinking", the regulation of which is within the competence of the designer. For additional examination of conceptual models, it is necessary to connect the “Supreme Control Body” and the “Additional Activation and Adaptation Unit”.

The novelty of the scientific results obtained in the framework of the study lies in the disclosure of the possibilities of managing the process of conceptual modeling in the design of the environment through a system of sequentially obtained interrelated models:

Stage 1 – Spatial model, Target model, Content model, User model - the results of the functioning of components 0. “Area”, 1. “Purpose”, 2. “Content”, 3. “Use”, respectively;

Stage 2 – Architectural model, Design model - the results of the functioning of the “Architectural block” and “Designer block”, respectively;

Stage 3 – Environmental model - generalizing, obtained on the basis of resolving contradictions. This model can be attributed to cause-and-effect conceptual models, since it highlights the relationship between the components and their mutual influence.

The scientific value of the results obtained consists in clarifying the content of the process of conceptual modeling in the design of the environment, as well as the possibility of managing it. A model for managing the process of conceptual modeling in the design of the environment has been developed, characterized in that it is based on the model of the mechanism of interaction between the components of the conceptual modeling in the design of the environment and the system of models reflecting the process of conceptual

modeling in the design of the environment, which implies the implementation of managerial influences on the leading contradiction between “Architectural” and “Design” modeling blocks (consisting, respectively, of contradictory pairs of components 0. “Area” – 1. “Purpose” and 2. “Content” – 3. “Use”), which includes the indicated blocks, the management resource (systems thinking), the subject of management (environment designer), the highest management body (project manager), the block of additional activation and adaptation (expert group, professional community), the management task (creation of a conceptual model of the environment), the main result of management (environment model); allowing to develop an effective methodology for conceptual modeling of the design of the environment as a design area.

The contribution to the environmental design methodology is to expand the scientific toolkit by incorporating homeostatic methods into it. A model is proposed that allows revealing the management of conceptual modeling in the design of the environment through a system of direct and feedback circulation of systemic thinking, as a resource, between the components and participants of the process, in order to obtain a model of a descriptive, predictive or normative nature.

The practical result of applying the obtained model can be the development of specific measures for managing the process of conceptual modeling in the design of the environment based on homeostatic methodology, namely, the development of a guide for the interaction between the designer, project manager, expert group and the local community in terms of regulating the process of conceptual modeling. Possible areas of application are in the field of design idea formation, which will help to increase the competence of design decisions, as well as to achieve productive results both in educational and professional activities.

Prospects for further research lie in the field of developing a methodology for conceptual modeling in the design of the environment with the aim of optimizing it at the pre-design stage.

3.3. Concept modeling technique in environment design

With a deep professional understanding of the problems of the design object and the vectors of its development, the conceptual model becomes a link between the research and creative levels of design activities. Theoretical studies periodically carried out in this area confirm this thesis. For example, the analysis of the place and meaning of the concept in design thinking, conducted by T.Yu. Bystrovoy made it possible to conclude that when conceptual modeling is applied, "the social and communicative potential of an architectural or design object increases, it is easier to "read" by the audience, is not alienated, and enters the human space".[137] From a practical point of view, the scope of design, connected with the space of human habitation, can no longer be limited to the output of "finished products". For modern society, according to P.V. Kapustin, the demonstration of the process of thinking itself is in demand, "its explicit and hidden ideas, its deployment in the field of social values and goals, awareness of the humanitarian, social and environmental aspects, generated meanings, possible consequences and long-term effects"[138]. However, the lack of rootedness of conceptual modeling methods in environmental design in the scientific field, on the one hand, and the need to update the theoretical base associated with the study of the design object in the field of environmental design, on the other hand, give rise to the lack of a holistic productive methodology for conceptual modeling. This is an obstacle to the development of both the object of transformation itself and the subject of project activities, in order to improve the overall quality and comfort of the living environment, and also makes it difficult to demonstrate conceptual models to society.

[137] Bystrova T. Yu. Conceptual thinking in architecture and design: to the formulation of the question // Culturology of the XXI century: theory and practice. 20 years of the Department of Culturology and Design: Sat. scientific tr. Yekaterinburg, 2011. P. 41.
[138] Kapustin P. V. et al. On the conceptual content of the current architectural and design thinking // Architectural research. 2019. No. 4 (20). P. 5.

When conducting a study directly, the methodology of conceptual modeling in the design of the environment, as a fixed set of methods of practical activity leading to a predetermined result, the author could not find[139].

The development of a scientifically based methodology for conceptual modeling in environmental design, which will allow to obtain a meaningful normative-prognostic model, will be possible if it is based on: obtained using a categorical-system methodology, a scientifically based definition of the concept of "conceptual modeling object in environmental design", a model of user qualities of the environment from the point of view of design, developed models of the mechanism of interaction between the components of conceptual modeling in the design of the environment, a system of models of inter component contradictions of conceptual modeling in the design of the environment, a system of models reflecting the process of conceptual modeling in the design of the environment, models for managing the process of conceptual modeling in the design of the environment.

The research task is to develop a methodology for conceptual modeling in environmental design; description of the goal, objectives, basic principles, basic concepts, stages, tools and procedures; approbation of the specified technique on the example of a real environment design project in order to obtain conclusions about its performance and effectiveness.

The results of the current stage of the study are published in the article "Methodology of conceptual modeling in the design of the environment as a design area"[140].

The expected positive effect of solving the problem consists in obtaining at the initial stage of designing additional information about the goals of the socio-cultural and spatial development of the design object, necessary for the further development of a productive and popular design idea.

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[139] Philosophical Encyclopedia [Electronic resource]. New Philosophical Encyclopedia: in 4 volumes; ed. V. S. Stepina. M.: Thought, 2001. URL: https://dic.academic.ru/dic.nsf/enc_philosophy/8661/METHODS

[140] Tolstova A. A. Methods of conceptual modeling in the design of the environment as a field of design // Architecton: university news. 2022. No. 3 (79). URL: http://archvuz.ru/2022_3/15/

The previous stages of the research have yielded results that are potentially significant for overcoming the problem of insufficient integration of the environmental design methodology into the scientific field in the development of a conceptual modeling methodology in environmental design. For the detailed development of the above methodology, the following integrative provisions have been synthesized:

- based on the theory of dynamic information systems, the object of conceptual modeling in the design of the environment can be described using the following features: “spatiality” (material, temporal, cultural), “purpose” (functional, technological, aesthetic) and “fullness” (subject, process, semantic);
- within the framework of the categorical-system methodology, the model of user qualities of the environment from the position of conceptual modeling allows us to present consumer qualities (goal-setting, life support, identity, etc.) in the form of a multi-level information system that reflects their evolution as the acquisition of new attributes;
- when during conceptual modeling in the design of the environment there is an interaction between the user, the object and the designer, then the “Use” component is added to the initial components of the environment, which is responsible for the implementation of the user’s needs for life support, goal-setting and identity, as well as the “Design” component corresponding to the functional role of the designer; the order of occurrence of components, that is, the acquisition of new attributes by conceptual modeling, as a system object, becomes: “Area”, “Use”, “Purpose”, “Design”, “Content”; the author's study of the mechanism of interaction of these components by categorical-symbolic methods showed that in this case, the main contradiction unfolds between the pairs of components “Area – Purpose”, and an additional contradiction – “Content – Use”, while “Purpose” and “Use” are active components associated with the target audience, and “Area” and “Content” are passive, but perform a controlling function, keeping the paired active components within certain limits; the control component that regulates the distribution of the system resource becomes “Design”;

- at the same time, in the perspective of the categorical-system methodology, the content of the contradictions between these paired components of conceptual modeling is determined and the dependence of the direction of development of conceptual modeling on the parameters of the functioning of the components is revealed;
- when considering the process of conceptual modeling in design, the environment, from the point of view of the homeostatic approach, it was found that the result of the interaction of the components "Area – Purpose" is the Architectural model, and "Content – Use" – the Design model, the stability of which depends on the modes of interaction between the components;
- in order to manage the process of conceptual modeling in the design of the environment, the thesis developed a model based on the impact on the relationship both between the components themselves and between blocks of components; The result of this control is the Environmental Model, based on the resolution of contradictions between the Architectural and Design blocks of conceptual modeling as a system object.

Thus, on the basis of the conceptual apparatus and the formed theoretical platform, it seems possible to develop a methodology for conceptual modeling in the design of the environment as a design area.

For the convenience of perception of the developed methodology, it is necessary to clarify the basic concepts.

So, the object of conceptual modeling in the design of the environment – it is an integral system that has signs of material, temporal, cultural spatiality; appointment of functional, technological, aesthetic and fullness of subject, process, semantic.

Environmental design, as a spatial interpretation of social processes and "design spaces", is an interdisciplinary activity and combines not only all types of design in a complex, but takes on many functions of architectural activity, and also uses the methods of those types of sciences and arts that are required in each specific case to achieve an integral result. Namely, providing comfortable living conditions for a person, forming a "field" of social contacts and an image (environmental atmosphere).

Conceptual modeling in the design of the environment is focused on building a meaningful normative-prognostic model that determines the structure of the system, the properties of its elements and the cause-and-effect relationships inherent in the system and essential for achieving the goal of modeling. Conceptual modeling, as a separate stage of scientifically based design activity, is used at the pre-project stage in order to determine the problem field and further develop the design idea.

The main principles of conceptual modeling include:

- the principle of problematicity (consideration of the task for design as a problem associated with a conflict between the existing state of the environment and its expected qualities);
- the principle of cyclicity (preservation of feedback between the subsequent and previous stages of modeling);
- the principle of complexity (equal attention to all components of the environment: space, processes and content);
- the principle of interdisciplinarity (the use of different scientific approaches that are significant for the purpose of modeling);
- the principle of integrity (interdependence and interconnectedness of all modeling components).

The role of conceptual modeling is to determine the problem field for the formation of a design idea between the descriptive (descriptive) and normative-prognostic (desirable) state of the environmental object from the point of view of the target audience.

Purpose of conceptual modeling – development of a system of models for the interaction of environment components and a user component based on the request of the target audience.

The last thing that needs to be clarified before a step-by-step description of the methodology is the conditions for its application, which will reduce the risk of falling into the “trap of systems” and, to the extent possible, minimize the subjective nature of the results. The conditions for the application of the methodology by the author include:

- the need to build a meaningful normative and prognostic model of the environment as a design object, focused on identifying the relationship between the object and the user of the design activity;
- the presence of an intellectual resource – systemic thinking, which makes it possible to apply the methodology of conceptual modeling, the level of development of which determines the quality of the model;
- the presence of a supreme governing body that determines the rules for the existence of a model in the environment in terms of interaction with the external context (architectural and landscape, socio-economic, legal, etc.);
- the possibility of involving an expert group and the local community to test the models obtained as a result of applying the methodology.

The content and logic of the conceptual modeling technique in environmental design includes four stages:

I. exploration of the components 0. “Area”, 1. “Purpose”, 2. “Content”, 3. “Use” – result Descriptive model;

II. study of the interaction of components as a self-developing system – result Predictive model;

III. study the impact of an environmental problem on components and manage the interaction between components – result Architectural Model and Design Model;

IV. control of interaction between blocks of components – result Environment model (Table 3.3.1).

Table 3.3.1: Stages of conceptual modeling in environment design.

Stage	Content	Result
I	study of components 0. “Area”, 1. “Purpose”, 2. “Content”, 3. “Use”	Descriptive model
II	study of the interaction of components as a self-developing system;	predictive model
III	study the impact of an environmental problem on components and manage the interaction between components	Architectural Model and Design Model

IV	control of interaction between blocks of components	environment model

The description of each stage is made in the format of step-by-step instructions.

Stage I – study of components 0. “Area”, 1. “Purpose”, 2. “Contet”, 3. “Use”:

I a) conduct a study of the components in the sequence: 0. “Area”, 1. “Purpose”, 2. “Content” 3. “Use”, it should be noted that component 3. “Use” depends on the target audience and may have variability;

I b) decipher each component in accordance with the qualities indicated in the diagram;

I c) describe the resulting model.

Special conditions: when deciphering the components, attention should be paid to the sources of information. For component 0. “Area” – this is a historical and cultural analysis of the object of modeling, as well as its full-scale examination. For component 1. “Purpose” – analysis of the functional and technological solution of the object, as well as volumetric and spatial composition. For component 2. “Content” – analysis of the content of the environmental object, its scenario use, as well as the typological affiliation of the modeling object. For component 3. “Use” – a sociological study and the use of various participatory methods to identify the needs of the target audience, as well as the analysis of scientific and journalistic literature and social networks associated with the object of modeling. In conclusion, it is recommended, based on personal perception of the environment, to offer a metaphor that would reflect the essence and semantic load of the modeling object, allowing you to verbalize the image (atmosphere) of the environment.

When applying the methodology, at this stage the result should be obtained in the form of a Descriptive Model (Fig. 3.3.1).

Stage II – study of the interaction of components as a self-developing system:

II a) use the functioning parameters specified in the methodology for pairs of components that are in a state of conflict - these are 0. “Area” and 1. “Purpose”, 2. “Content” and 3. “Use”; to identify, on the basis of the proposed criteria, to what value (extremely low or extremely high) of the functioning parameter the controlling

components in pairs strive for the first pair - 0. “Ares” and for the second pair – 2. “Content” holding their paired active components in certain limits;

II b) explore the contradictions between the pairs of components 0. “Area” and 1. “Purpose”, 2. “Content” and 3. “Use” of the environmental object as a self-developing system;

II c) determine the integral parameters of the functioning of both pairs of components,

II d) describe the resulting model.

Special conditions: when choosing, in accordance with the criteria for the value of the parameter of the functioning of the component, it is necessary to be based on the results obtained at the first stage of the implementation of the methodology. This will make it possible to draw conclusions about the prospects for the development of the object as a self-developing system.

When studying the contradiction between pairs of components, for the stability of the model, it is necessary to take into account that changes occur with a phase difference, respectively, it is necessary that the development options for each of the paired components receive opposite values in the proposed ranges (for example, if the development option for component 0.0. is located at the minimum mark proposed range, then for component 1.0. – at maximum).

When applying the methodology at this stage, the result should be obtained in the form of a Predictive Model (Fig. 3.3.2).

Stage III – study the impact of environmental problems on components and manage the interaction between components:

III a) based on the analysis of the descriptive model and modeling tasks, formulate environmental problems and determine what type they belong to;

III b) determine the features of the impact of environmental problems on the relevant components and propose options for their solution;

III c) identify which block (“Architectural block”, consisting of components 0. “Area”) – 1. “Purpose”, and “Design block”, consisting of components 2. “Content” –

3. “Use”) refers to this component and to clarify the mode of interaction of components within the block that has arisen as a result of solving the problem;

III d) propose options for resolving contradictions within the block for the identified mode, taking into account the results of forecasting at stage II,

III e) describe the resulting model.

When applying the technique at this stage, two results should be obtained: Architectural model and Design model (Fig. 3.3.3.).

Special conditions: when looking for a solution to the identified problems, it is necessary to remain within the typology of the problem field. So, for the problems of component 0. “Area”, the solution lies in the field of harmonization; for component 1. “Purpose” – in the scope of the purpose of the environment (definition of the range of tasks to be solved by the designer); for component 2. “Content” – in the plane of development of the environment; for component 3. “Use” – in the field of personal attitude to the environment of the consumer.

Within the framework of the methodology, it is possible to consider three modes of interaction between components within a block:

A. solutions found for the problems identified for both components positively influence each other and a synergistic effect can be observed within the block;

B. and C. the solution of one of the problems for any component weakens the characteristics of the second component, and, in this case, it is necessary to resolve the contradictions that have arisen, and, if necessary, use feedback to return to the previous stages.

Stage IV – managing the interaction between blocks of components:

IV a) determine the nature and identify the mode of interaction between the Architectural and Design blocks; offer options for resolving the identified contradictions, describe the result;

IV b) to analyze the resulting model with the involvement of the opinion of the expert group and the local community; repeat the cycle if necessary.

Special conditions are that the “Designer block” may vary depending on a specific user or group from the target audience for which the Design model is being developed,

respectively, when using the methodology, it is necessary to carry out a stepwise analysis, between the unchanged “Architectural block” and several “Design Blocks”.

As part of the methodology, it is recommended to consider two modes:

A. a situation of mutual reinforcement, when the blocks coincide in terms of the potential for mutual influence and adaptation;

B. the situation when the “Architectural block” resists the external influence of the “Designer block” (possible causes – this is the low system complexity of a particular environment, as a design object, or the limitations of an external context).

The result of this stage, and the methodology as a whole, is the achievement of a strategic goal in the form of an Environmental Model (Fig. 3.3.4).

Thus, a methodology for conceptual modeling in the design of the environment has been developed, which includes three stages [1) the study of interaction components, 2) the study of the interaction of components as a self-developing system, 3) the study of the influence of the environmental problem on the components and the management of interaction between the components, 4) the management of contradictions between blocks of interaction components] (Fig. 3.3.5). Characterized by the fact that it is based on scientifically based ideas about the object of conceptual modeling in the design of the environment, the model of user qualities of the environment from the position of conceptual modeling, the mechanism of interaction of the components of conceptual modeling in the design of the environment, models of inter component contradiction of conceptual modeling in the design of the environment, the process of conceptual modeling in the design of the environment and its management model, which makes it possible to obtain at the initial design stage the conceptual models of the object that are most significant for the effective implementation of the project and its quality: Descriptive model, Predictive model, Architectural model, Design model, Environmental model (Fig. 3.3.6).

The essential advantage of the developed technique, from the point of view of its heuristic potential, is: the construction of a structural model of the object of study, taking into account the mechanism of interaction and the qualitative composition of its components, i.e. user, object and designer as participants in communication;

understanding the content of the contradictions between the components; comprehension and regulation of interaction modes both between separate components, and between blocks “Architectural” and “Designer”; management of inter component interaction by resolving identified contradictions, as well as using feedback channels between stages.

Thus, as a result of scientific research, a tool was added to the theoretical base of the specialty in the form of a methodology for constructing a meaningful normative and prognostic system of models that determine the structure of the system, the properties of its elements and cause-and-effect relationships inherent in the system and essential for achieving the goal of modeling.

From the point of view of application, the proposed method of conceptual modeling will make it possible to obtain at the initial stage of design the conceptual models of the design object, the most significant for the effective implementation of the project and its quality: Architectural model, Design model, Environmental model, etc. Thus, the introduction of this technique will contribute to realizing the possibility of scientifically based creation of a comfortable living space, on the one hand, and improving the skills of specialists, on the other, thereby realizing the current directions for the development of the profession in accordance with state programs.

Prospects for further research are in testing of the proposed methodology on model objects both in the implementation of project activities, the preparation and presentation of competitive projects, and in the educational process, when teaching students under the master's program “Environment Design”.

3.4. Testing the conceptual modeling technique in environment design

The developed technique can be applied when carrying out conceptual modeling as a separate stage of scientifically based design activities, at the initial stage of design, in order to determine the problem field and further develop a design idea.

In order to verify the effectiveness of the application in practice, the author tested the methodology on the example of a real design object. As a model object, the courtyard of the Larinsky Gymnasium on the 6th line of Vasilevsky Island in St. Petersburg, 15, an

architectural monument and a cultural heritage site of Russia of regional significance, was chosen (Fig. 3.4.1). The building has its own history: the original building was built in 1780 (architect Paulsen Gottlieb-Christopher), in 1835-36 it was rebuilt according to the project of architect A.P. Shchedrin. As part of this project, the facility was adapted to current educational needs, the 3rd floor was built on, the facade was changed, and the premises were redesigned for training sessions. After the completion of work in the building, the Larinsky gymnasium was opened - the fourth gymnasium of the new type. In 1897-1898, according to the project of the gymnasium graduate architect A.N. Iossa, the Church of St. Tatiana. In Soviet times, the building of the former gymnasium housed various educational institutions, including those related to the Kozitsky plant. Currently, it is at the disposal of the Faculty of Arts of St. Petersburg State University. In this regard, the courtyard of the Larinsky Gymnasium serves as an experimental platform for students, a kind of open-air auditorium. For example, plein-airs are held here, students plant ornamental plants and take care of them, create installations in the center of the courtyard on the site of the lost fountain. Students of the Department of Design, educational program “Environment Design” as course projects under the guidance of the author, have repeatedly developed proposals for updating the courtyard space in order to adapt it to the request of the target audience (Fig. 3.4.2, 3.4.3, 3.4.4). However, during the discussion, all options did not withstand constructive criticism, and, despite the fact that the space seems familiar and understandable, it was decided here, first of all, to apply the conceptual modeling technique in order to find a reasonable solution that would take into account the features of all components and correspond to the general trajectory of the development of the courtyard system of the Larinsky gymnasium as a self-developing system.

At the first stage of applying the proposed methodology, it is necessary to investigate the components of the environment and make a brief description of them according to the algorithm. The explanation of the obtained model is reduced to a systematic list of characteristics. It is convenient to present the result in the form of a table (Table 3.4.1.).

Table 3.4.1. Concept Modeling Technique in Environment Design:
stage I – descriptive model. Approbation on the example of the courtyard of the Larinsky gymnasium.

Component 1. PURPOSE		**Component 2. CONTENT**	
1.0 functional	the main thing: *transit space*, minor: *recreational space*, possible: *environment-event*	equipment: *benches, visors*, navigation: *plates*,landscape design*:*	2.0 subject
1.1.technological	afterbirth. Action: *intersection of space with a stop in the center*; equipment: *three entrances, arch, seating in the center,* conditions: *depend on season and weather*	the script is intuitive: *communicate*, target: *walk, sit*,eventful: *draw, plant plants, create installations*	2.1.process
1.2. aesthetic	composition: *centric*, color: *ocher, gray, seasonal greens*, pointers scale: *windows, doors*	archetype: *monastery garden*, style: *classical fountain*, a metaphor: *source of knowledge*	2.2 semantic
Component 0. AREA		**Component 3. USE**	
0.0. material	form: *cubic*, boundaries: *courtyard facade*, surface: *paving and plastering*	safety: *closed yard*, availability: *only for St. Petersburg State University* , sustainability: *maintaining the connection of times*	3.0 life support
0.1. temporary	duration: *from 1780*, sequence of events: *different educational institutions*, cyclicity: *academic year and seasonality*	community: *preservation of the heritage site*, team: *transit*, individual user: *view from the window*	3.1. target
0.2. cultural	individuality: *petersburg yard*, values: *university*; singularity: *FI studentship*	region: *city center*, society: *department*, culture: *Larin Gymnasium*	3.2. identical

The inner courtyard is a cubic space bounded by a courtyard façade, the dominant surface finishing materials of which are stucco and paving. The space of time in it can be traced since 1780, through the sequence of events associated with the change of

educational institutions, as well as the annual cycle of educational processes and seasons. The cultural space has a pronounced individuality, which can be described as a “Petersburg courtyard”, in which the values of universitarians dominate, and there is also a special subculture of the Faculty of Arts, which currently occupies this building.

From the user's point of view, this is a stable system capable of maintaining the current state when exposed to external factors, namely, in the context of the perception of the historical architectural environment, to maintain the “connection of times”; at the same time, a safe closed courtyard accessible only to students and staff of St Petersburg University. The intended purpose, which is varied: from the point of view of public importance for St. Petersburg, is the preservation of a cultural heritage site; for a team of students and teachers, this is a transit space that provides shortened communication between buildings; for an individual user - it can be, for example, only the view from the window. Identity, in the sense of spatial affiliation, is formed here by the location of the courtyard directly in the center of the historical city, social affiliation – by teams of educational programs of design, painting and arts and crafts, which occupy the premises adjacent to the courtyard, cultural affiliation - by the value of the heritage site (Larinsky Gymnasium) and church.

From the point of view of the functional purpose of space: the main thing is transit, the secondary is recreation, and the possible is the organization of the environment-event. From the standpoint of the technological purpose of space, the sequence of actions is to cross the courtyard space diagonally or in a straight line, with a possible stop in the center. Technological equipment is represented by the presence of three entrances to the courtyard from the building and an arch leading towards the square, as well as the organization of seating in the center. Technological conditions for the operation of the yard depend on weather conditions and the season. From an aesthetic point of view – he space has a centric composition, the dominant colors are: ocher and gray, as well as the green color of the landscape, from May to September. The scale of space is set by windows and doors on the facade of the gymnasium.

From the point of view of subject content, it can be noted – elements of equipment (benches, canopies of entrance groups, drains); elements of visual communication

represented by nameplates of St. Petersburg State University; landscape design, which is perceived as a small garden. Process filling allows us to distinguish three main behavioral scenarios: intuitive – communicate; target – pass, sit; eventful – draw, plant plants, create installations, etc. Semantic content can be characterized based on the identification of the archetype – "monastery garden" The main decorative element is a classic fountain, and the metaphor proposed by the author, based on the archetype and the fact that the fountain is located in the courtyard of an educational institution, is a "source of knowledge".

The resulting Descriptive Model allows you to determine the composition of the environmental object as a system of components and their qualities, which in the future, at the second stage of testing the methodology, will make it possible to develop a Predictive Model, as well as identify the main problems and search for ways to solve them at stage three.

At the second stage, it is necessary to use the functioning parameters specified in the methodology for pairs of components that are in a state of contradiction; to identify what value (lowest or highest) of the parameter the controlling components in pairs tend to; determine how the contradiction between paired components unfolds when one of them tends to the maximum value, and the second is at the minimum level.

So, as a hypothesis when developing a predictive model for a pair of components 0. "Area" and 1. "Purpose", the controlling component is 0. "Area". Accordingly, when considering the development of material space, it seems appropriate to dwell on the potential of working with dominant planar parameters, which automatically determines the main functional purpose as creative, expressed by the active development of material space. For space-time, the range of solutions lies between maintaining stability or generating variability. In the case of the inner courtyard of the Larinsky Gymnasium, it is permissible to speak of more than two hundred years of stability, which can only be violated in the event of the appearance of external risks, which is currently not available, respectively, this parameter in the working hypothesis can be assessed as stable. In this regard, the technological purpose, expressing a professional approach to working with the environment as a design object, should be oriented towards the creation of a technological algorithm (instruction) that determines the sequence of actions in the

environment and, accordingly, minimizes the possibility of improvisation, which can lead to to abrupt changes, for example, in the cyclical functioning of the courtyard, due to the educational process. The cultural space, if we consider it as a self-developing system, strives to preserve its integrity as part of the Faculty of Arts, St. Petersburg State University and St. Petersburg. Accordingly, aesthetic solutions should lie in the plane of the synthesis of the new and the old, without sharp contrasts that can disrupt the existing atmosphere.

For the second pair of components 2. “Content” and 3. “Use”, the controlling component is 2. “Content”, which keeps the active component 3. “Use” within certain limits, depending on the target audience. So, when considering the subject content, we can safely assume that ergonomics (convenience and comfort) is its priority quality, which is due to the recreational purpose for a quiet holiday. Accordingly, the use of yard space for life support in terms of safety, accessibility and sustainability will develop through consumption, that is, passive use. On the contrary, if it was about active recreation or creative space, then the provocative nature of the environmental equipment would be more appropriate and would initiate overcoming, that is, its active adaptation. When analyzing the functioning parameter of process content, we can talk about the minimum value of the degree of assignment, and consider it as a catalyst for processes, since space implies a high degree of freedom, in contrast to a production or medical facility, in which the execution of instructions would come first. Thus, for target use, the decision will lie in the field of target generation. For semantic content, different solutions are possible, depending on the tasks facing the designer. Suppose that it is necessary to minimize the degree of modernization and preserve the traditional meanings laid down earlier. In this case, the identity will gravitate toward regionalism. In the event that the option of introducing new meanings into the space was chosen, namely, demonstrating the intercultural significance of university education, then, for the user, this would mean the formation of a global identity, as belonging to the world community of university students.

Thus, the result of approbation of the second stage of the conceptual modeling technique in the design of the environment made it possible to present a predictive model

that makes it possible to characterize the prospects for the development of the courtyard space of the Larinsky Gymnasium as a self-developing system. The development of a pair of components “Area – Purpose”: assignment to the function of creation on the material plane of space, assignment to a technological algorithm for the stability of temporary space, assignment to the aesthetics of synthesis for the integrity of the space of culture. Development of a pair of components “Use – Content”: the life support of the user through the consumption of ergonomic subject content, the generation of user goals as a catalyst (source of development) for process content, the use of regional identity to fill it with traditional meanings (Table 3.4.2).

Table 3.4.2. Concept Modeling Technique in Environmental Design: Stage II– predictive model. Approbation on the example of the courtyard of the Larinsky gymnasium.

0. “Area” and 1. “Purpose"”	**2. “Content” and 3. “Use”**
0.0. - 1.0. assignment to the function of creation on the material plane of space	2.0. - 3.0. life support of the user through the consumption of ergonomic subject content
0.1. – 1.1. assignment to a technological algorithm for the stability of temporary space	2.1. – 3.1. generating custom goals as catalyst (source of development) process filling
0.2. – 1.2. assignment to the aesthetics of synthesis for integrity of cultural space	2.2. – 3.2. the use of regional identity to fill with traditional meanings

At the third stage it is necessary: to clarify the environmental problem for each of the components; determine the features of its influence and identify solutions in the context of the proposed type; determine the mode of interaction of components inside the blocks that arose as a result of solving the problem and propose solutions for this mode.

Based on the analysis of the descriptive model obtained at the first stage of testing the methodology, and modeling tasks, it is possible to formulate environmental problems

and determine what type they belong to. For the courtyard of the Larinsky gymnasium – it could be a whole list. Let's dwell on some of them. So, for component 0.2. “Cultural area” An important problem is the lack of signs of belonging to St Petersburg University and the Faculty of Arts, which makes it difficult to perceive the environment as part of a university polycentric campus. For component 3.2. “Use identical” – cultural affiliation to the Larinsky gymnasium is not expressed, many of the students do not get the opportunity to get acquainted with the history of the building and the gymnasium life that once took place within its walls. For component 1.0. “The purpose is functional”, problems can be caused by the need for a new purpose of the environment, a change in the sequence of actions or the formation of a new aesthetic, for example, it is possible to integrate an educational function into the courtyard, such as a lecture hall. For component 2.0. “Subject content” – the lack of high-quality equipment for recreation and difficult navigation form an unfriendly space in relation to humans. For component 2.1. “Process content” – the lack of resources for the creative manifestation of students of the Faculty of Arts, practically excludes the space of the yard from university life, making it impossible to transfer part of the events to the open air. For component 2.2. “Content semantic” – the archetype identified as a result of the development of the descriptive model can be manifested by means of environmental design, and also, the proposed metaphor, if a worthy and accessible means is found, can add imagery to the courtyard space of the Larinsky gymnasium.

Further, it is necessary to offer options for solving the stated problems. So, for component 0. “Area”, the solution of the problem lies in the plane of harmonization as a regular, commensurate binding of the qualities of material space. Accordingly, the absence of signs of belonging to St Petersburg University and the Faculty of Arts can be solved by the repetition of the whole, for example, recognizable architectural solutions of the main building of St Petersburg University, in its parts. For component 1. “Purpose”, the solution of the problem lies in the plane of the purpose of the environment (defining the range of tasks to be solved), respectively, the creation of space for the lecture hall can be formed by changing the technological conditions for organizing the space and

integrating the appropriate equipment. For component 2. “Content”, the solution to the problem lies in the plane of mastering the environment, respectively, the lack of high-quality equipment for recreation, difficult navigation, the lack of opportunities for creative manifestation of students of the Faculty of Arts and the need to more actively manifest the features of the archetype and identify the metaphor by means of environmental design may lie, at the initial stage, in the plane of tactical urbanism, as well as in the development of projects by students of the departments of design, painting and arts and crafts, with their subsequent implementation within the framework of grants and sponsorship. For component 3. “2Use”, the solution to the problem lies in the plane of personal attitude to the environment, respectively, cultural belonging to the Larinsky gymnasium can be expressed by popularizing and recreating the gymnasium culture using event scenarios.

Next, it is necessary to clarify the mode of interaction between the components within the Architectural and Design blocks. It is convenient to present the nature and result of the interaction in the form of a table (Table 3.4.3).

Table 3.4.3. Concept Modeling Technique in Environment Design: Stage III– Architectural model and Design model. Approbation on the example of the courtyard of the Larinsky gymnasium.

Mode	**Communication type**	**Character interactions**	**Result of interaction**
A	0(+) 1(+)	Mutual amplification situation	Synergistic effect
A	2(+) 3(+)	Mutual amplification situation	Synergistic effect

For the “Architectural block” one can observe a synergistic effect when solving the problems declared for components 0. “Area” and 1. “Purpose”. This is due to the fact that the creation of a space for a lecture hall can be designed using the corporate identity of St Petersburg University, provided that the direction of self-development determined by the predictive model is preserved, namely:

- to develop the assignment to the function of creation on the material plane of space, that is, not to turn the lecture hall into a set of art objects for admiring, but leave the possibility for various modifications;
- keep the assignment to the technological algorithm for the stability of the temporary space, which involves the formation of a schedule and rules of conduct for the lecture hall, which will not allow turning it into an independent object outside the educational process,
- to strengthen the designation for the aesthetics of synthesis, for the integrity of the space of culture, which implies a respectful attitude to the context and the delicate introduction of new objects into the courtyard of the Larinsky gymnasium.

For the “Design block”, also, one can observe a synergistic effect in solving the problems declared for components 2. “Content” and 3. “Use”. This is due to the fact that an event scenario using tactical urbanism methods can, on the one hand, promote gymnasium culture, and, on the other hand, solve the problems of filling the courtyard space, provided that the forecasting results are preserved, namely:

- life support of the user through the consumption of ergonomic subject content, that is, careful study and satisfaction of the needs associated with compliance with modern requirements for the comfort of the environment by means of environmental design;
- constant generation of user goals as a catalyst (source of development) of process content, implies the formation of conditions for the emergence of a “contact field” and new target scenarios;
- conscious use of regional identity to fill with traditional meanings associated with the metaphorical image of the “source of knowledge” and the archetype of “monastic yard”.

The models obtained at the third stage can be characterized as progressive and having a synergistic effect in terms of the development of an environmental object as a system. This allows us to evaluate the results achieved at the previous stages of testing the methodology as satisfactory, and the models themselves as productive for the development of a design idea.

At the fourth stage, it is necessary to determine the nature and reveal the mode of interaction between the Architectural and Design blocks obtained at the previous stage. The result obtained can also be presented in the form of a table (Table 3.4.4).

Table 3.4.4. Concept Modeling Technique in Environment Design: Stage IV– Medium model. Approbation on the example of the courtyard of the Larinsky gymnasium.

Mode	**Communication type**	**Character interactions**	**Result of interaction**
A	Arch. (+) Dis. (+)	Mutual amplification situation	Synergistic effect

So, at the third stage of approbation of the methodology, it was found that the Architectural model justifies the creation of space for the lecture hall, which can be designed using the corporate identity of St. Petersburg State University, and the Design model offers an event scenario using the methods of tactical urbanism, which can, on the one hand, culture, and on the other hand, to solve the problems of filling the space of the yard. These results, when interacting, have a mutually reinforcing effect on each other. Accordingly, the final model can be presented as a request to create a space for a lecture hall using the SPbU corporate identity, which can be implemented using the methods of tactical urbanism and be supplemented by storytelling on the theme of “Larinskaya Gymnasium”, which will make it possible to make a competitive project for further promotion and search for funding.

The environment model obtained at the fourth stage can be characterized, like the two previous ones, as progressive and having a synergistic effect. This allows us to evaluate the overall results of testing the methodology as positive, and the model itself as corresponding to its generalizing role in the methodology.

So, the technique of conceptual modeling in the design of the environment was tested on a model object, which was chosen as the courtyard of the building of the Larinsky Gymnasium in St. Petersburg. At the first stage, the interaction components are investigated and a detailed Descriptive Model is obtained. At the second stage, the courtyard of the Larinsky gymnasium was studied as a self-developing system and a

predictive model was obtained. At the third stage, the features of the influence of environment problems on the components and the management of contradictions between the components were identified and studied, the Architectural and Design models were obtained, demonstrating a synergistic effect in resolving the identified problems. At the fourth stage, the management of contradictions between blocks of interaction components was studied and the Environmental model was obtained, which will become the basis for the formation of a design idea that balances between the descriptive (descriptive) and normative-prognostic (desirable) state of the environmental object from the point of view of the target audience.

The practical value of the results lies in the fact that the resulting system of models can become the basis for drawing up a detailed design assignment, as well as for formulating a design idea when developing a project for adapting the courtyard of the Larinsky Gymnasium for the purposes of the Faculty of Arts of St. Petersburg State University. At the same time, the expert role of the proposed methodology is also possible for developing criteria for verifying the compliance of the projects for the development of the courtyard of the Larinsky gymnasium with the problem field and the characteristics of the components of space as a self-developing system.

For additional confirmation of the productivity of the proposed method. Master students of the first year of study of the educational program “Environmental Design” of St. Petersburg State University under the guidance of the author. As part of the development of the discipline “Conceptual modeling of environmental objects” (Appendix 2, annotation 1). Conceptual models for different types of objects have been developed, which, in addition to the tabular one, have received a graphical expression in the sketch format.

So, one of the objects was the former complex of warehouse buildings of the joint-stock company “Prosveshchenie”, architect. Kapelinsky M.Yu. 1906 – 1907, at the address: St. Petersburg, Moskovsky pr. 93 (Fig. 3.4.5). As a result of the application of the methodology by the undergraduate student of the first year of study, Igosheva E.D. under the leadership of the author, a Descriptive model (Fig. 3.4.6, 3.4.7, 3.4.8) and a Predictive model (Fig. 3.4.9, 3.4.10) were obtained. On the basis of which, an architectural model has been developed based on an event scenario using the methods of

tactical urbanism, which, on the one hand, can promote, along with educational, research and industrial culture, and on the other hand, solve the problems of filling the space of the “City Corridor” which form warehouse buildings (Fig. 3.4.11). The design model proposes the creation of a space for a street gallery, which can be solved by changing the technological conditions of the space and integrating the appropriate equipment, while harmonizing the external appearance in accordance with the new purpose should be provided, provided that the original identity is revealed (Fig. 3.4.12). The environmental model is formulated as the creation of a harmonious multifunctional, event-rich space of the “City Corridor”, endowed with a design code, subject to the identification of the initial identity by the methods of tactical urbanism. Also, during the simulation, the author found a metaphor to describe the resulting model – "repository of professionalism" (Fig. 3.4.13).

Another urban object was the St. Petersburg courtyard facing Kanonerskaya Street on Pokrovsky Island (Fig. 3.4.14). As a result of the application of the methodology by the undergraduate of the first year of study Sysolyatina A.V. under the guidance of the author, a Descriptive Model (Fig. 3.4.15, 3.4.16, 3.4.17, 3.4.18) and a Predictive Model (Fig. 3.4.19) were obtained. The architectural model developed on their basis did not confirm the initial hypothesis that the courtyards adjacent to the street space have a high potential to become public. Modeling showed that the creation of a courtyard space in the historic quarter cannot be considered as a territory for the development of a full-fledged public function; the publicity of the space will be limited, but not completely excluded. This, first of all, should be a space for local residents, equipped for the activities of local communities (Fig. 3.4.20). The design model recommends launching community processes, provoking action, and forming local communities. It is necessary to provide for the possibility of using space with varying degrees of activity for pastime within the residential courtyard (Fig. 3.4.21, 3.4.22). Resulting Environmental Model – This creation of a space of everyday life, on the territory facing Kanonerskaya Street, with components of a “pocket” park, for local residents and citizens. The territory for the collective use of local communities, smoothly flowing into the public area of the street, corresponding to modern requirements for comfort and visual aesthetics, not conflicting with the architectural heritage and historical buildings of the quarter (Fig. 3.4.23).

Work with a landscape object as part of the testing of the methodology was carried out for the embankment of the Terek River on Tkhapsaev Street, Vladikavkaz. As a result of the application of the methodology by the undergraduate student of the first year of study, Martirosyan S.S. under the guidance of the author, a Descriptive Model was obtained (Fig. 3.4.25). On the basis of which the developed Architectural model showed that the creation of a comfortable space on the embankment can be solved by changing the technological conditions for its use and integrating appropriate equipment, and the harmonization of the external appearance must be carried out on the basis of identifying the identity of the coastal territory in the context of national culture (3.4.26). The design model showed that the synthesis of components will allow, through the introduction of event scenarios and connection with city events, to create a continuous sub-base for socio-cultural events that reveal culture and regional identity (Fig. 3.4.27). The final environmental model showed that the formation of the embankment space around the socio-cultural framework will serve as an impetus for the development of the event component of the urban environment, solve the problems of the lack of high-quality public spaces and contribute to the revival and actualization of national traditions, strengthening and development of local identity. The metaphor of the project has become “a connecting thread”.

In addition to working with students, in order to promote the methodology developed as a result of the study in the circle of the professional community, the author developed a draft program “Conceptual modeling in environment design: application methodology (for higher education and additional professional education)” (Appendix 2, annotation 2).

Prospects for further research lie in the plan of testing the proposed methodology on other real and educational design objects in order to refine and detail it.

Conclusions on the third chapter

Based on the universal scheme of interaction of components in the process of conceptual modeling and in substantiating the feasibility of using the categorical method

“Simple compensatory homeostat”, in order to identify ways to increase the stability of this process, a system of models has been developed that reflects the process of conceptual modeling in the design of the environment, differing in that they are based on the mechanism of mutual regulation of conflicting pairs of components “Area” – “Purpose” (“Architectural block”) and “Content” – “Use” (“Designer block”) of conceptual modeling in the design of the environment unfolding as a competition for the “problem statement” resource, which allows you to identify and describe the results of the components (Spatial model, Target model, Content model, User model) and the results of the blocks (Architectural model and Designer model), as well as the nature of the interaction of these components of opposites, depending on the type of feedback cross-link.

Based on the analysis of tasks and results in terms of managing the process of conceptual modeling in the design of the environment and substantiating the application of the categorical method “Deployed Compensatory Homeostat” for the purposes of managing this process; developed a model for managing the process of conceptual modeling in the design of the environment, characterized in that it is based on the model of the mechanism of interaction between the components of conceptual modeling in the design of the environment and the system of models reflecting the process of conceptual modeling in the design of the environment. Assuming the implementation of managerial influences on the leading contradiction between the “Architectural” and “Designer” modeling blocks (consisting, respectively, of conflicting pairs of components “Area” – “Purpose” and “Content” – “Use”), which includes the indicated blocks, the management resource (systems thinking), the subject of management (environment designer), the highest management body (project manager), the block of additional activation and adaptation (expert group, professional community), the management task (creation conceptual model of the environment), the main result of management (environmental model); allowing to develop an effective methodology for conceptual modeling of the design of the environment as a design area.

An original methodology for conceptual modeling in the design of the environment has been developed, which includes four stages [1) the study of interaction components,

2) the study of the interaction of components as a self-developing system, 3) the study of the influence of an environmental problem on components and the management of interaction between components, 4) the management of contradictions between blocks of components interaction], which is based on scientifically based ideas about the object of conceptual modeling in the design of the environment, the model of user qualities of the environment from the position of conceptual modeling, the mechanism of interaction of the components of conceptual modeling in the design of the environment, models of inter component contradiction of conceptual modeling in the design of the environment, the process of conceptual modeling in the design of the environment and its management model, which allows to obtain at the initial stage of design the conceptual models of the design object, the most significant for the effective implementation of the project and its quality: Descriptive model, Predictive model, Architectural model, Design model, Environmental model, etc.

The proposed methodology was tested on real and educational design objects in order to check its productivity. The results of conceptual modeling and their graphical interpretation, carried out by undergraduates of St. Petersburg State University of the educational program “Environment Design”, as part of the development of the discipline "Conceptual modeling of environmental objects" are presented. Demonstrated are design projects made using, at the stage of theoretical justification, conceptual models, confirming the effect of applying the methodology, expressed as a result: validity, complexity, uniqueness. Thus, the purpose of the study was achieved.

CONCLUSION

In the performed scientific research, the problem of insufficient rootedness of conceptual modeling methods in environmental design in the scientific field, on the one hand, and the need to update the theoretical base associated with the study of the object of conceptual modeling in the field of environmental design, on the other hand, which gave rise to the lack of a holistic productive methodology, are substantiated and resolved. conceptual modeling, which could develop both the object of transformation itself and the subject of project activities in order to improve the overall quality and comfort of the living environment.

The study of the theoretical aspects of conceptual modeling in the design of the environment made it possible to review and analyze the definitions of the category "environment" in the scientific literature in design activities and the concepts formed on its basis, on the basis of which the basic characteristics of the desired object were identified. The comparative analysis of the scientific classifications of needs carried out further made it possible to form a list of needs that can be satisfied by the tools of project activities. The results obtained, in aggregate, allow us to conclude that the study of modeling methods is relevant, which can be used to resolve the identified contradictions of the object: between external factors of influence and self-development of the environment as a system, as well as the user: between specifying the request of the target audience and the variability of human needs.

Studies of the degree of study of project activity as a process, in order to identify the place of modeling in it and its relationship with other stages, as well as the methodological tools that the designer has for this type of activity, together with the systematization of the data obtained on the basis of a universal interaction scheme, made it possible to attribute all pre-project activities to conceptual modeling, as well as to identify the importance of developing its methodological base and the potential for using environmental and system approaches in terms of building conceptual models.

Defining the essence of conceptual modeling as a general scientific activity and identifying its role in environmental design, as well as internal and external factors

influencing conceptual modeling in environmental design, made it possible to determine the place, role, principles and main directions of conceptual modeling in environment design.

Thus, the analysis of the theoretical base of the study made it possible to establish the need to develop a methodology for conceptual modeling in the design of the environment to eliminate the contradictions between the relevance of modeling as a research and expert activity and the lack of understanding of the essential features of the subject of modeling.

Further study of the essential aspects of conceptual modeling in environmental design based on a systematic approach, general scientific categorical-system methodology and the theory of dynamic information systems allowed us to obtain the following results. To identify a set of basic aspects of the concept of "an object of conceptual modeling in the design of the environment", on the basis of which to develop a detailed definition of the concept, and also to propose a system of concepts for describing the subject area. Present the user qualities of the environment from the position of conceptual modeling in the form of a multi-level information system that reflects their development as the acquisition of new qualities; carry out a typology and description of these levels, on the basis of which to obtain an information model of the user qualities of the environment in accordance with the changing needs of society from the position of conceptual modeling. Perform a critical analysis of scientific approaches to the description of the mechanism of interaction "designer – object – user" in project activities, identify their potential in terms of studying the interaction of conceptual modeling components; to develop a model of the mechanism of interaction between the components of conceptual modeling in the design of the environment, which includes inter component relations of contradiction, direct and inverse restrictions in a closed chain of components. Perform a review and critical analysis of the basic contradictions of the design of the environment, establish their connection with the components of conceptual modeling, propose a system of models of inter component contradictions of conceptual modeling in the design of the environment, demonstrating the interaction of components as objects of opposites in the process of competition for a basic resource.

Thus, from the position of general scientific methodology, a description of the qualitative characteristics of the subject of research in their interconnectedness and interdependence was carried out, on the basis of which a system of models was formed, which, in turn, made it possible to proceed to the construction of a methodology in order to manage conceptual modeling in the design of the environment.

For this, a study of conceptual modeling in the design of the environment as a controlled activity was carried out, based on a systematic approach and methods of homeostatics, which made it possible to analyze and present the organization of the process of conceptual modeling in the design of the environment in the form of an interaction scheme; to increase the stability of this process, develop a system of models that reflect the process of conceptual modeling in the design of the environment based on the mechanism of mutual regulation of conflicting pairs of conceptual modeling components. After that, perform a critical analysis of tasks in terms of managing the process of conceptual modeling, propose a model for managing the desired process, based on the principles of homeostatics through the impact on the contradiction that develops and unfolds between its components.

On the basis of all the results obtained in the study, the author has developed a methodology for conceptual modeling in the design of the environment, which includes four stages: 1. study of the components of interaction, 2. study of the interaction of components as a self-developing system, 3. study of the impact of the environmental problem on the components and management of the interaction between components, 4. managing contradictions between blocks of interaction components. After that, the proposed methodology was tested as a separate stage of scientifically based design activities, at the initial stage of design, in order to determine the problem field and further develop the design idea.

So, within the framework of the dissertation study of the theoretical foundations and essential aspects of conceptual modeling in the design of the environment as a field of communication, the author independently obtained seven results that have the qualities of novelty.

1. **Definition of "conceptual modeling object in environment design"** – as a model for identifying the main features of the environment (spatiality, purpose and fullness), as well as a system of concepts for describing the subject area.
2. **Model of user qualities of the environment from the position of conceptual modeling**, which differs in that the consumer qualities of the environment (goal-setting, life support, identity) are presented in the form of a multi-level information system that reflects their evolution as the acquisition of new qualities.
3. **Model of the mechanism of interaction between the components of conceptual modeling in the design of the environment,** demonstrating the possibilities of controlling the specified mechanism by influencing inter component relations.
4. **System of models of inter component contradictions of conceptual modeling in environment design**, which makes it possible to reveal the dependence of the stability of conceptual models in the design of the environment on the distribution of systems thinking between their components.
5. **A system of models reflecting the process of conceptual modeling in environmental design**, which allows to identify and describe the results of the operation of the components, as well as the nature of their interaction, depending on the type of feedback cross-coupling.
6. **Conceptual modeling process management model in environment design**, demonstrating the possibilities of controlling the specified process by influencing inter component relations.
7. **Concept modeling technique in environment design**, which allows to obtain at the initial stage of design the conceptual models of the design object, the most significant for the effective implementation of the project and its quality.

So, within the framework of the dissertation research, in accordance with its purpose and on the basis of the developed results, the following conclusions are formulated:

- The relevance of the design of the environment is due to the need to resolve the contradictions of the object: between external factors of influence and the self-development of the environment as a system, as well as the user: between the specification of the request of the target audience and the variability of human

needs. The effect of resolving these contradictions at the initial stage of project activity in the process of conceptual modeling using a systematic approach is to endow the design solution with the qualities of validity, complexity, and uniqueness.

- The role of conceptual modeling as a tool for constructing meaningful models in environmental design is to identify the problem field and develop an organizational idea between the descriptive (descriptive), predictive and normative (desirable) state of the environmental object from the point of view of the target audience. The main directions of conceptual modeling in the design of the environment, in accordance with the principles: problematic, cyclical, complex, interdisciplinary, integrity, are the essential parameters of the object and user in the communication process;
- The object of conceptual modeling in the design of the environment is an integral system that has the spatiality of the material, temporal, cultural; appointment of functional, technological, aesthetic; fullness of subject, process, semantic.
- The needs of the user from the standpoint of conceptual modeling are provided by the following qualities of the environment: life support (security, accessibility, sustainability), goal setting (compliance with collective, public, personal goals), identity (regional, social, cultural identity).
- During the interaction between the user, the object and the designer, the order of occurrence of the components, that is, the acquisition by conceptual modeling, as a system object, of new attributes becomes: “Area”, “Use”, “Purpose”, “Design”, “Content”; the main contradiction unfolds between the pairs of components “Area – Purpose”, and an additional contradiction – “Use – Content”, while “Purpose” and “Use” are active components associated with the target audience, and “Area” and “Content” – passive, but performing a controlling function, keeping the paired active components within certain limits; “Design” becomes the control component that regulates the distribution of the system resource.
- Management of the mechanism of interaction between the components of conceptual modeling in the design of the environment is possible by influencing

the contradictions between the components “Area” and “Purpose”, “Use” and “Content”, which unfolds with a phase difference in the process of competition for a basic resource, regulation of these contradictions is necessary in order to increase sustainability of conceptual modeling.

- In the process of conceptual modeling in the design of the environment with competition for the “problem statement” resource, the result of the interaction of the “Area – Purpose” components is the Architectural model, and “Use – Content” – the Design model, the stability of which depends on the modes of interaction between the components; The result of managing this process is an environmental model based on the resolution of contradictions both between components and blocks of conceptual modeling components as a system object.
- The proposed method makes it possible to obtain a meaningful model of the object of study, taking into account the mechanism of interaction and the qualitative composition of its components, i.e. user, object and designer as participants in communication; understanding the content of the contradictions between the components; comprehension and regulation of interaction modes both between separate components, and between blocks “Architectural” and “Designer”; management of inter component interaction by resolving identified contradictions, as well as using feedback channels between stages.

Thus, in the dissertation work, the goal was achieved and confirmation of the hypothesis was obtained that the systematic and, developed on its basis, general scientific approaches to the process of conceptual modeling and its subject in environmental design, will ensure the formation of a productive methodology that is significant for the process of project activity in terms of direct and indirect management of it in order to improve the quality of the habitat.

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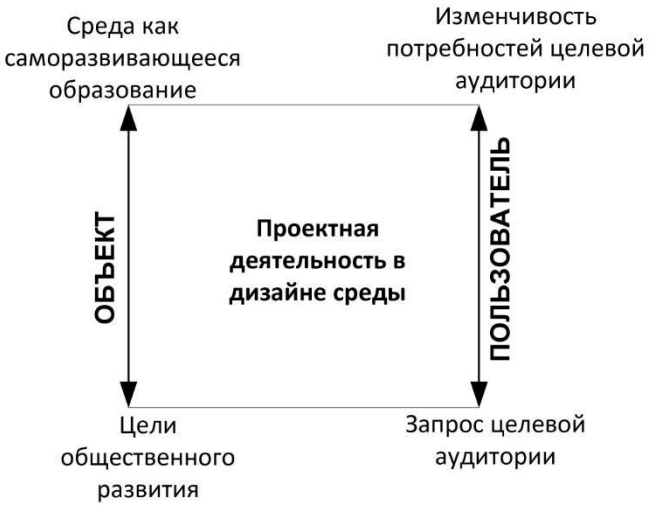
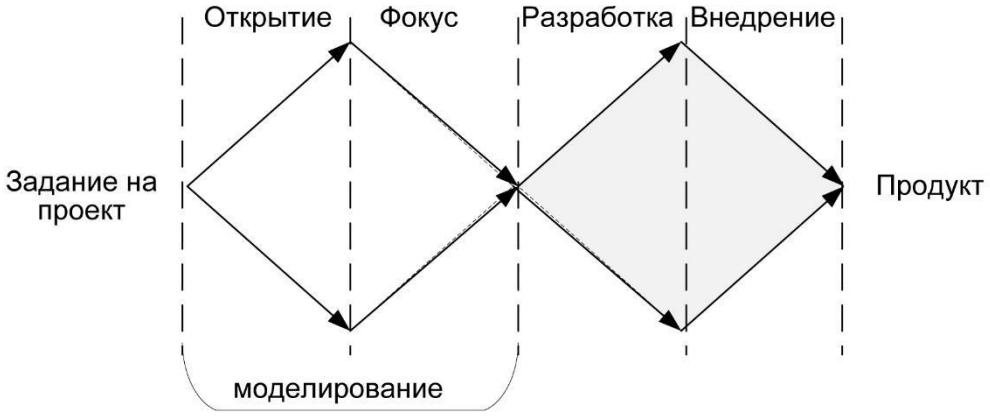
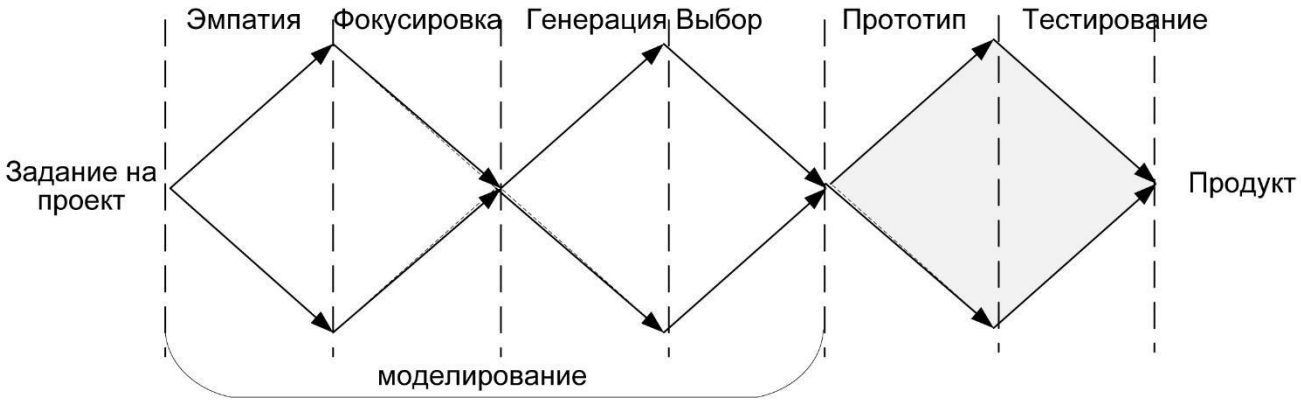
APPENDIX 1



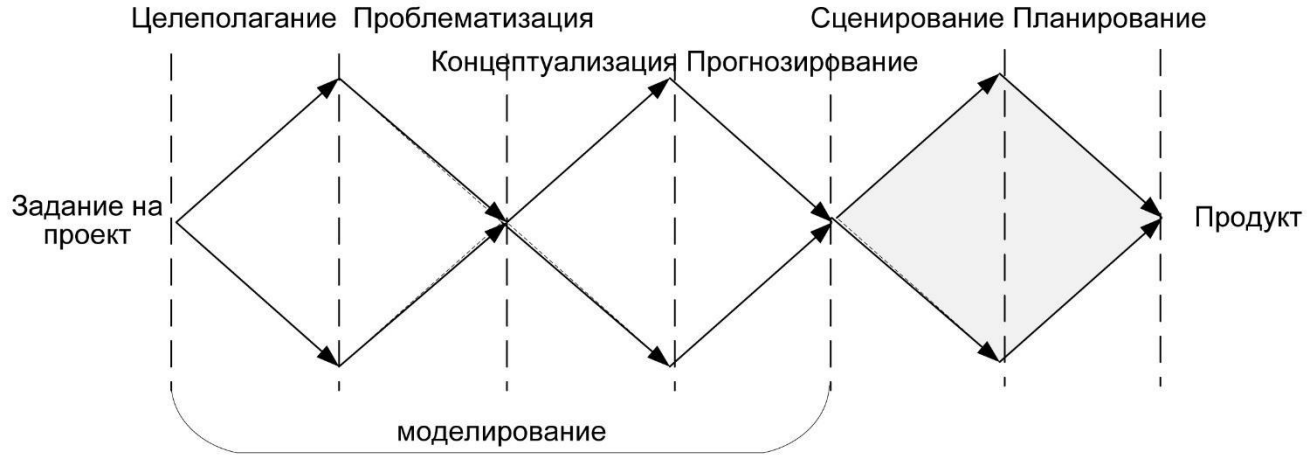
1.1.1. Scheme of contradictions in project activity: object and user factors.



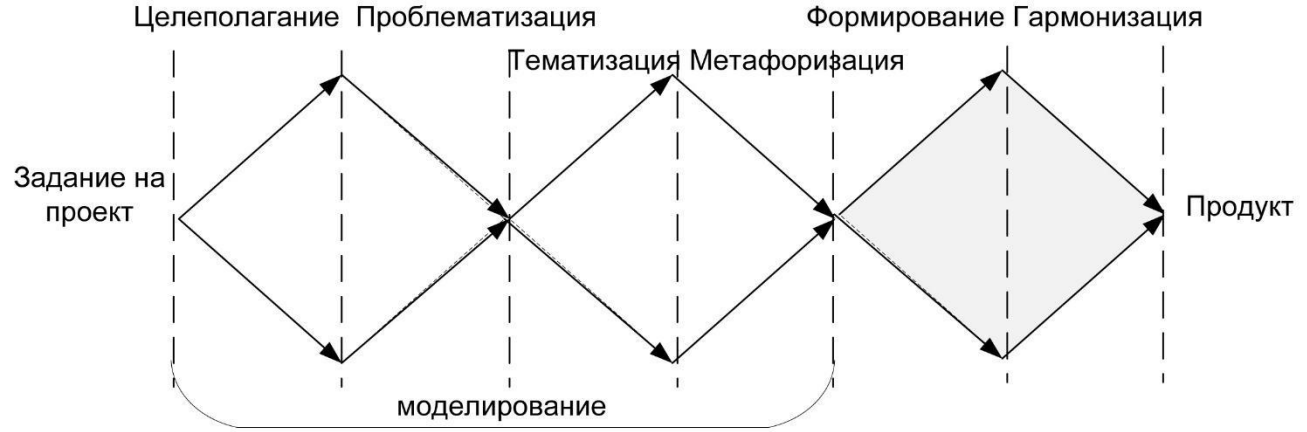
1.2.1. The process of creating a product,
represented by the “Double Diamond” chart.



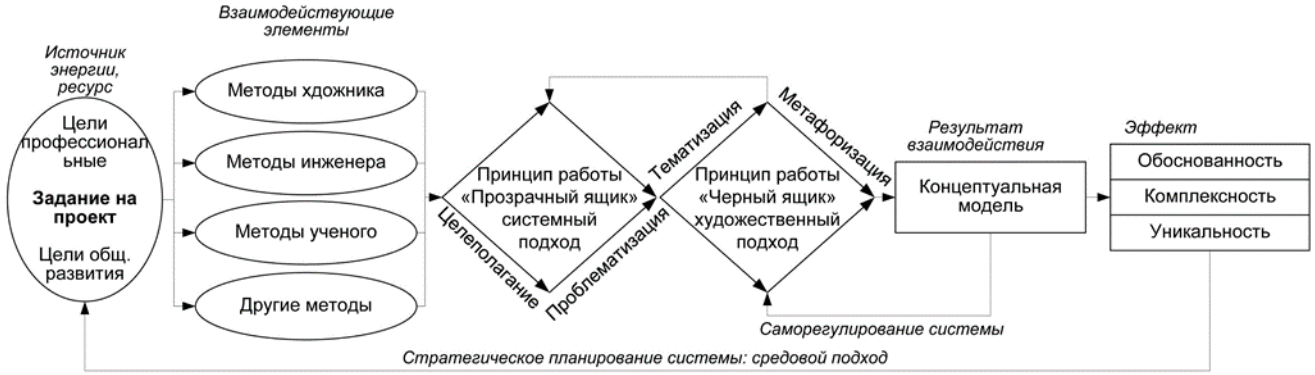
1.2.2. The process of creating a product in a design thinking strategy.



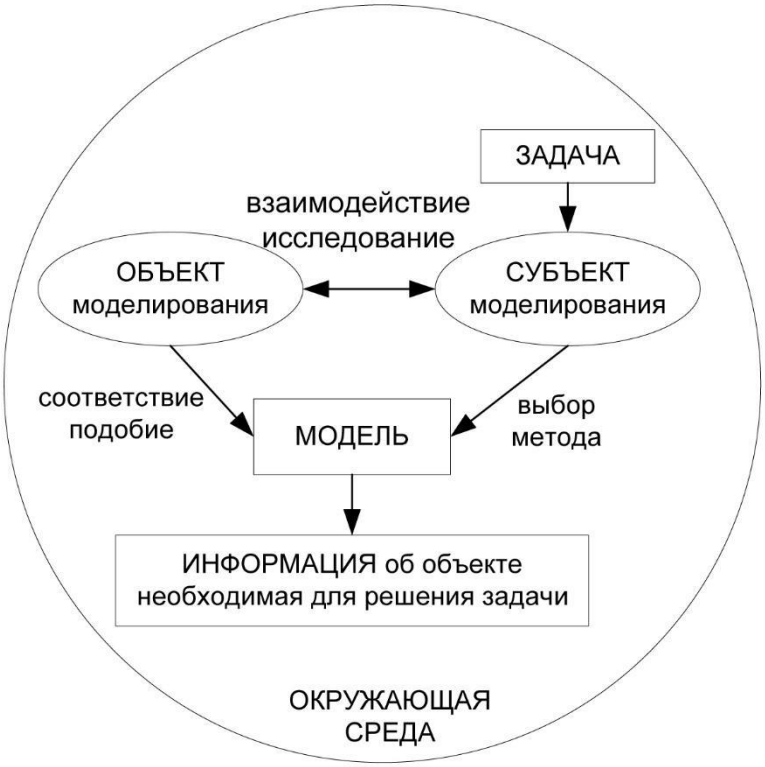
1.2.3. Product Development Activity Process
in the strategy of design programming methodology.



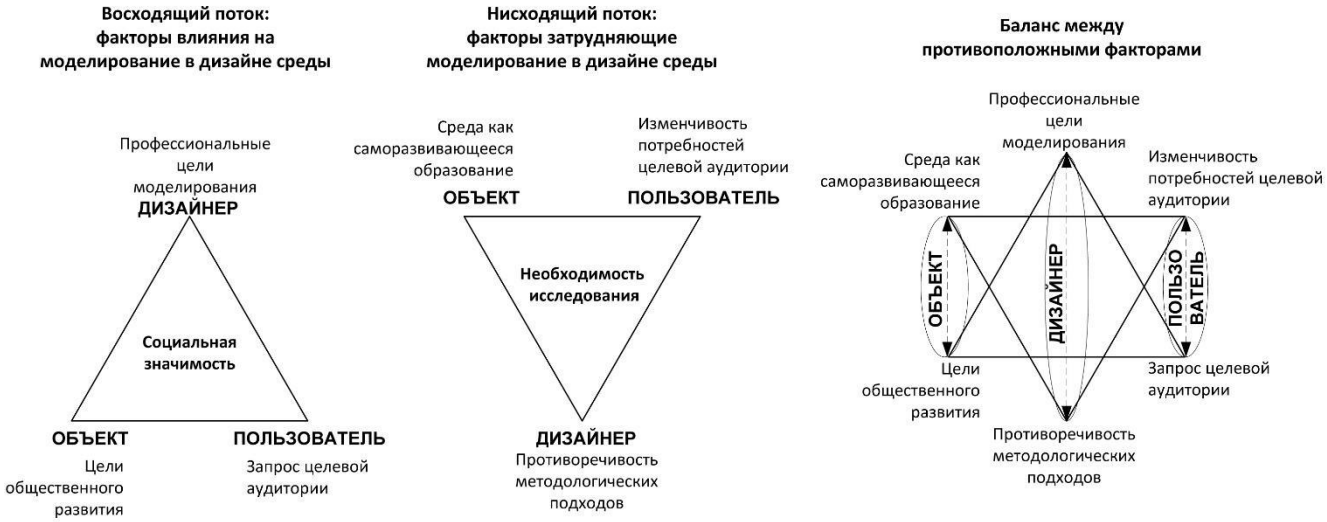
1.2.4. Product Development Activity Process
in the architecture design strategy



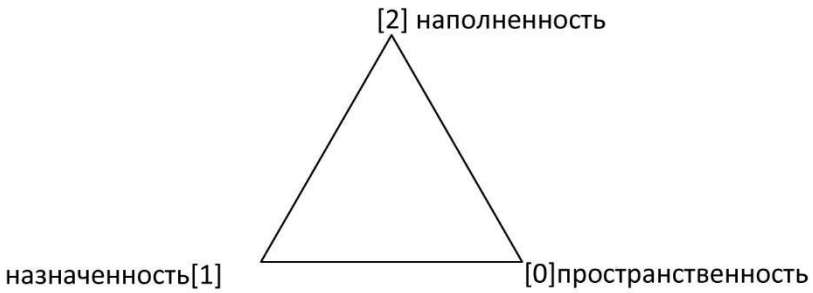
1.2.5. Scheme of interaction of environment design methods as elements of the process of conceptual modeling.



1.3.1. General scientific block diagram of modeling.

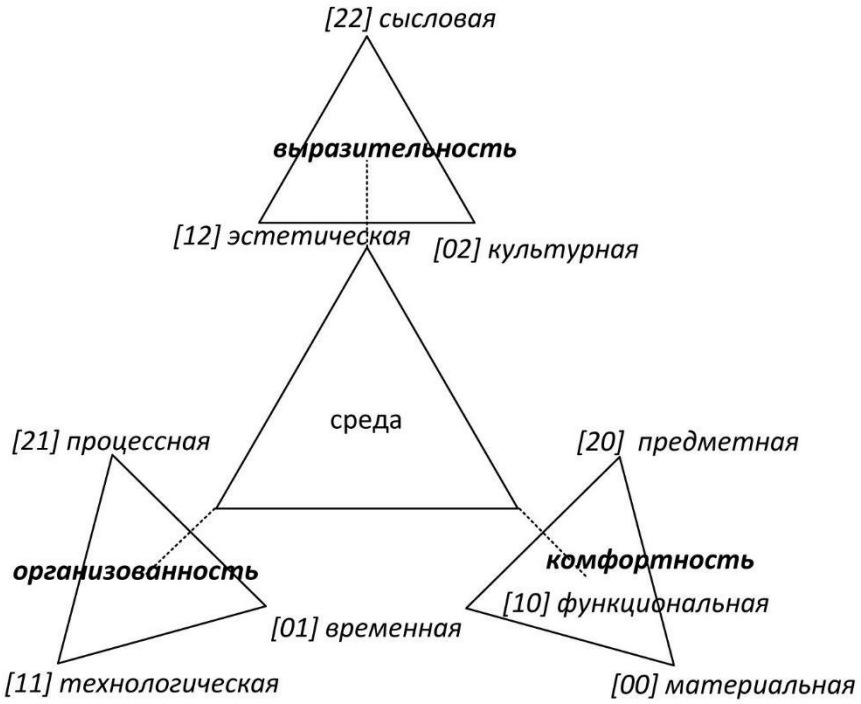


1.3.2. Schematic of the balance between opposing factors of conceptual modeling in environment design: object, user, and designer factors.



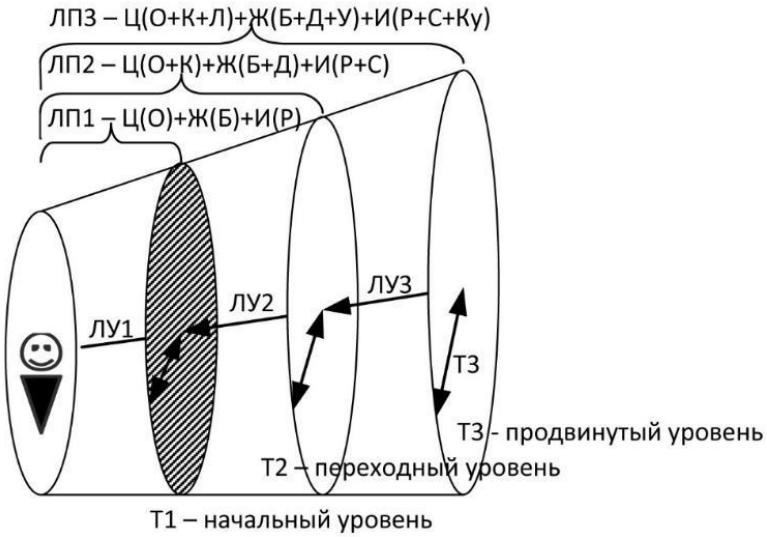
2.1.1. Two-level triadic deciphering of the concept “conceptual modeling object in environment design”: the first level.

2.1.2. Two-level triadic deciphering of the concept “conceptual modeling object in environment design”: the second level, aspect No. 1.



2.1.3. Method “Mutation of categories”: the concept of “object of conceptual modeling in the design of the environment”: aspect No. 2 testing the hypothesis.

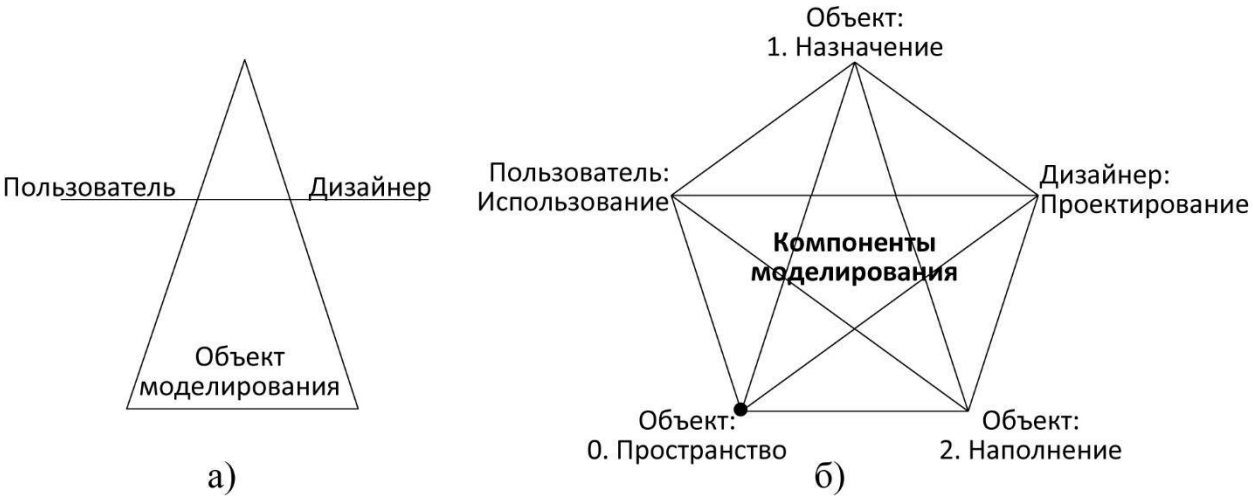
2.1.4. Method “Mutations of categories”: the concept of “object of conceptual modeling in the design of the environment”, aspect No. 3 mixed interaction of components based on a mathematical algorithm.



2.2.1. Categorical model “Final information flow”

user qualities of the environment from the position of conceptual modeling.

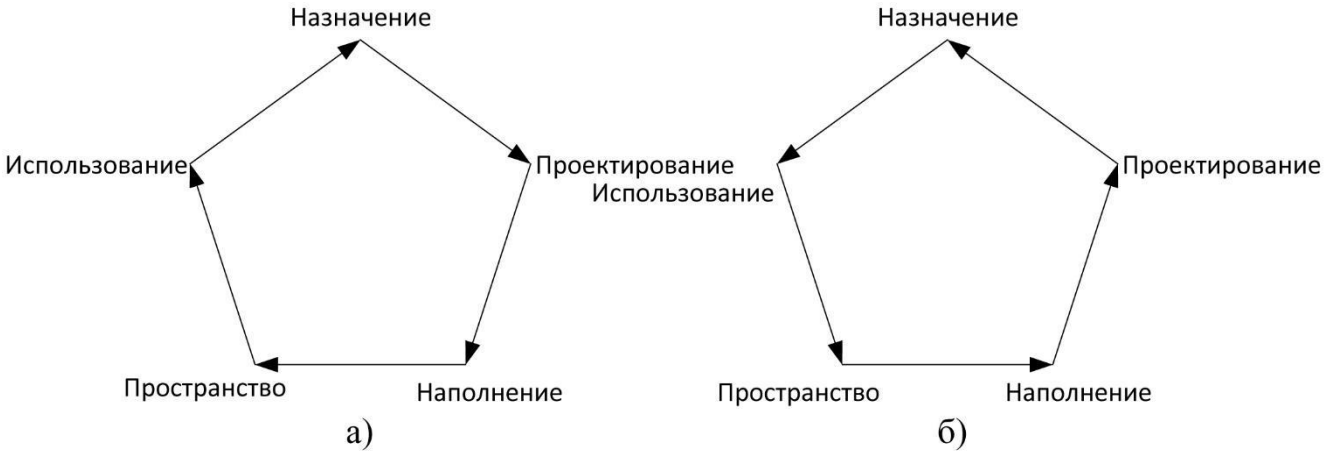
Symbols: needs: Ц - goal-setting, Ж - life support, И - identity; quality of the environment: О - compliance with public goals, К - compliance with collective goals, Л - compliance with personal goals; Б - safety, Д - availability, У - sustainability; Р - regional identity, С - social identity, Ку - cultural identity.



2.3.1. The model of the mechanism of interaction between the components of conceptual modeling in the design of the environment, presented using the categorical-symbolic method “Pentagram”:

a) the system “user - object - designer”,

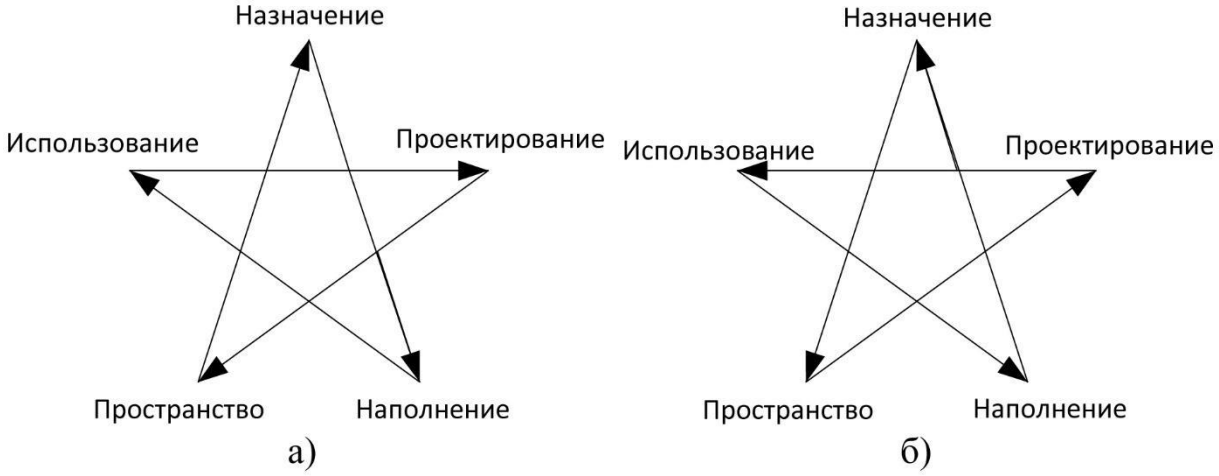
b) correlating the components of the system with the elements of the pentagram.



2.3.2. Relations of mutual support between the components of the “Pentagram”:

a) direct (normal) support,

b) reverse (pathological) support.

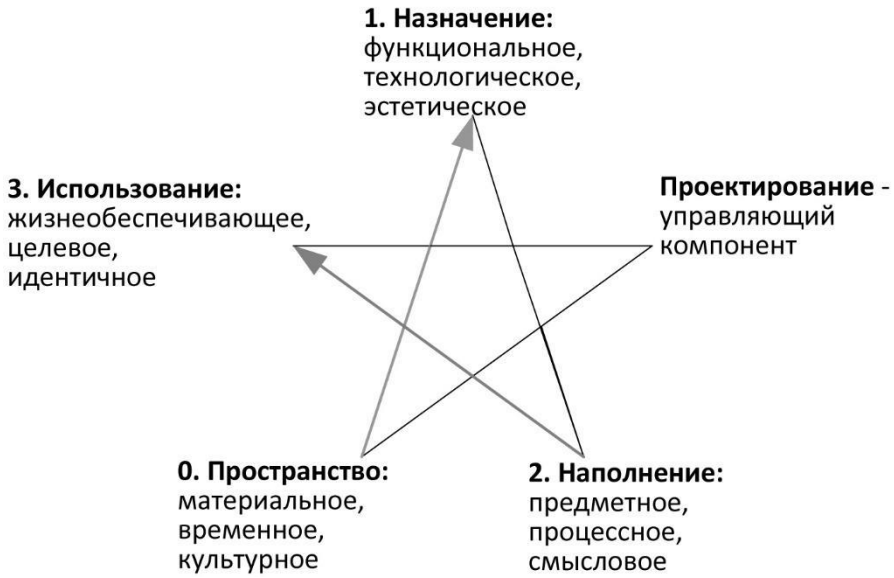


2.3.3. Relations of mutual limitation (control)

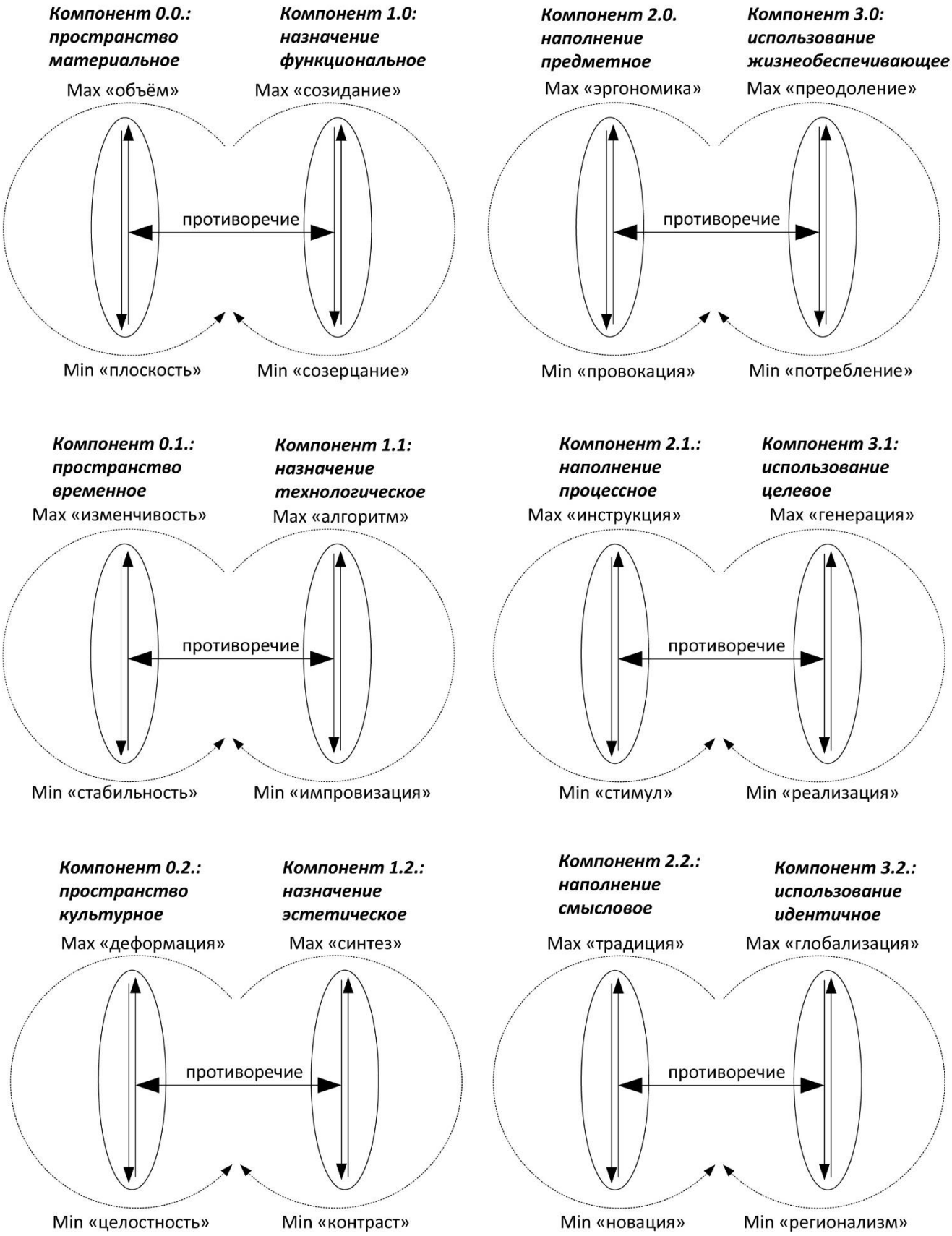
between the components of the “Pentagram”:

a) direct (normal) restriction,

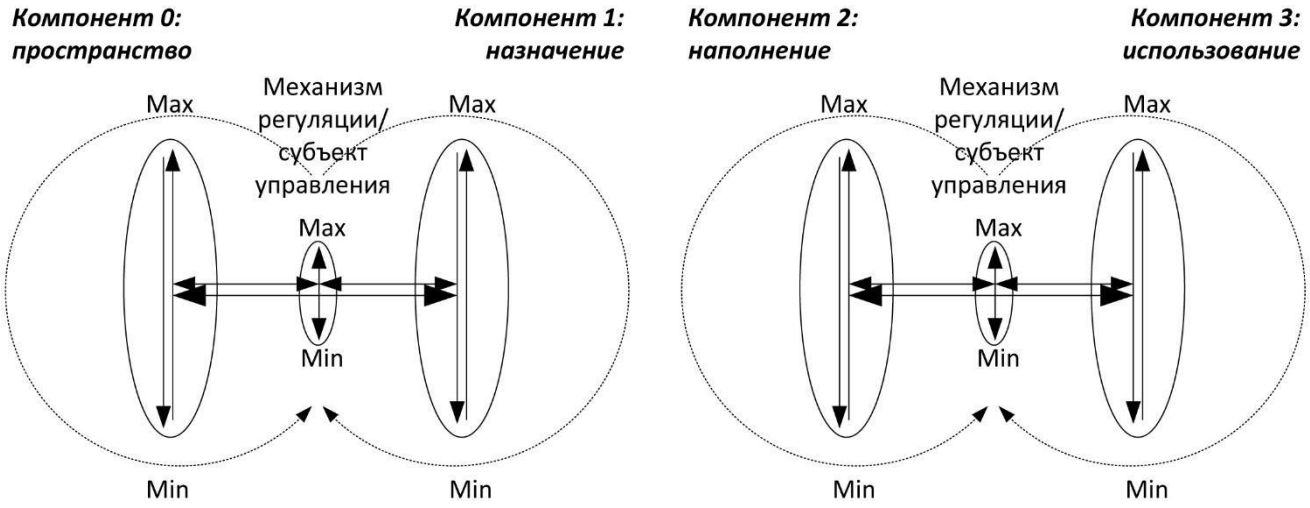
b) reverse (pathological) limitation.



2.4.1. Model of the mechanism of interaction of components of conceptual modeling: the main pairs of interacting components.

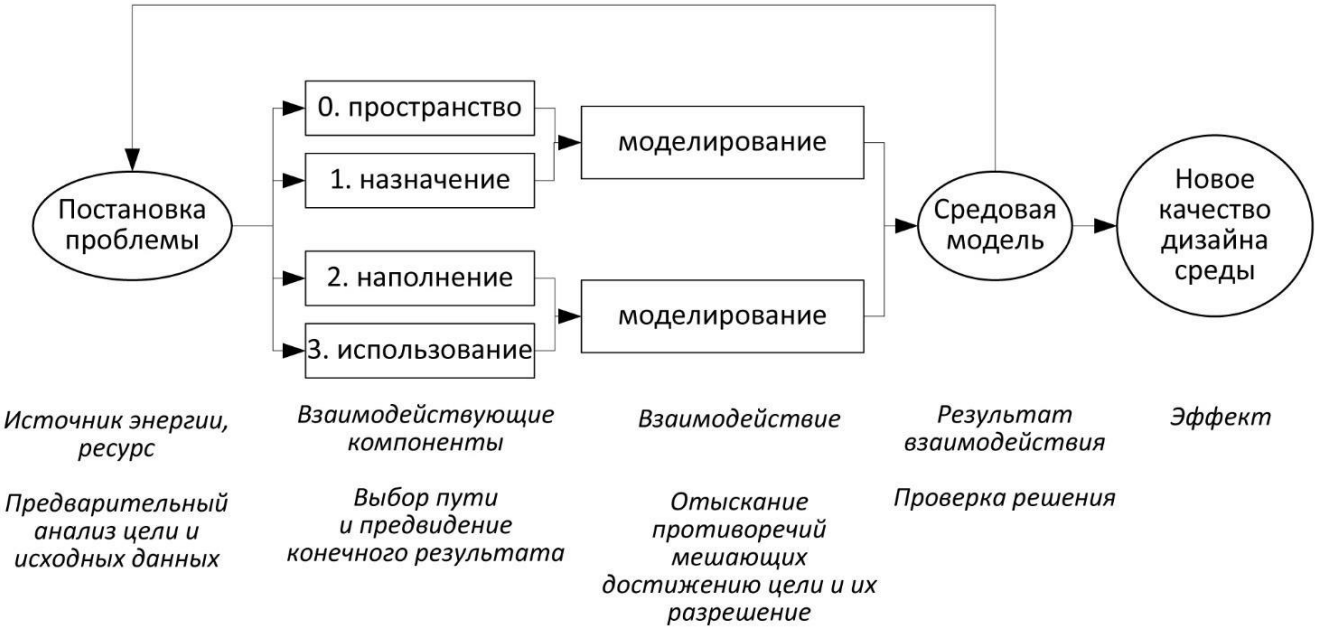


2.4.2. The system of models of inter component contradictions of conceptual modeling in the design of the environment represented by
categorical method “Universal scheme of contradiction”.

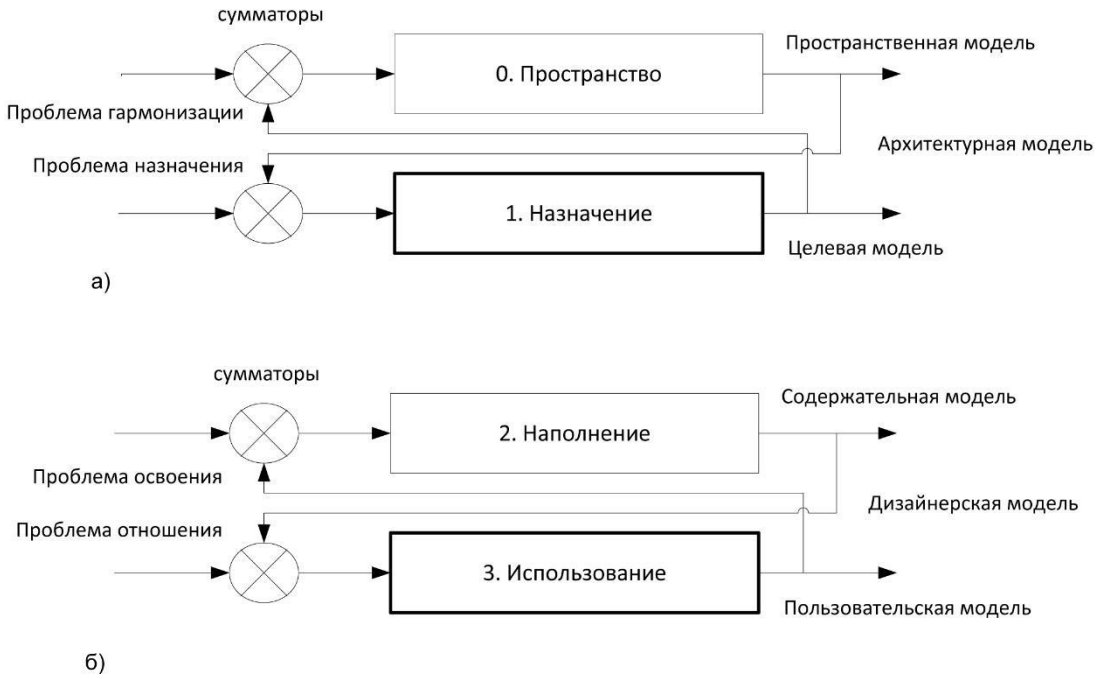


2.4.3. Regulated Contradiction Scheme

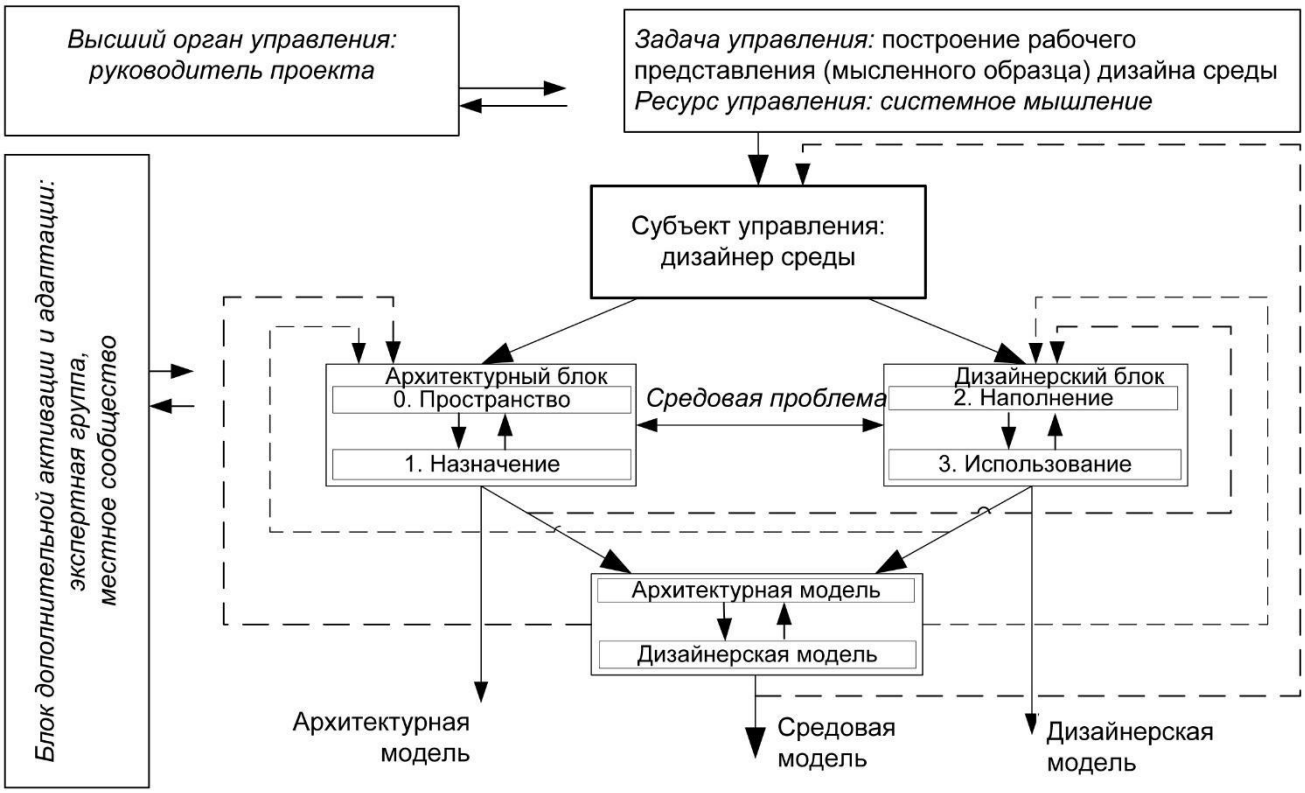
in conceptual modeling in environment design.



3.1.1. Scheme of interaction of components in the process of conceptual modeling.



3.1.2. The system of models reflecting the process of conceptual modeling in the design of the environment: a) “0. Area - 1. Purpose”, b) “2. Content - 3. Use”.



3.2.1. Managing the Conceptual Modeling Process in Environment Design in the “Deployed Compensatory Homeostat” model.

3.2.2. The model of interaction between the “Architectural block” and the “Designer block” in the process of conceptual modeling in the design of the environment, presented using the “Simple Compensatory Homeostat” method.

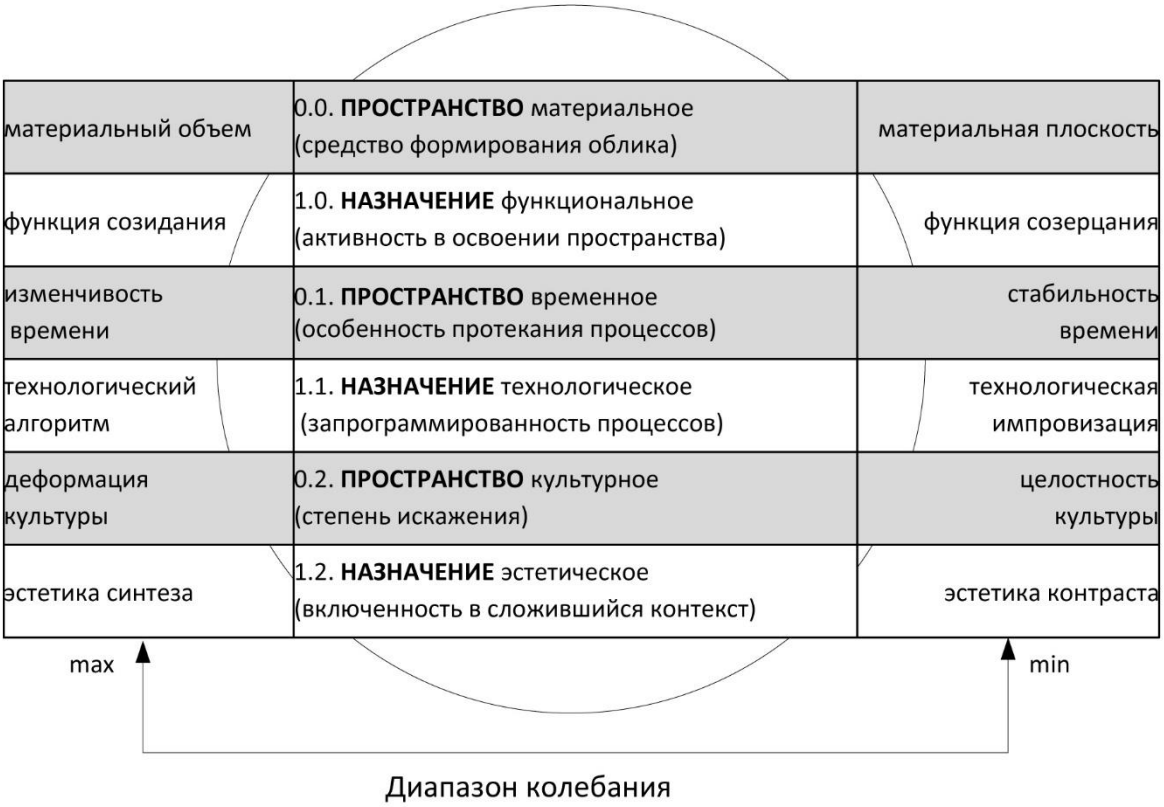
Компонент 1. **НАЗНАЧЕНИЕ**	
1.0. функциональное	1.0. назначение главное, второстепенное, возможное
1.1. технологическое	1.1. последовательность действий, оснащение, условия реализации
1.2. эстетическое	1.2. композиция, цветовое решение, указатели масштаба

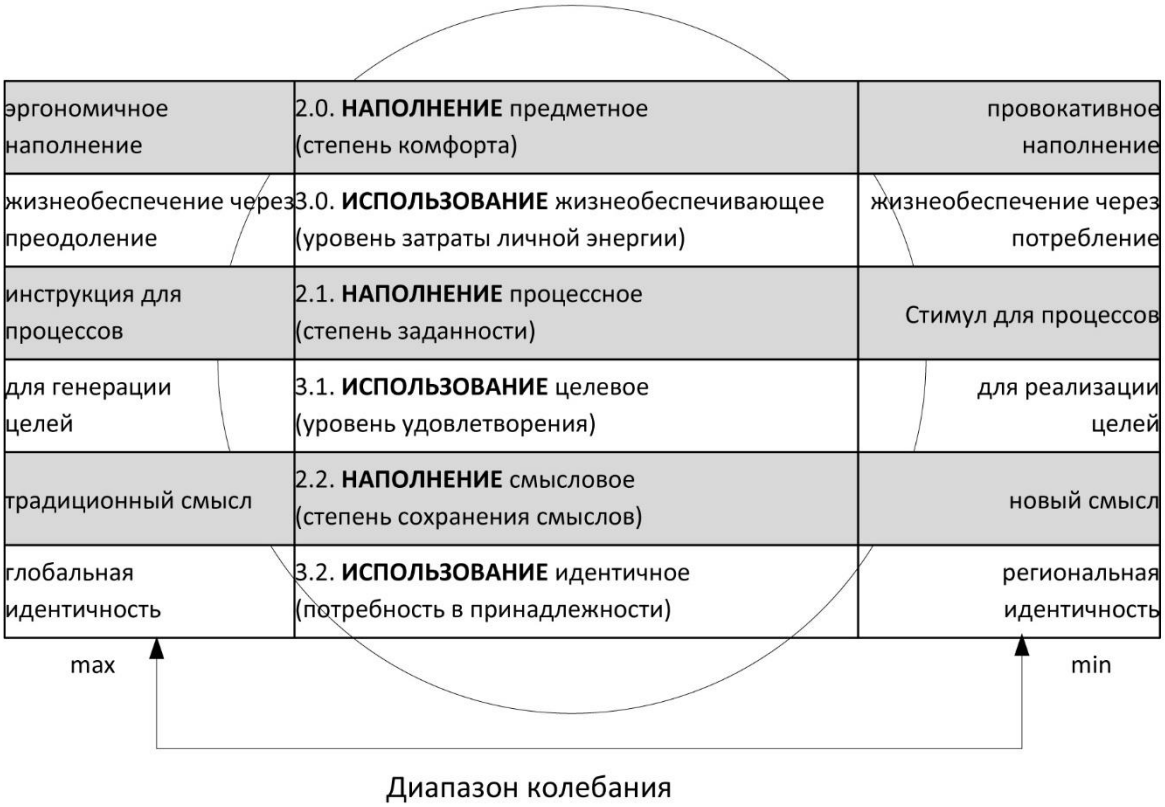
Компонент 2. **НАПОЛНЕНИЕ**	
2.0. оборудование, система навигации, ландшафтное оформление	2.0. предметное
2.1. интуитивный, целевой, событийный сценарий	2.1. процессное
2.2. архетип, стиль, метафора	2.2. смысловое

Компонент 0. **ПРОСТРАНСТВО**	
0.0. материальное	0.0. форма, границы, поверхность
0.1. временное	0.1. длительность существования, последовательность событий, цикличность явлений
0.2. культурное	0.2. индивидуальные особенности, ценностные установки, особость

Компонент 3. **ИСПОЛЬЗОВАНИЕ**	
3.0. безопасность, доступность, устойчивость	3.0.жизнеобеспечивающее
3.1. общество, коллектив, индивидуальный пользователь,	3.1. целевое
3.2. регион, социум, культура	3.2. идентичное

3.3.1. Conceptual Modeling Technique in Environment Design.
Stage I: exploration of components 0. “Area”, 1. “Purpose”,
2. “Content”, 3. “Use”.





3.3.2. Conceptual Modeling Technique in Environment Design.

Stage II: study of the interaction of components as a self-developing system.

АРХИТЕКТУРНАЯ МОДЕЛЬ

режим	Тип связи	Характер взаимодействия	Результат взаимодействия
А	0(+) 1(+)	ситуация взаимного усиления	Синергический эффект
Б	0(+) 1(-)	Назначение противоречит характеристикам пространства, которое готово к трансформации и адаптации	Разрешение противоречий за счет компонента 0.Пространство
В	0(-) 1(+)	пространственные характеристики доминируют, назначение трансформируется в соответствии с условиями	Разрешение противоречий за счет компонента 1.Назначение

ДИЗАЙНЕРСКАЯ МОДЕЛЬ

режим	Тип связи	Характер взаимодействия	Результат взаимодействия
А	2(+) 3(+)	ситуация взаимного усиления	Синергический эффект
Б	2(+) 3(-)	использование не находит возможности для реализации, наполнение воздействует на ЦА и корректирует потребности	Разрешение противоречий за счет компонента 3. Использование
В	2(-) 3(+)	наполнение игнорирует интересы использования среды, использование стимулирует появление нового наполнения	Разрешение противоречий за счет компонента 2.Наполнение

3.3.3. Conceptual Modeling Technique in Environment Design.

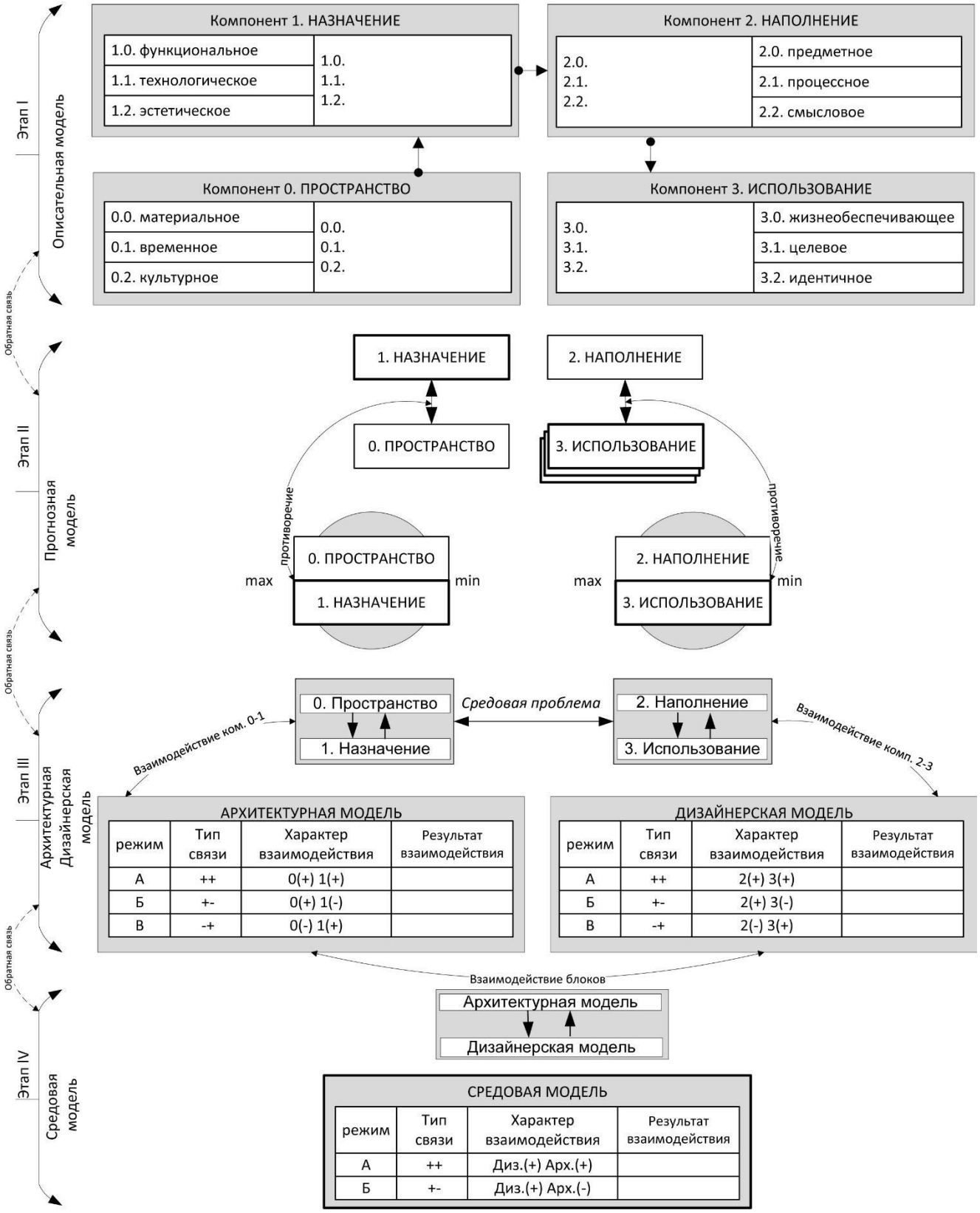
Phase III: Investigate the impact of environment issues on components and manage interactions between components.

СРЕДОВАЯ МОДЕЛЬ

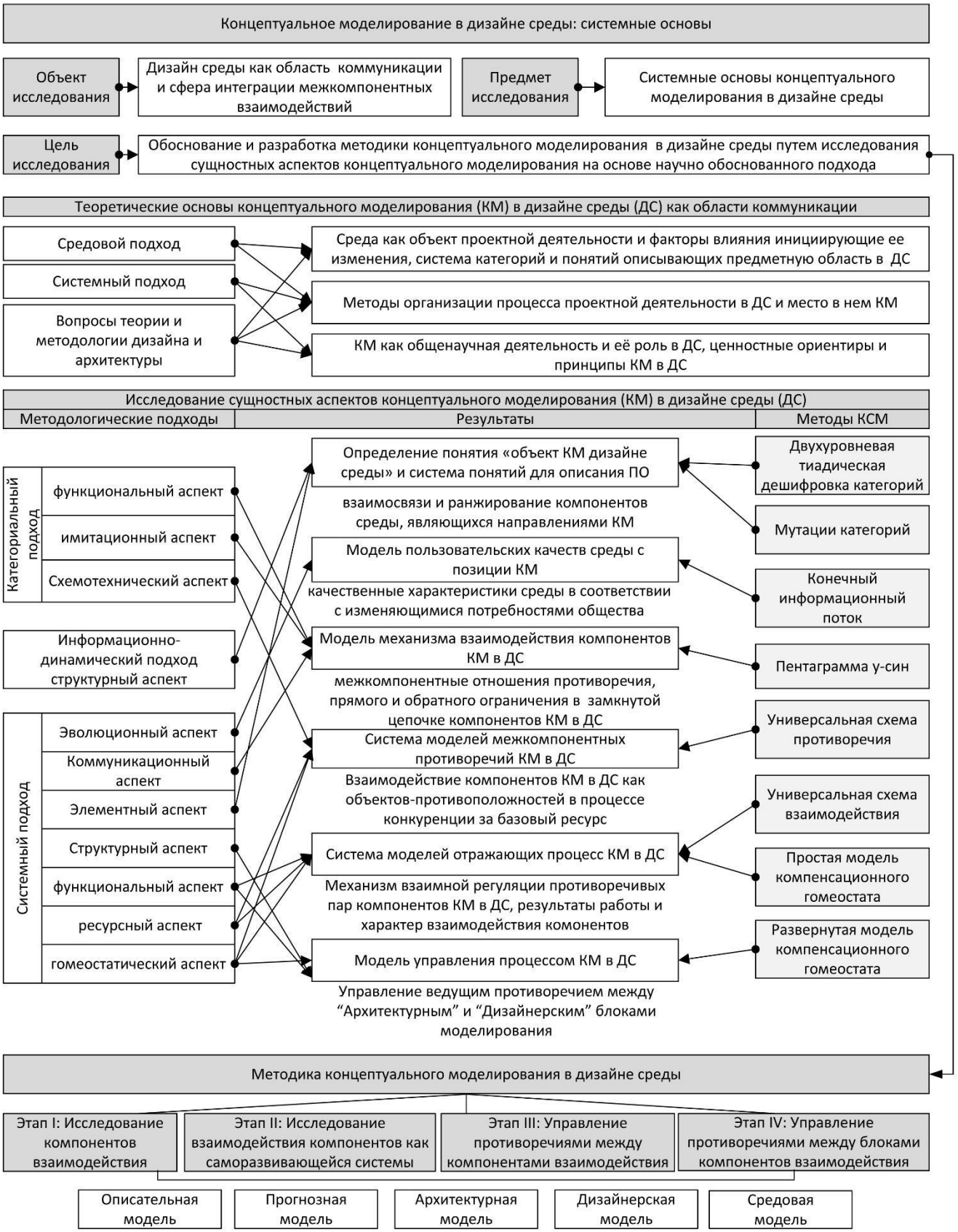
режим	Тип связи	Характер взаимодействия	Результат взаимодействия
А	Арх.(+) Диз.(+)	ситуация взаимного усиления	Синергический эффект
Б	Арх.(-) Диз.(+)	“Архитектурная модель” блокирует, “Дизайнерская модель” стимулирует	Разрешение противоречий за счет «Дизайнерской модели»

3.3.4. Conceptual Modeling Technique in Environment Design.

Stage IV: managing the interaction between blocks of components.



3.3.5. The content and logic of the conceptual modeling technique in environmental design.

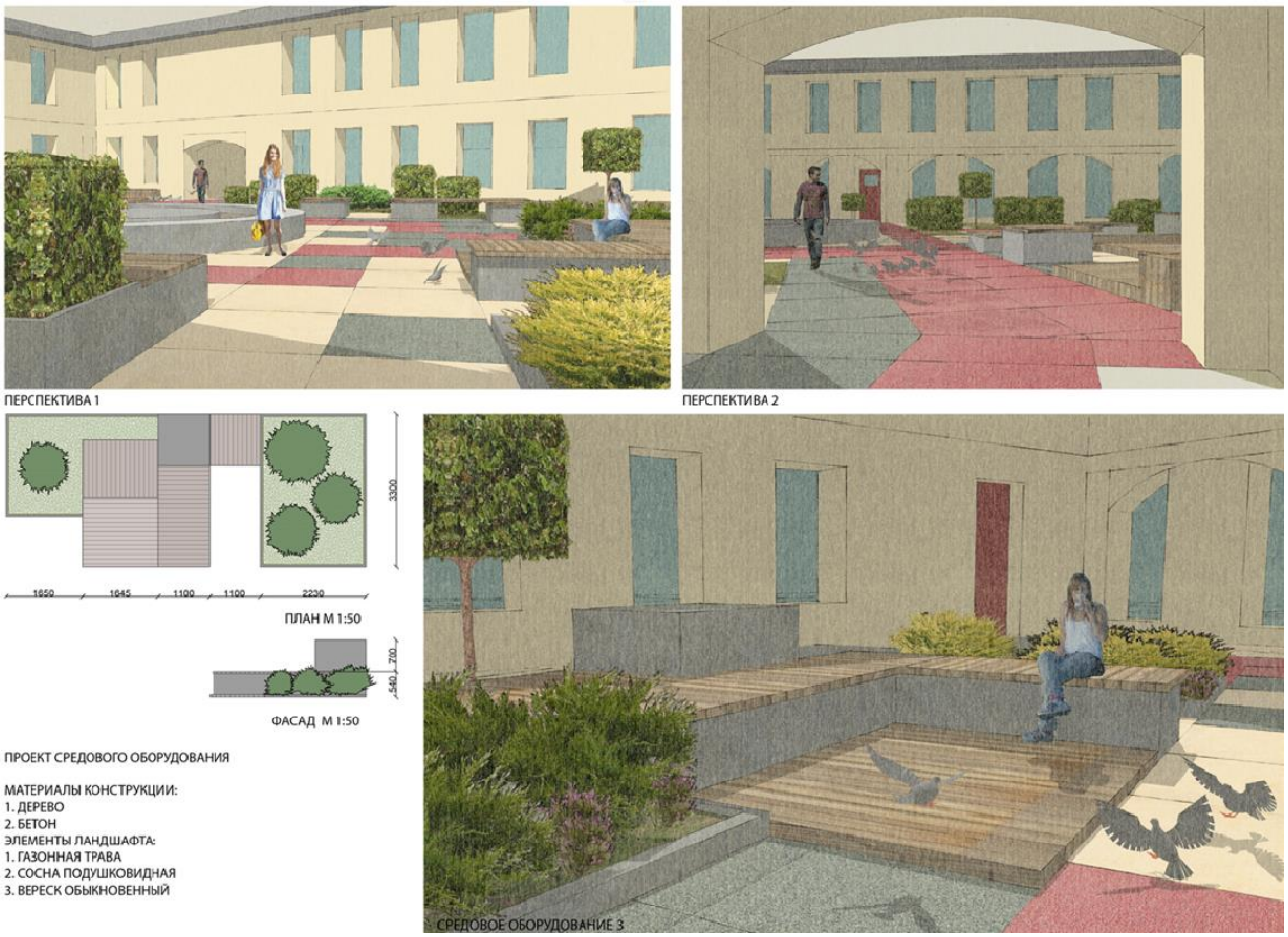


3.3.6. The logical scheme of dissertation research

on the topic “Conceptual Modeling in Environment Design: System Foundations”.

3.4.1. Model object: courtyard of the Larinsky gymnasium (building of the Faculty of Arts of St. Petersburg University), St. Petersburg, Vasilyevsky Island, line 6, 15.

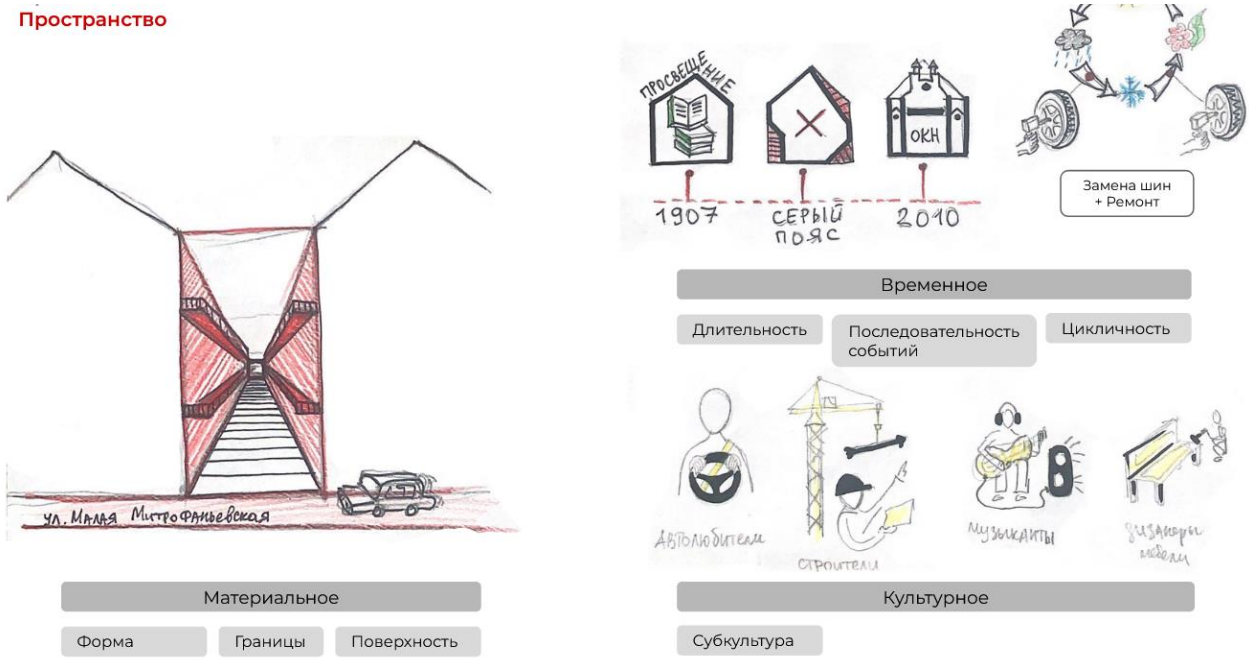
3.4.2. The project for the development of the courtyard of the Larinsky gymnasium “Creative Impulse”, author Kovaleva A., head Tolstova A.A.



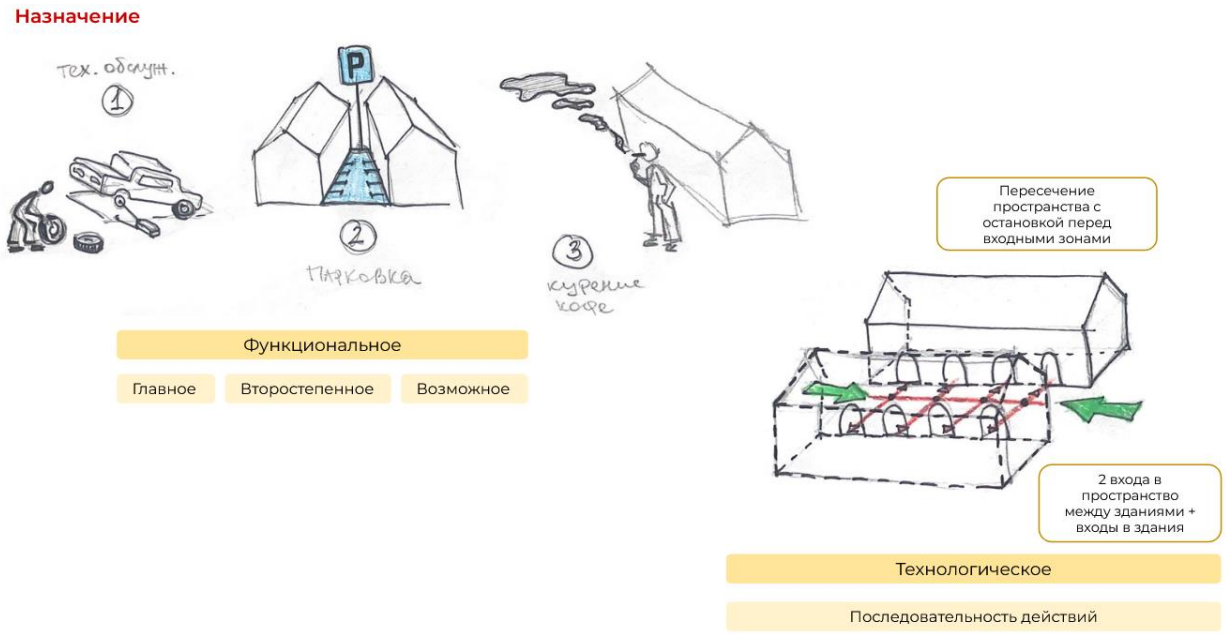
3.4.3. The project for the development of the courtyard of the Larinsky gymnasium “Geometric code”, author Sukhikh A., leader Tolstova A.A.

3.4.4. The project for the development of the courtyard of the Larinsky gymnasium “Could you play the nocturne ...”, author Oskina D., head Tolstova A.A.

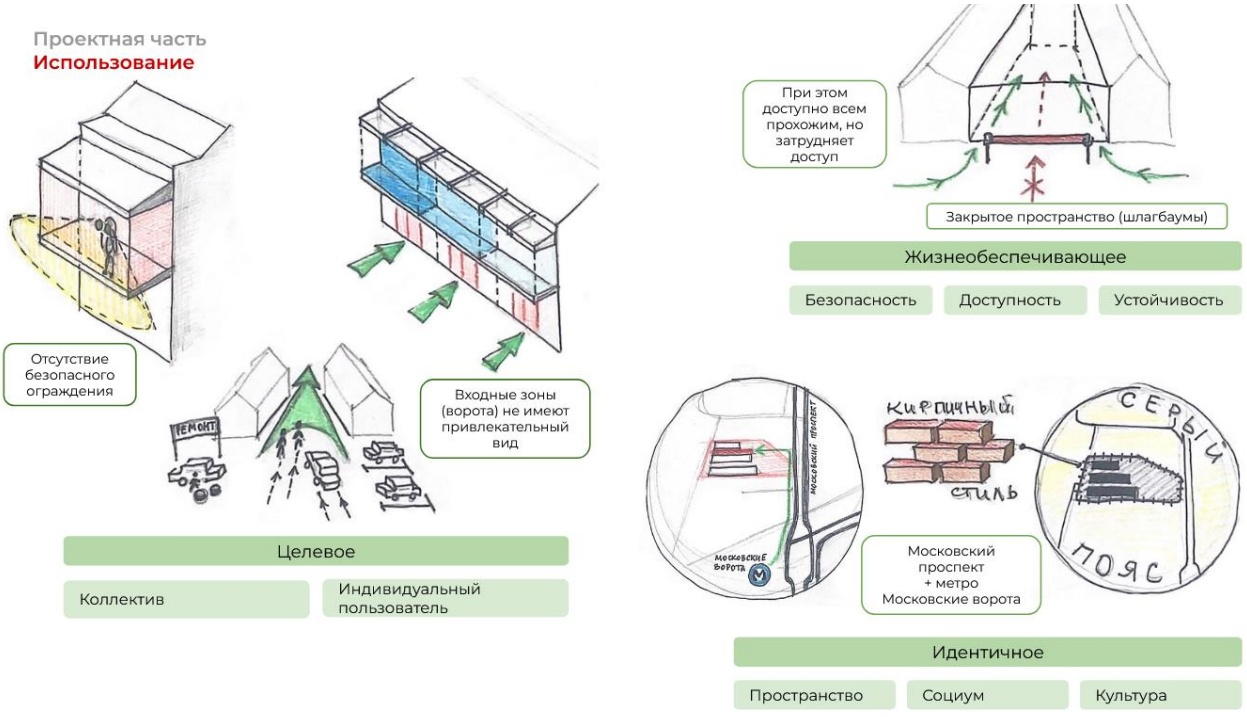
3.4.5. Model object: the former complex of warehouse buildings of the joint-stock company “Prosveshchenie”, St. Petersburg, Moskovsky pr., 93, lit. A B C.



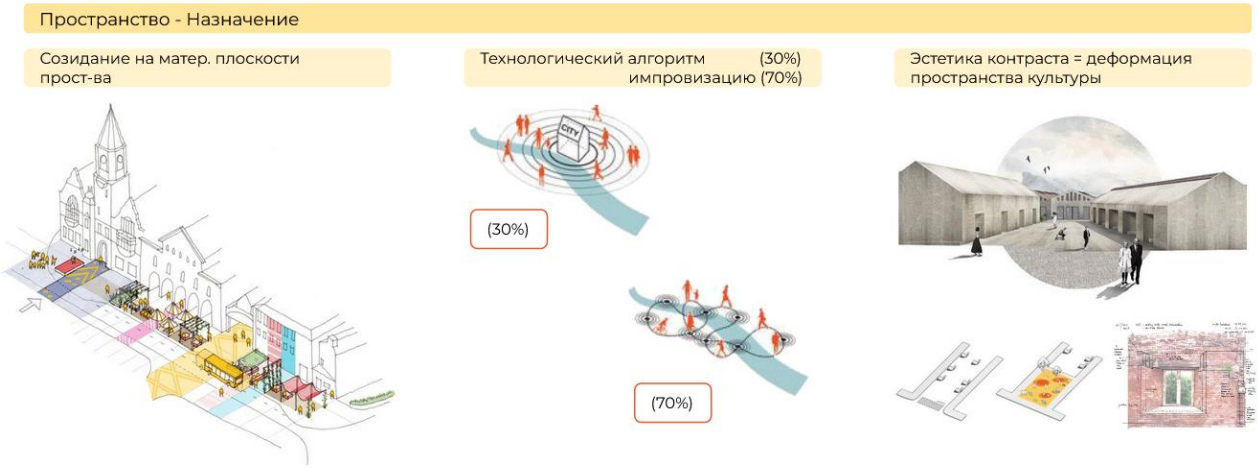
3.4.6. Concept Modeling Technique in Environment Design:
stage I - Descriptive model. Approbation on the example of the former complex of warehouse buildings of the joint-stock company “Prosveshchenie”: component 0. Area
(author: Igosheva E., leader: Tolstova A.A.).



3.4.7. Concept Modeling Technique in Environment Design:
stage I - Descriptive model. Approbation on the example of the former complex of warehouse buildings of the joint-stock company “Prosveshchenie”: component 1. Purpose
(author: Igosheva E., leader: Tolstova A.A.).



3.4.8. Concept Modeling Technique in Environment Design:
stage I - Descriptive model. Approbation on the example of the former complex of warehouse buildings of the joint-stock company “Prosveshchenie”: component 3. Use
(author: Igosheva E., leader: Tolstova A.A.).

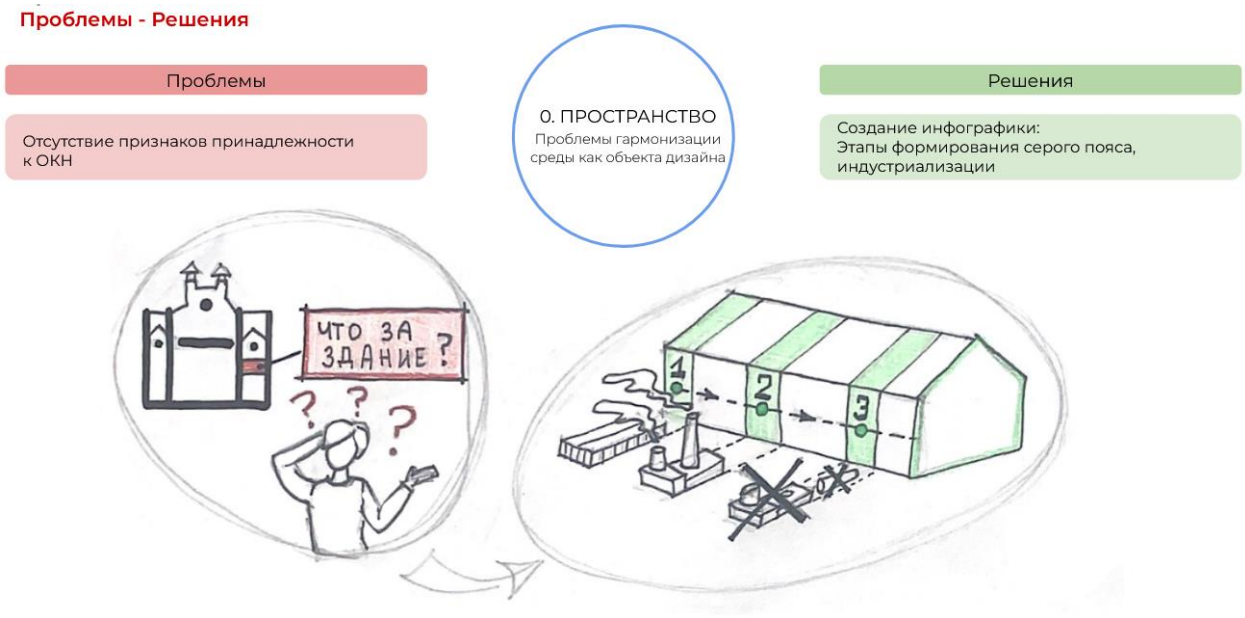


3.4.9. Concept Modeling Technique in Environment Design:

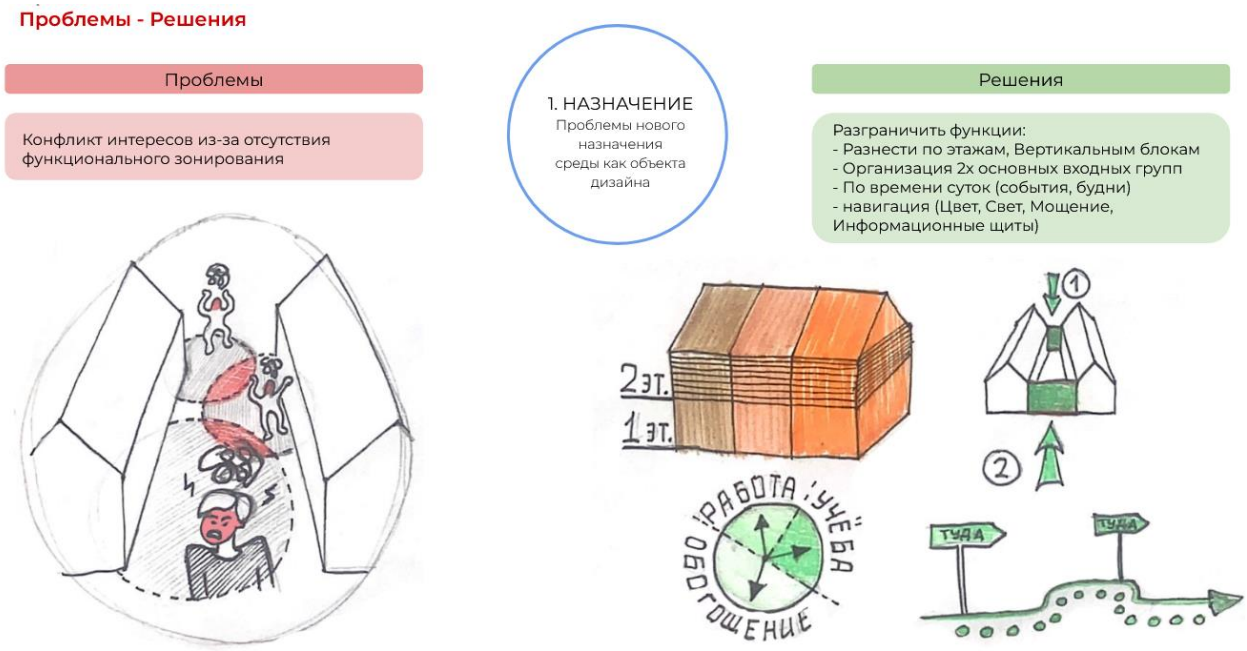
stage II - Predictive model. Approbation on the example of the former complex of warehouse buildings of the joint-stock company “Prosveshchenie”: component 0. Area - component 1. Purpose (author: Igosheva E., leader: Tolstova A.A.).

3.4.10. Concept Modeling Technique in Environment Design:

stage II - Predictive model. Approbation on the example of the former complex of warehouse buildings of the joint-stock company “Prosveshchenie”: component 2. Content - component 3. Use (author: Igosheva E., leader: Tolstova A.A.).



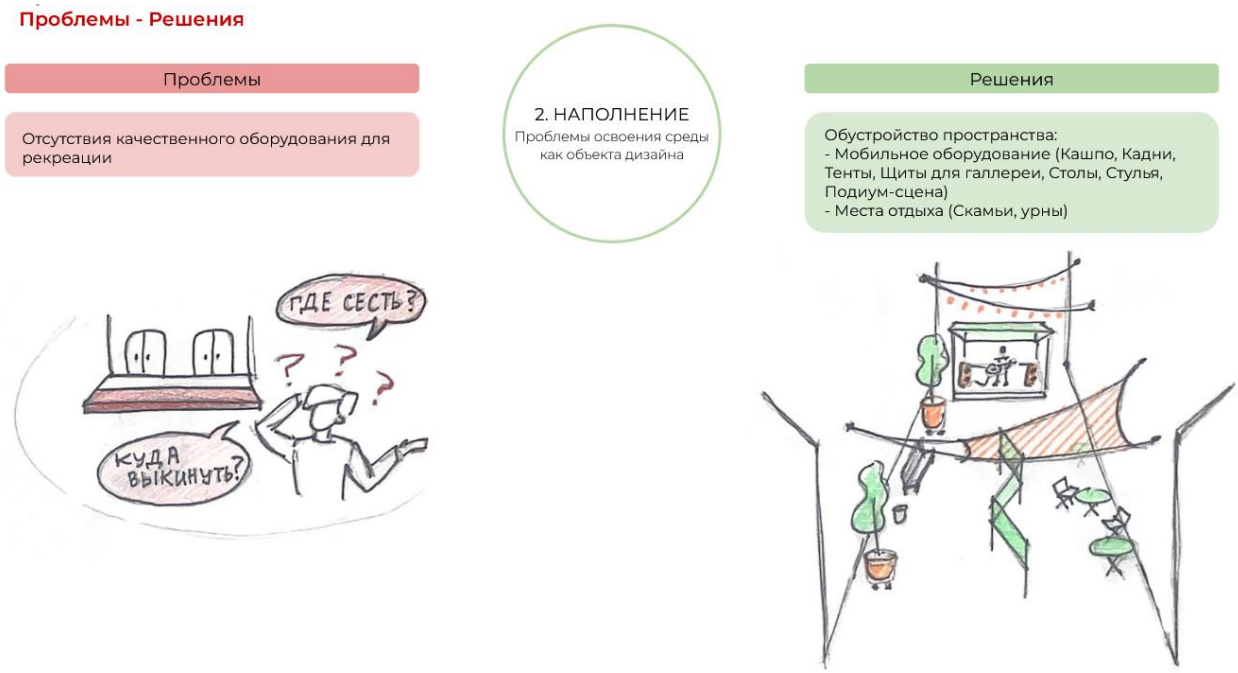
A) Component 0. Area



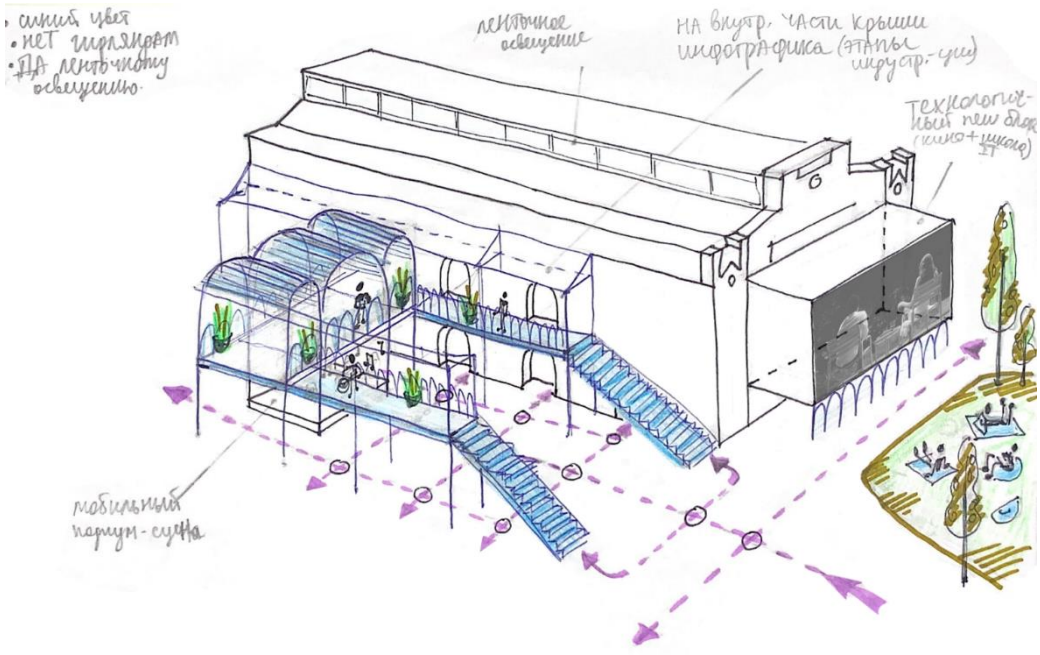
B) Component 1. Purpose

3.4.11. Concept Modeling Technique in Environment Design:

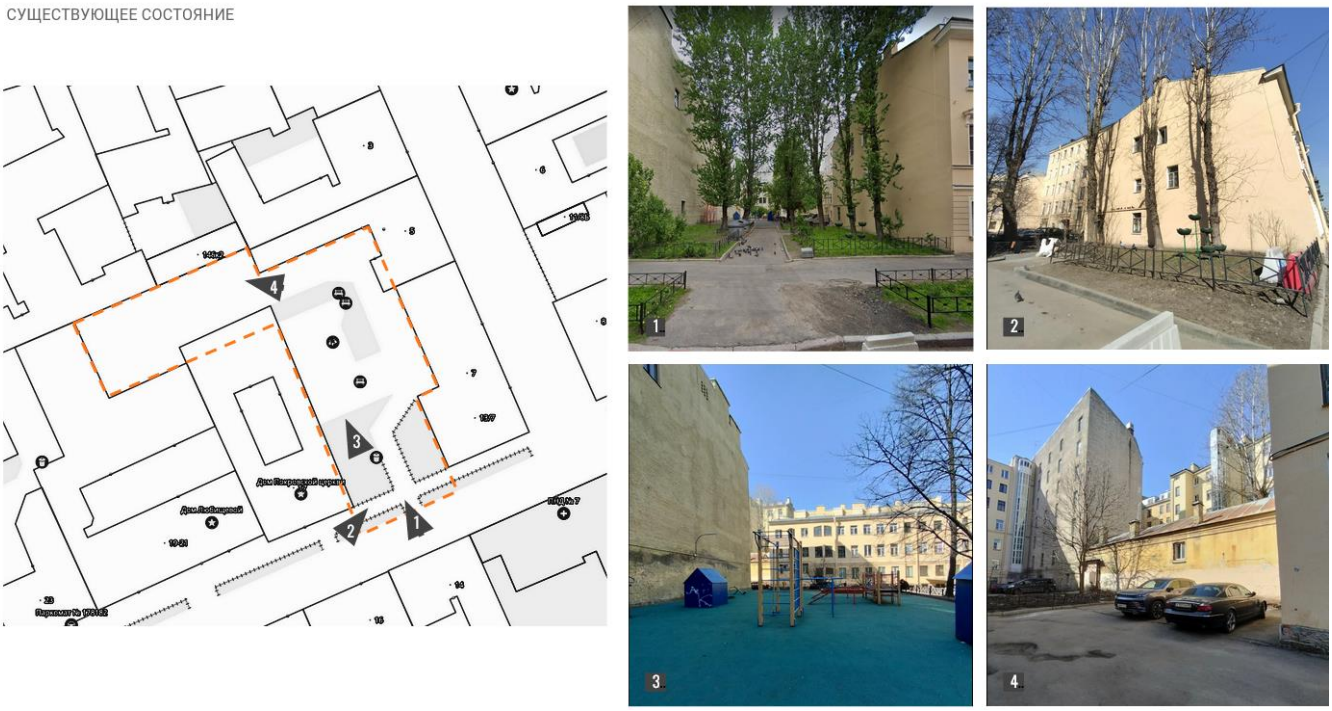
stage III - Architectural model. Approbation on the example of the former complex of warehouse buildings of the joint-stock company “Prosveshchenie” (author: Igosheva E., leader: Tolstova A.A.).



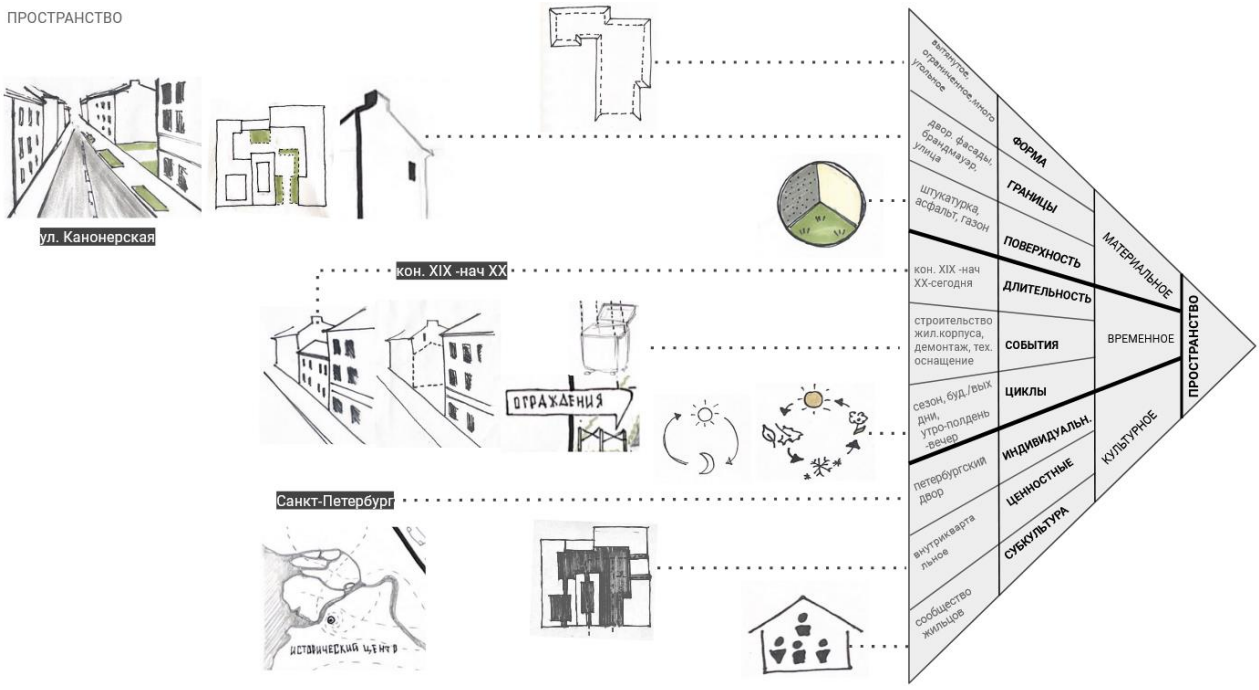
3.4.12. Concept Modeling Technique in Environment Design: stage III - Design model. Approbation on the example of the former complex of warehouse buildings of the joint-stock company “Prosveshchenie”: component 2. Content (author: Igosheva E., leader: Tolstova A.A.).



3.4.13. Concept Modeling Technique in Environment Design: stage IV - Environmental model. Approbation on the example of the former complex of warehouse buildings of the joint-stock company “Prosveshchenie” (author: Igosheva E., leader: Tolstova A.A.).



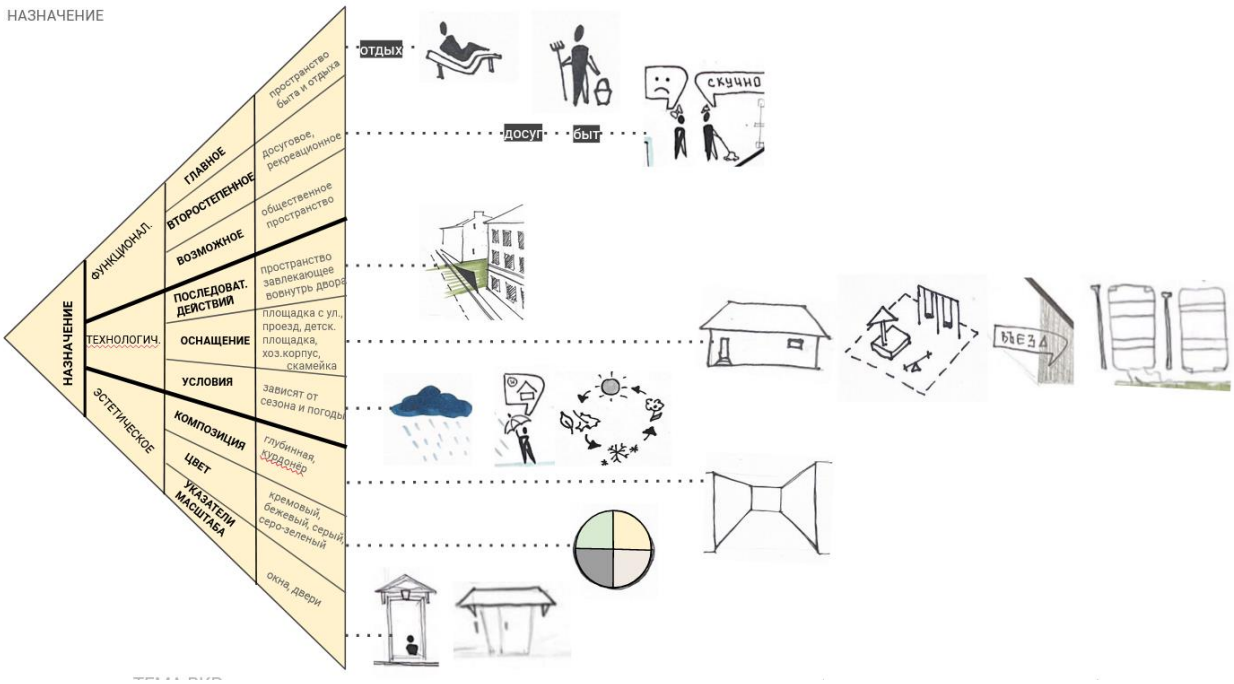
3.4.14. Model object: open courtyard, St. Petersburg, st. Kanonerskaya d. 13-17.



3.4.15. Concept Modeling Technique in Environment Design:

stage I - Descriptive model. Approbation on the example of an open courtyard on the street.

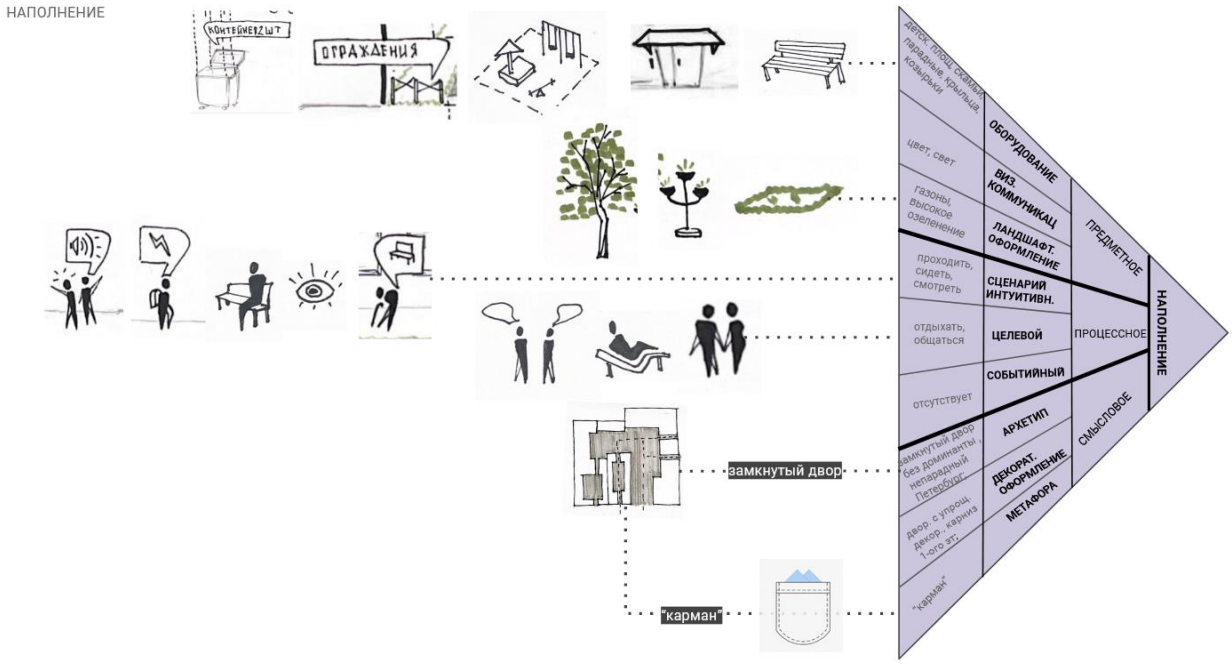
Kanonerskaya: component 0. Area (author: Sysolyatina A., leader: Tolstova A.A.).



3.4.16. Concept Modeling Technique in Environment Design:

stage I - Descriptive model. Approbation on the example of an open courtyard on the street.

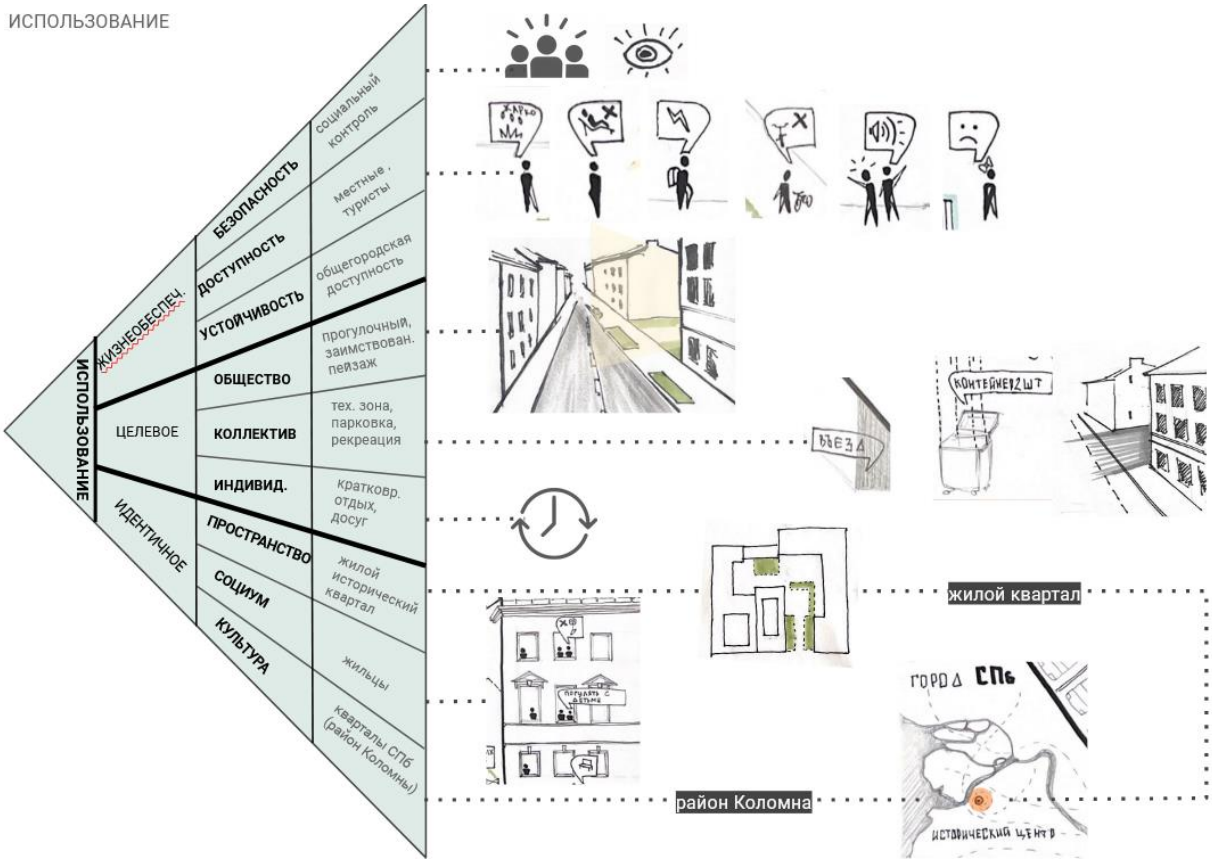
Kanonerskaya: component 1. Purpose (author: Sysolyatina A., leader: Tolstova A.A.).



3.4.17. Concept Modeling Technique in Environment Design:

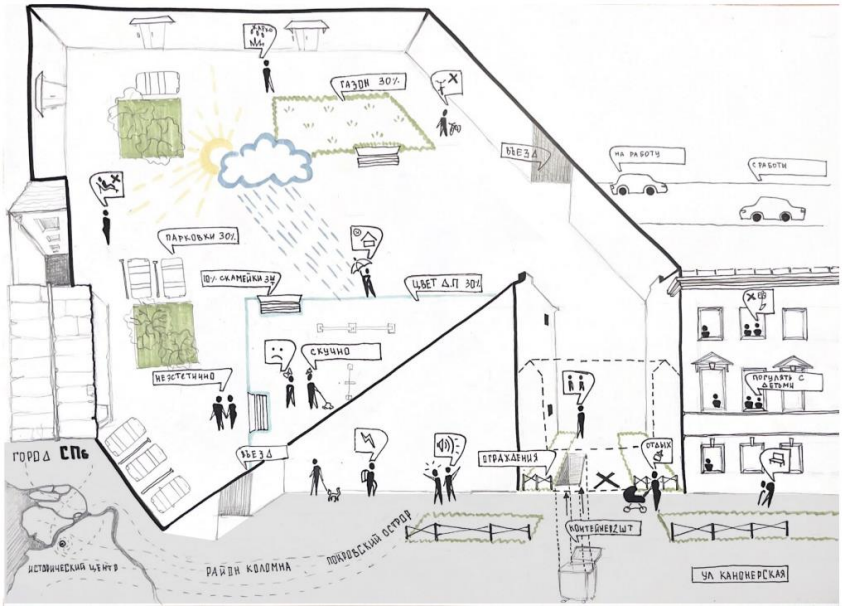
stage I - Descriptive model. Approbation on the example of an open courtyard on the street.

Kanonerskaya: component 2. Content (author: Sysolyatina A., leader: Tolstova A.A.).



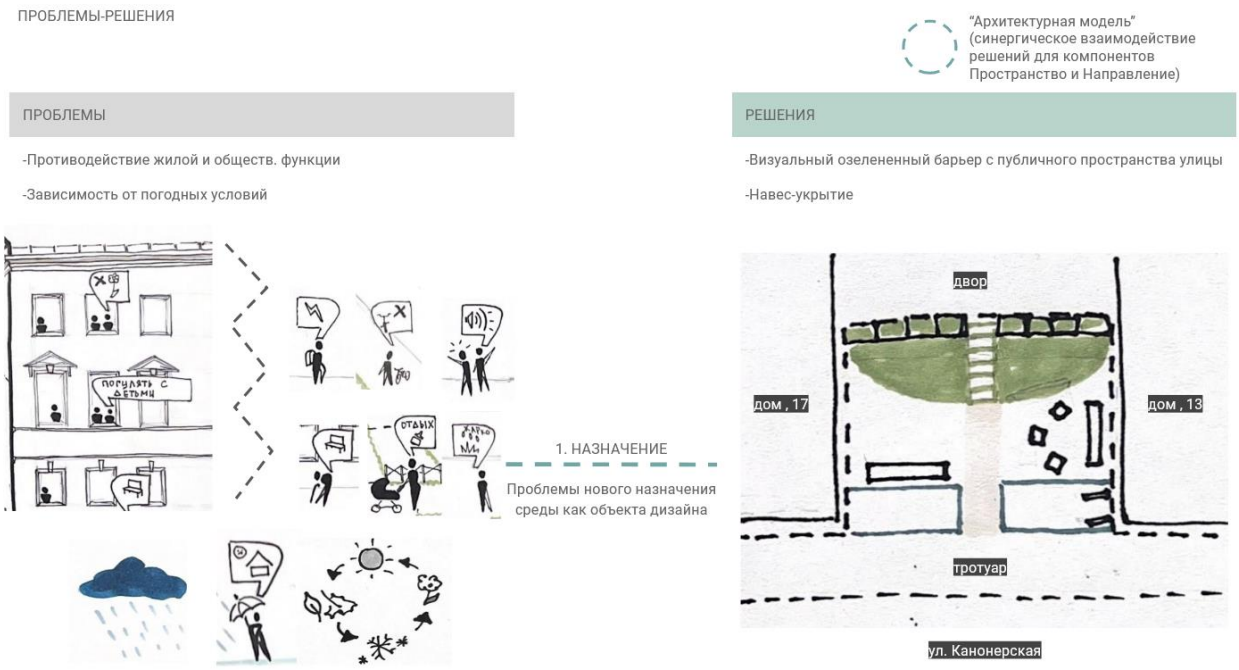
3.4.18. Concept Modeling Technique in Environment Design:

stage I - Descriptive model. Approbation on the example of an open courtyard on the street. Kanonerskaya: component 3. Use (author: Sysolyatina A., leader: Tolstova A.A.).

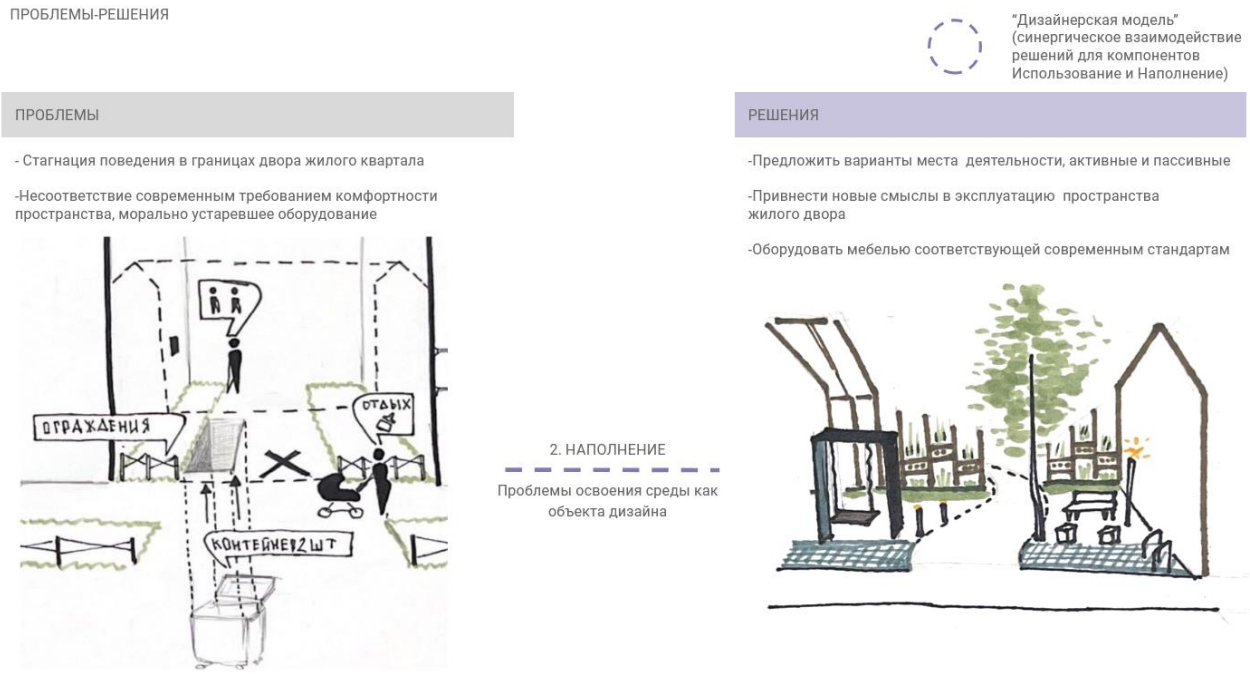


3.4.19. Concept Modeling Technique in Environment Design:

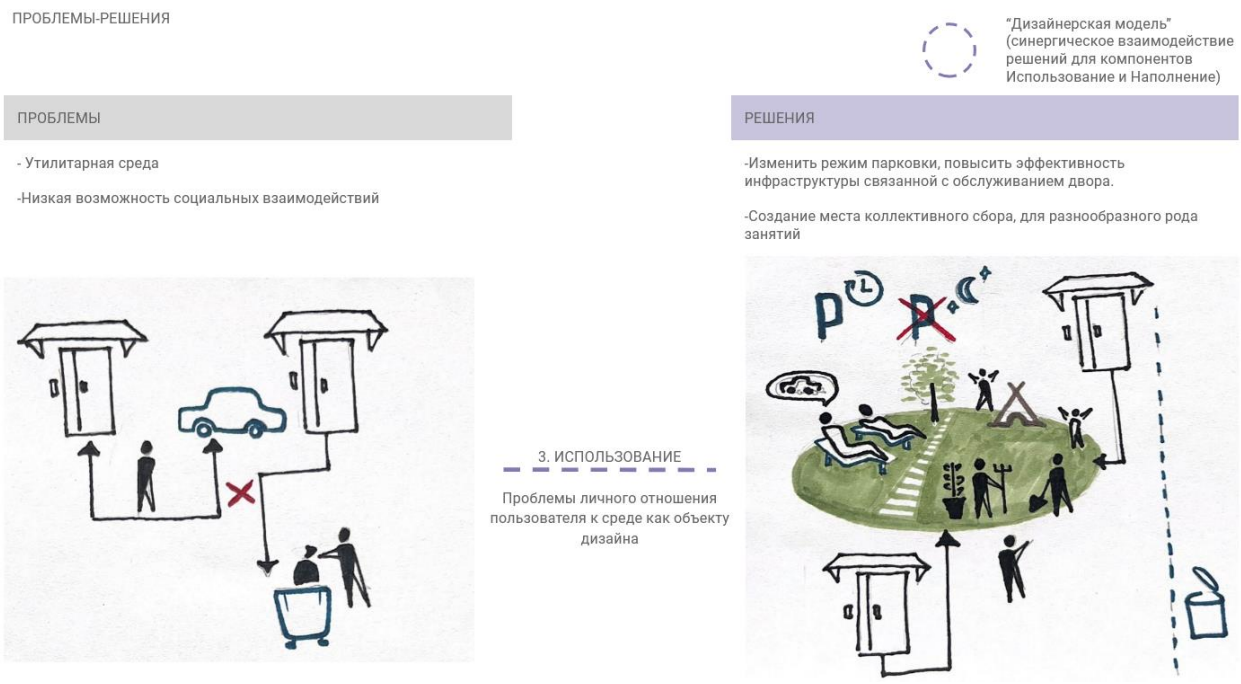
stage II - Predictive model. Approbation on the example of an open courtyard on the street. Kanonerskaya (author: Sysolyatina A., leader: Tolstova A.A.).



3.4.20. Concept Modeling Technique in Environment Design:
stage III - Architectural model. Approbation on the example of an open courtyard on the street. Kanonerskaya (author: Sysolyatina A., leader: Tolstova A.A.).



3.4.21. Concept Modeling Technique in Environment Design:
stage III - Design model: component 2. Content. Approbation on the example of an open courtyard on the street. Kanonerskaya (author: Sysolyatina A., leader: Tolstova A.A.).



3.4.22. Concept Modeling Technique in Environment Design:

Stage III - Design model: component 3. Use. Approbation on the example of an open courtyard on the street. Kanonerskaya (author: Sysolyatina A., leader: Tolstova A.A.).

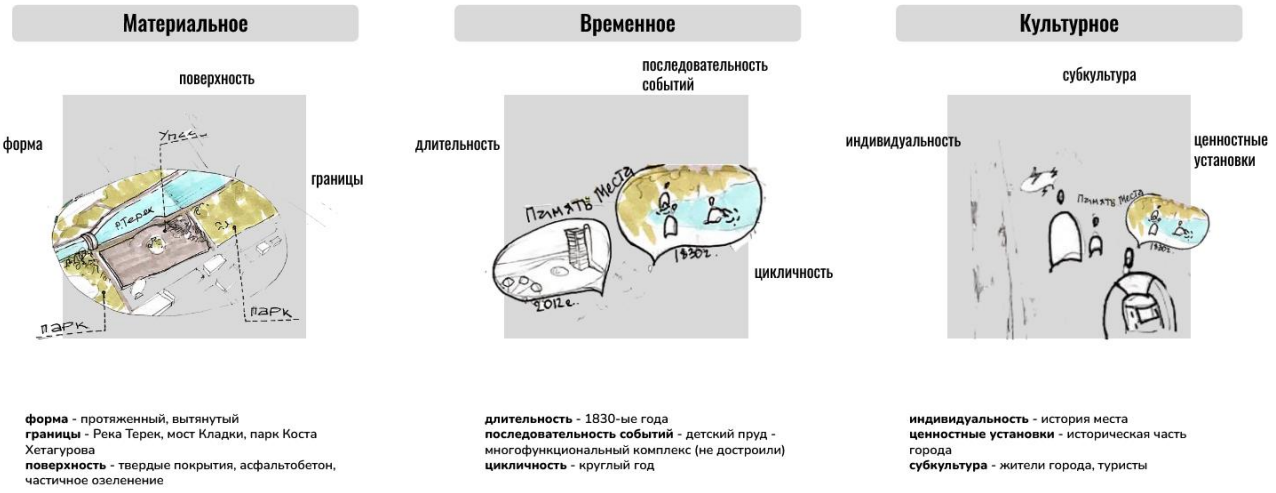
3.4.23. Concept Modeling Technique in Environment Design:

stage IV - Environmental model. Approbation on the example of an open courtyard on the street. Kanonerskaya

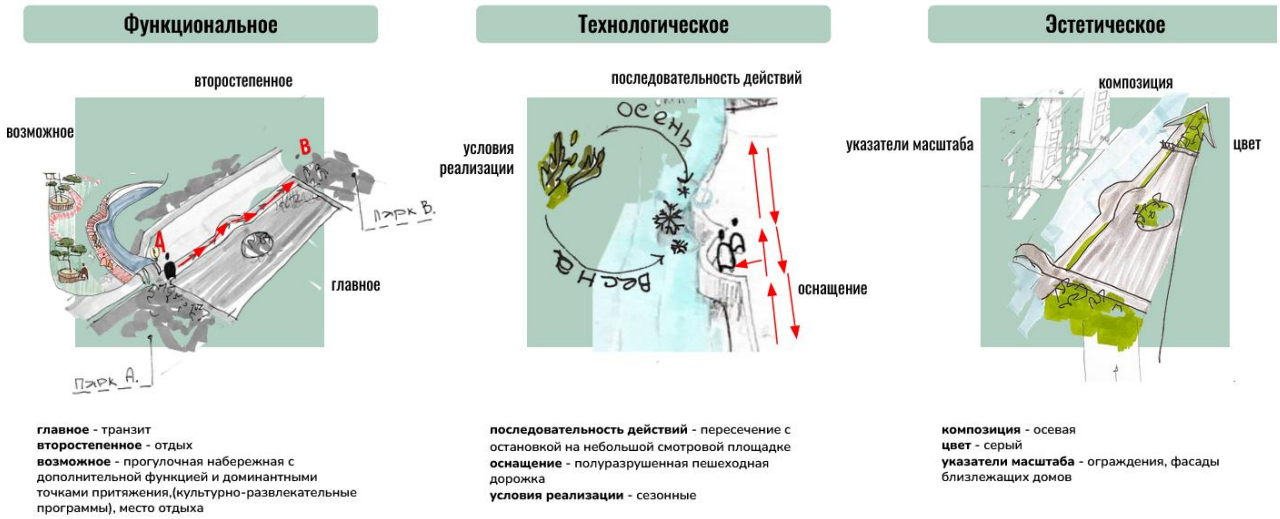
(author: Sysolyatina A., leader: Tolstova A.A.).

3.4.24. Model object: embankment of the Terek river,

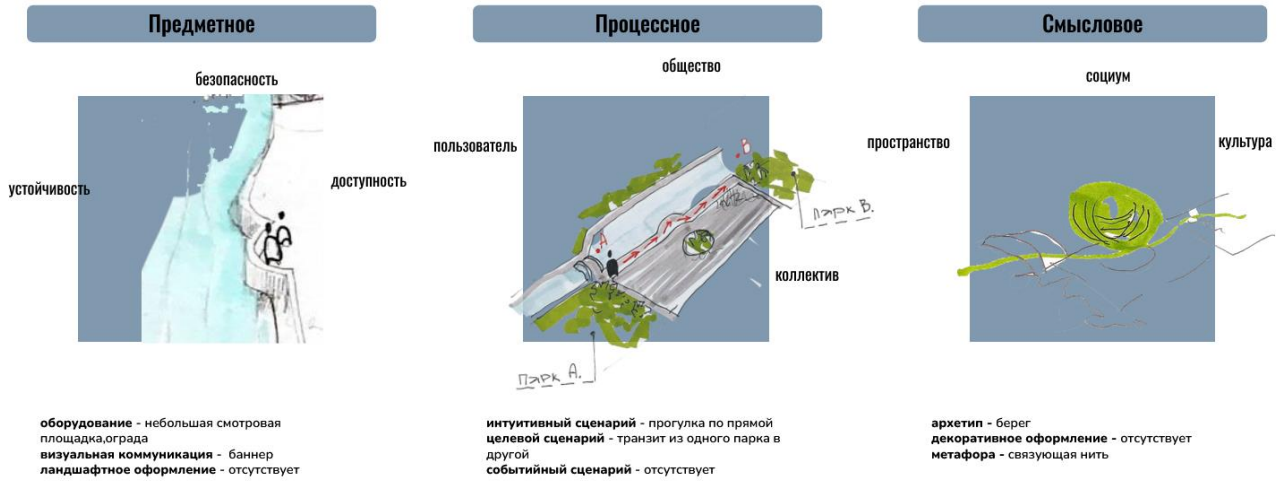
Vladikavkaz, st. Tkhapsaev.



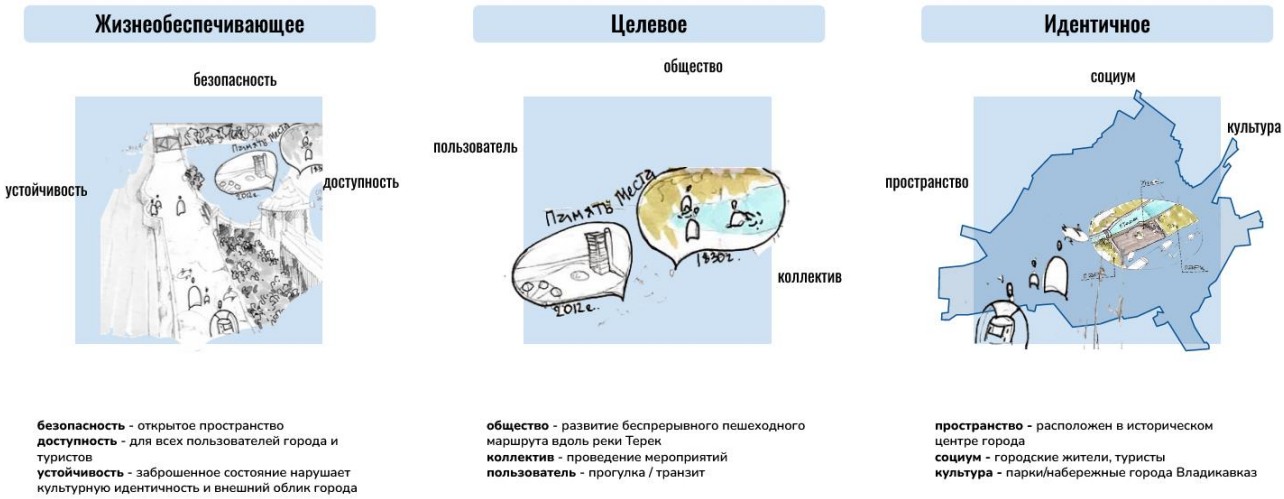
A) Component 0. Area



B) Component 1. Purpose



C) Component 2. Content

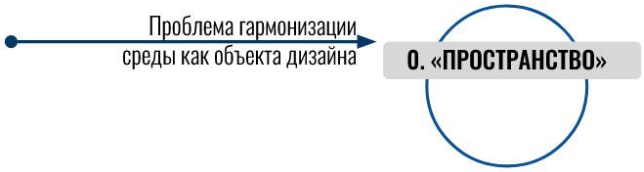


D) Component 3. Use

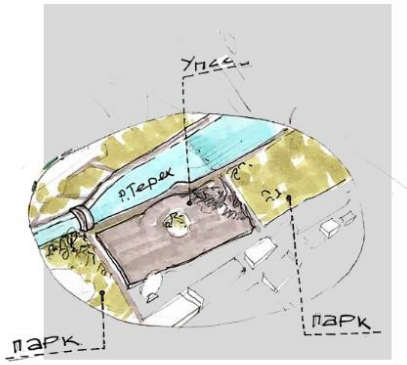
3.4.25. Concept Modeling Technique in Environment Design:

Stage I - Descriptive Model. Approbation on the example of the embankment of the Terek River:

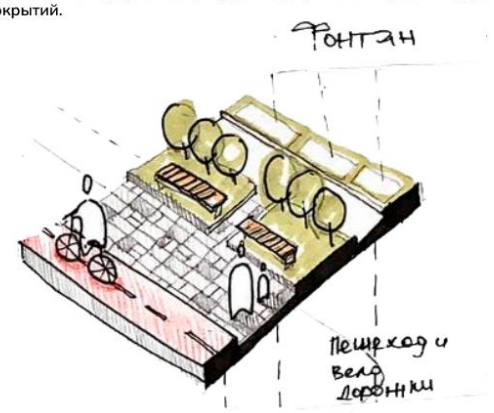
(author: Martirosyan S., supervisor: Tolstova A.A.).



Площадь не гармонирует с природной средой.

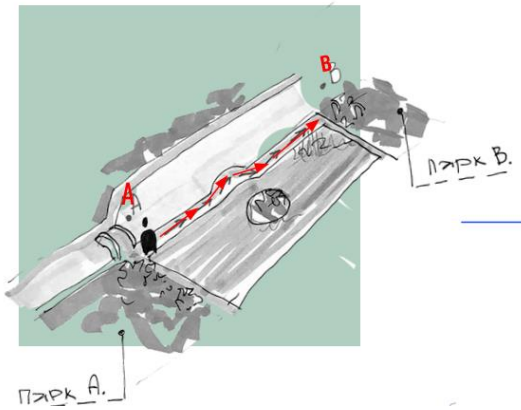


Проблема может быть решена в связке с 1"Назначение" и 2 "Наполнение". Например грамотное функциональное зонирование тер-ии набережной, террасирование; организация уровней; применение разных дорожных покрытий.

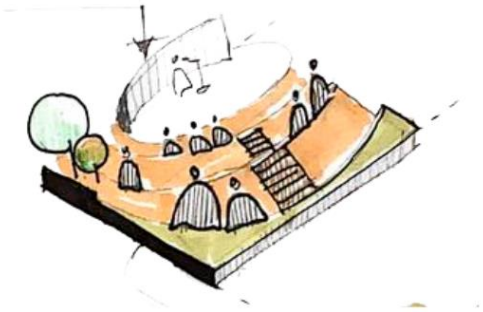


A) Component 0. Area

Проблемы могут быть вызваны нехваткой ресурсов для комфортного пребывания и выполнения последовательных действий; также однообразность этих самых действий, что влечет за собой отток пользователей.



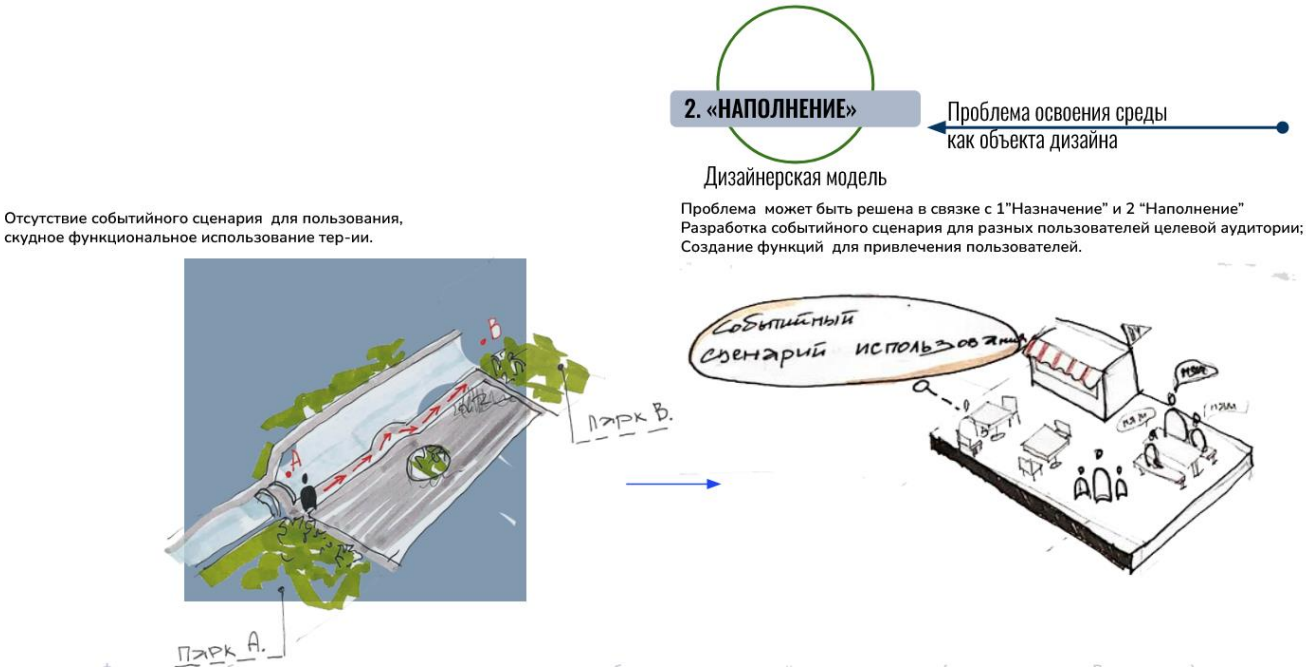
Решением проблемы может быть внедрение нового назначения среды; изменение последовательности действий или формирование новых функций для места. Функциональное зонирование может быть решено путем изменения технических условий и использования в связке с 2.0. "Предметное наполнение".



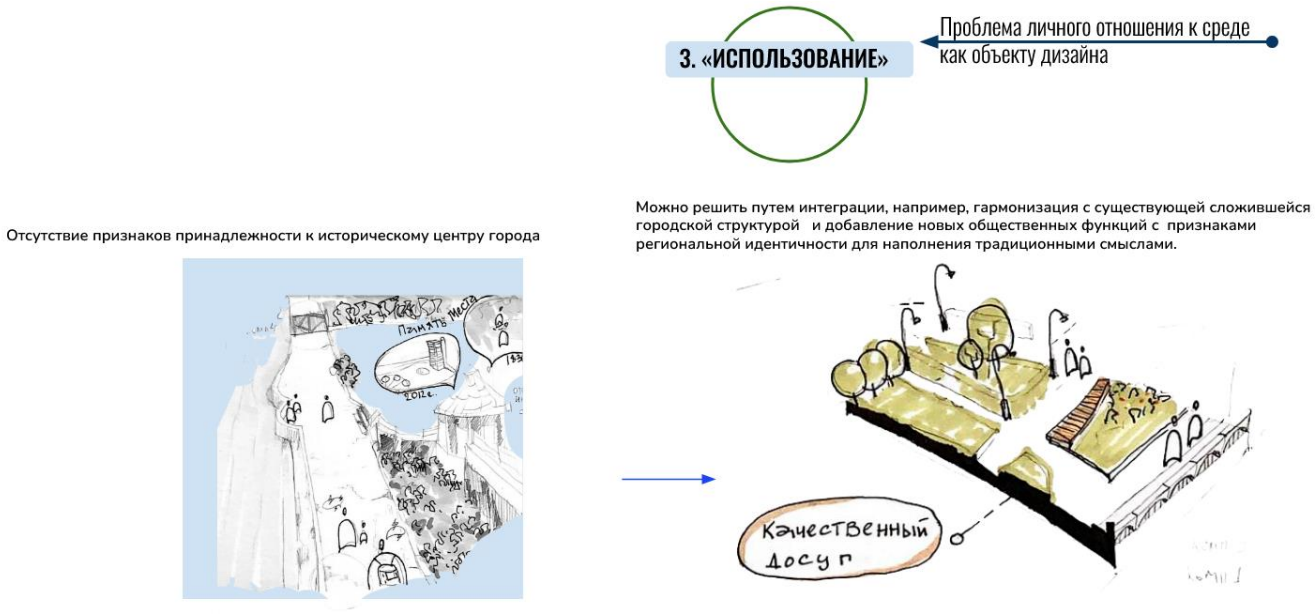
B) Component 1. Purpose

3.4.26. Concept Modeling Technique in Environment Design:

stage III - Architectural model. Approbation on the example of the embankment of the Terek River (author: Martirosyan S., leader: Tolstova A.A.).



A) Component 2. Content



B) Component 3. Use

3.4.27. Concept Modeling Technique in Environment Design:

stage III - Design model. Approbation on the example of the embankment of the Terek River

(author: Martirosyan S., leader: Tolstova A.A.).

APPENDIX 2

ABSTRACT 1

WORKING PROGRAM OF THE EDUCATIONAL DISCIPLINE

“Conceptual modeling of environmental objects”

RelevanceThe course is due to the need for an in-depth study of the conditions for the formation of a design object as a system in order to understand its component composition, properties, principles of interaction and development opportunities to facilitate further communication with the target audience and search for sound and sustainable design solutions. The acquired knowledge, skills and abilities are necessary for students to successfully master the discipline “Theory and Practice of Design Design”, organize research and creative work and prepare a master's thesis.

Purpose of the program: the formation of “systemic thinking” and the development of skills for managing the creative process during the design of environmental objects through the use of conceptual modeling techniques.

Course objectives:

- to form in students an understanding of the specifics of the phenomenon “environment as an object of design” and an idea of the methods of its modeling;
- give an idea of the theoretical and methodological foundations of conceptual modeling, its role, goals, principles and place in the design of the environment;
- to give an idea of the conditions for applying the content and logic of the conceptual modeling technique in the design of the environment;
- to teach technologies for applying graphical, morphological and predictive methods for developing and visualizing conceptual models for the purposes of environment design in practice, including using methods of collective and heuristic modeling;
- to form the ability to determine the basic components of conceptual modeling and explore their interaction;
- to form the skills of managing the mechanism of interaction between the components of conceptual modeling in the design of the environment by influencing the contradictions between them;
- develop the skills to identify an environment problem and analyze its impact on the components of conceptual modeling in environmental design.

Planned workload: 72 hours, including contact 38 hours.

The target audience: the program is aimed at students studying in the direction 54.04.01 “Design” in the profile 02 “Environment Design”.

The structure of the training sessions

№	Designation	Types of occupations	Amount of allocated time (hour)
1	**Module**		
1.1	Introduction to the Subject: The Relevance of Environment Design	Lecture Practical lesson Seminar	2 2 2
1.2	Project activities in environment design	Lecture Practical lesson	2 2
1.3	Creative approach in project activities	Lecture Practical lesson Seminar	2 4 2
1.4	System approach in project activity	Lecture Practical lesson	2 6
1.5	Conceptual Modeling in Environment Design: Key Requirements	Lecture Seminar	2 2
	Independent work using the method. materials		4
	Exam		2
2	**Module**		
2.1	Introduction to the Methodology: Modeling Issues in Environment Design	Lecture Seminar	2 2
2.2	Defining Conceptual Modeling Components in Environment Design	Lecture Practical lesson	2 4
2.3	The mechanism of interaction between the components of conceptual modeling in the design of the environment and the contradictions arising from it	Lecture Practical lesson	2 2
2.4	Concept Modeling Technique in Environment Design, Stages 1 and 2.	Lecture Practical lesson	2 4
2.5	Concept Modeling Technique in Environment Design, Stages 3 and 4.	Lecture Practical lesson Seminar	2 4 2
	Independent work using the method. materials		3
	Consultation		2
	Exam		3
	Total		**72**

Control and measuring materials

1. **Exam at the end of Module 1** is carried out in the form of a portfolio defense in the format of a computer presentation based on the work performed in the practical and seminar sessions of Module 1.

Portfolio composition:

- Model obtained using the SWOT analysis method;
- Model obtained using the “Tag Cloud” method;
- Model obtained using the “Mental map” method;
- Analysis of the heuristic method to choose from;
- Model obtained using the “Relevance tree” method;
- Model obtained using the “Fishbone” diagram;
- Model obtained using the “Morphological map” method;
- Evaluation according to the criteria of the method of conceptual modeling studied within the course, to choose from;
- Analysis of an article from the list of additional literature on lecture topics.

Criteria for evaluation:

- weight of one portfolio component – 10 points, the maximum score obtained in the presence of all well-executed components – 90 points;
- graphic quality of portfolio design – 10 points.

Maximum score for the submitted portfolio – 100 points.

2. **Exam at the end of Module 2** and the end of the study of the discipline is carried out in the form of a portfolio defense in the format of a computer presentation based on the work performed in the practical and seminar sessions of Module 2 and an oral answer to one additional question on the topics of the course.

Portfolio composition:

- title page;
- table of contents;
- brief information about the modeling object;
- a system of models obtained on the basis of the application of the conceptual modeling technique: Descriptive model, Predictive model, Architectural model, Design model, Environmental model of the object;
- conclusions.

Criteria for evaluation:

- portfolio: the novelty of the result obtained by applying the methodology of conceptual modeling and developing a system of models;
- portfolio: interconnection between the models obtained as a result of applying the methodology of conceptual modeling;
- portfolio: the presence in the presentation of all five models of high quality, in accordance with the algorithm of the conceptual modeling technique;

- portfolio: graphic quality of portfolio design;
- verbal response to an additional question.

Single criterion weight – 20 points, maximum score – 100 points.

Developer of the working program of the discipline.

Full name	Student degree	Academic title	Job title	Contacts
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ABSTRACT 2

WORKING PROGRAM OF THE EDUCATIONAL DISCIPLINE

(PROJECT)

“Conceptual modeling in environment design: a methodology for applying (for higher education and additional professional education)”

Relevance the course from the point of view of the profession is due to the high potential of conceptual modeling as a tool for packing information about the object, the phases of its development and the examination of the project; from a designer's point of view as a tool for demonstrating the design process, a tool for increasing the competitiveness of the design product; from a student's point of view as a tool for developing methodological competencies and analytical thinking.

Purpose of the program: development of professional competence of teachers of higher education (specialty “Environment Design”) and teachers of additional professional education in terms of the application of conceptual modeling methods within the boundaries of teaching the discipline “Design”.

Course objectives:

- update ideas in the field of conceptual modeling as a system activity;
- to contribute to the understanding of the design design process in terms of including conceptual modeling at different stages in order to obtain descriptive, predictive and normative models of the design object;
- to promote the formation of skills regarding the application of conceptual modeling methods in the design of the environment;
- develop a roadmap for an educational project in the discipline “Design”, taking into account the inclusion of conceptual modeling at various stages of work in order to obtain conceptual models and expert evaluation of intermediate stages.

Planned workload: 18 hours, including contact 8 hours.

The target audience: the program is aimed at teachers of higher education in the direction of preparation 54.04.01, 54.03.01 “Environment Design”, as well as teachers of additional professional education in the areas of interior design and environment design.

The structure of the training sessions

Item no.	Topic name	Type of training sessions	Number of hours

1	A systematic approach to conceptual modeling in environment design	orientation lecture	2
		Seminar	2
2	Conceptual modeling technique based on a system of interrelated models	methodological lecture	2
		practical lesson	4
3	Potential for incorporating conceptual modeling into environmental design as a design activity	motivational lecture	2
		consultation	2
		independent work using teaching materials	2
		Final certification (test)	2

Control and measuring materials

As part of the course, the student develops a roadmap for the educational project in the discipline "Design", taking into account the inclusion of conceptual modeling at various stages of work in order to obtain conceptual models and expert evaluation of intermediate stages. The final certification provides for the successful defense of the roadmap, carried out in the PechaKucha format. The speaker is asked clarifying questions by both the teacher and other participants of the seminar. The result of the work is evaluated according to the criteria. The weight of one criterion is taken as 10 points, in case of incomplete compliance with the criterion, 50% of the weight of the criterion is set – 5 points. The maximum number of points a student can earn – 50 points. Upon successful completion of the attestation, the mark "passed" is set if the total score for all criteria is at least 25 points.

List of criteria assessments of the final certification:

1. a systematic approach to conceptual modeling was applied when setting the tasks of educational design in the design of the environment, namely, conceptual models are an interconnected apparatus built into project activities;
2. the actual methods of conceptual modeling were used in solving the problems of educational design in the design of the environment, namely, at least two methods mastered in the framework of the educational program were applied;
3. conceptual modeling methods have been applied and/or modernized in relation to the educational needs of representatives of different levels of students, namely, the roadmap traces the specifics of the methodological approach to solving project problems that meet the level of competencies formed for undergraduate, graduate, additional professional education students;

4. effective solutions to the problems of educational design design in higher education or additional professional education within the framework of the specialty “Environment Design” by the methods of conceptual modeling are proposed, namely, in the course of defending the roadmap when answering questions, the student convincingly demonstrated an understanding of the beneficial effect of the use of conceptual modeling in their teaching activities within the framework of environment design;

5. general professional competencies were demonstrated, namely, the graphic design of the presentation and the roadmap corresponds to the level of the professional standard “Design”, the report has a clear structure, the listener's speech complies with the declared regulations, the listener was consistent and convincing when answering questions.

Developer of the working program of the discipline.

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