

УДК 7.012

DOI:10.30857/2617-0272.2024.3.7

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## A HYBRID APPROACH TO LEARNING BASED ON EMOTIONAL EXPERIENCE AND THE DEVELOPMENT OF INNOVATIVE METATHINKING IN POST-WAR UKRAINE

**Purpose** of the study is to synthesize generalized metaheuristic and metacognitive models, the use of which in project culture contributes to the formation of innovative creative-critical metathinking of an individual.

**Methodology.** The methodology for studying creative activity and training of a designer is based on the post-neoclassical paradigm of scientific knowledge, subject-object integrity of the system of relations and dialectically developing relationships in a hybrid innovative learning environment. The methodology also includes new methods of interdisciplinary research and modeling of reality, integrating physical and social ontology. It is shown that the development of a structural-functional approach to the perception of physical and digital reality takes into account the peculiarities of an individual's brain activity.

**Results.** The main results obtained are a triad of generalized author's metamodels, namely:

1. A heuristic metamodel of post-neoclassical perception of physical reality by a designer, in which the independence of cognition cycles, as well as the complementarity of paradigms (synergetic, triadic and semiotic) combines physical and social ontology, which creates new opportunities for the formation of a designer's creative metathinking in the process of experience. activity.

2. A heuristic metamodel of post-neoclassical perception and reflection of physical and virtual reality by a conceptual designer, in which the dependence of cycles of cognition, as well as the complementarity of heuristic metamodels, is achieved through universal triangles (fractal, Pascal, Sierpinski), the structures of which contribute to innovative activity of the conceptual designer.

3. Cognitive meta-model for the formation of meta-thinking of a designer-conceptualist, which is based on the spatio-temporal balance of explicit and hidden relationships, the cognitive visualization of which contributes to the search for harmony in the process of experience-oriented learning and creative activity through semiotic tools.

**Scientific novelty** is determined by the complementarity of the structures of the author's metamodels of physical and digital reality, the synergy of which contributes to the optimization of experience-oriented models of teaching and self-learning.

The interrelation of the structures of metamodels and their complementarity is the basis of successful activities in a hybrid learning environment (real physical and virtual mathematical), which facilitates the transfer of emotional and intellectual content between objects and subjects of the digital world.

**Practical significance** of complementarity and interconnection of new metamodels of metathinking allows us to develop: universal criteria for determining the quality of design objects using GenAI; a method for identifying triads of interconnected opposites in information sources of various natures, the visualization of which simplifies interdisciplinary interaction between designers; create a personal e-assistant, e-consultant, e-expert using GenAI.

In post-war Ukraine, interdisciplinary exchange of ideas, methods and successful experiences is extremely relevant within the framework of a hybrid approach to understanding the harmony of physical and digital reality, which promotes successful creative activity based on the perception of the harmony of nature to achieve the unattainable. Further development of experiential learning through the formation of metathinking is necessary to improve mental health and adapt to inevitable social transformations.

**Keywords:** metascience, metadesign, consciousness, subconsciousness, signs, symbols, creative thinking, critical thinking.

**Introduction. Analysis of previous researches.** The digitalization of education has formed complex systems thinking, which, on the one hand, protects the student from information overload, and on the other, worsens his mental health. This limits the unique capabilities of online learning and also increases the complexity and virtuality of offline learning [14]. Therefore, creative scientific and pedagogical activity in post-war conditions requires the formation of a qualitatively new meta-thinking, which takes into account physical reality and has an innovative orientation. It is relevant to take into account the cognitive aspects and limitations generated by digitalization and artificial intelligence [11].

The aim of the work is to synthesize generalized metaheuristic and metacognitive models, the use of which in project culture contributes to the formation of innovative creative-critical metathinking of an individual.

The work [13] shows that the consequence of perceiving the world around us through a "digital prism" is the fragmentation of knowledge, clip thinking and hidden cognitive distortions that create the illusion of knowledge. Therefore, in [12] attention was drawn to the elements of geometric similarity in the structure of natural fractals and the spatio-temporal ordering of information flows of different nature in the space of dynamic events. It has been shown that for the study of nonlinear systems, the connection between fractal thinking and the holographic nature of memory is important [1; 10; 16], the key role of emotional intelligence in the cognitive perception of the harmony of the fractal nature, which contributes to the creative activity of the individual. Therefore, the recommendations of UNESCO and the UN on the transdisciplinarity of education in the 21st century need a more generalized understanding [12]. The article actualizes new problems and risks generated by the digitalization of education and AI, the complexity and multidimensionality of which follows from the UNESCO document "Artificial

Intelligence Technologies in Education: Prospects and Consequences".

**Statement of the problem.** As shown in [10], the peculiarities of thinking in science, art and design, as well as the connection of an individual's worldview with the perception of the harmony of nature form heuristic thinking and cognitive flexibility. With the help of neuroscience (neuroergonomics, neuropsychology, etc.), it has been established that the manifestation of cognitive problems depends on the psychophysiological state of a person [19]. The problems are a consequence of:

- accelerated digitalization of science, education and technology;
- difficulties in modeling nonlinear physical reality;
- hyperspecialization which led to side effects (fragmentation of knowledge, clip thinking and illusion of knowledge).

The formation of innovative creative-critical metathinking is facilitated by the unification of physical and social ontology, which makes it possible to take into account the characteristics of an individual's brain activity through the further development of a structural-functional approach to the perception of physical and digital reality [18]. The methodology also includes new methods of interdisciplinary research and meta-modeling of reality that integrate physical and social ontology.

**The results of the research and their discussion.** The research methodology includes new methods of interdisciplinary research and heuristic modeling (triadic methods of modeling physical and digital reality).

The benefits of a hybrid learning approach. The neocortex (new brain) is responsible for higher order cognitive functions such as sensory perception, language, abstract thinking, imagination and consciousness, and also controls analytical and mathematical thinking. Therefore, we also include an artificial neural network, which includes communication

channels, the human brain, and information sources of various natures (detectors, sensors, etc.) as universal hybrid environments. Their dynamics are subject to general principles, criteria and are described by the same equations, parameters and criteria. Obviously, therefore, the increasing complexity of cognitive computing has increased interest in neural networks, which are:

- one of the ways to implement artificial intelligence;
- a computer model that simulates the functioning of the human nervous system;
- a type of AI that is used to process complex data sets.

Artificial intelligence systems use various approaches (logical, structural, evolutionary and simulation), the boundaries between which are blurred. At the same time, the designer's brain is able to create new intrahemispheric and interhemispheric connections, activate new pathways, i.e. exhibit neuroplasticity [3; 19; 20]. Therefore, individualization of training based on the development of emotional intelligence and successful experience is relevant [16].

**Emotional experience.** A developmental model was proposed in [8; 9], which suggests that human emotions can be based on three functional levels: sensorimotor, schematic and conceptual. At the same time, the sensorimotor level consists of a set of universal expressive-motor programs that automatically trigger a certain number of stimuli, as well as corresponding subjective emotional feelings. In the process of development and learning, individual experience and the construction of an emotional information processing scheme are formed. Such emotional circuits are automatically activated, corresponding to spontaneous emotions that form the emotional experience that is relevant to the designer's brain. As shown in [16], thinking from simplicity to complexity (clockwise traversal) is structure-forming, and in the opposite direction – structure-destructive. Therefore, in the heuristic metamodel of perception (Fig. 1), the left hemisphere of the designer's brain analyzes the

topology physical reality, and the right hemisphere of the brain reflects the perception of the static complexity of the distribution of multiple sources of information (defects, inhomogeneities). Moreover, the perception of the transition from order to disorder does not depend on the sequence of consideration of the cycle – clockwise or counterclockwise. Such a heuristic meta-model made it possible to study the complementarity of dynamic and static descriptions of the distribution of information sources of various natures, the nature of the interaction of which is most manifested in the perception of dynamic and static complexity [4; 14].

The figure shows the independence of the direction of consideration of the cycle of perception of dynamic and static complexity in two models: 1) a model of an information transmission line, which contains heterogeneities; 2) a model of the designer's brain, whose hybrid environment displays many sources of information.

**Formation of creative metathinking.**

The heuristic metamodel is based on the complementarity of paradigms (synergetic, triadic and semiotic), which combine physical and social ontology. Therefore, the structural and functional asymmetry of the designer's brain and his emotional experience contribute to the formation of creative thinking in the learning process [21]. Creative thinking is based on intuition, knowledge and successful experience. Really:

- intuition forms the composition (image, work);
- knowledge promotes reflection;
- successful practice develops emotional intelligence.

Thus, in the generalized heuristic metamodel of the functioning of the designer's brain, the functional asymmetry of the brain reflects independent cycles of perception of physical reality. At the same time, effective hybrid online and offline learning can be implemented by:

- problem-oriented teaching and research methods;
- hybrid methods of information processing;
- a hybrid approach to cognitive visualization of information flows of different nature and their system analysis [17].

In real time, hidden connections arise between the dynamic and static complexity of models, the systematic search for which contributes to the development of creative metathinking.

**Metamodel of thinking of a designer-conceptualist.** In work [12] it is shown that for the synthesis of metamodels it is important: 1) to use inversion, the widespread use of which in physics, biology, computer science, psychology and other sciences contributes to the search for new universals and patterns; 2) to identify triads of conjugate opposites that reflect hidden connections consciousness with the subconscious; 3) systematically analyze the harmony of triads of conjugate opposites by coloring them with natural colors (Fig. 2).

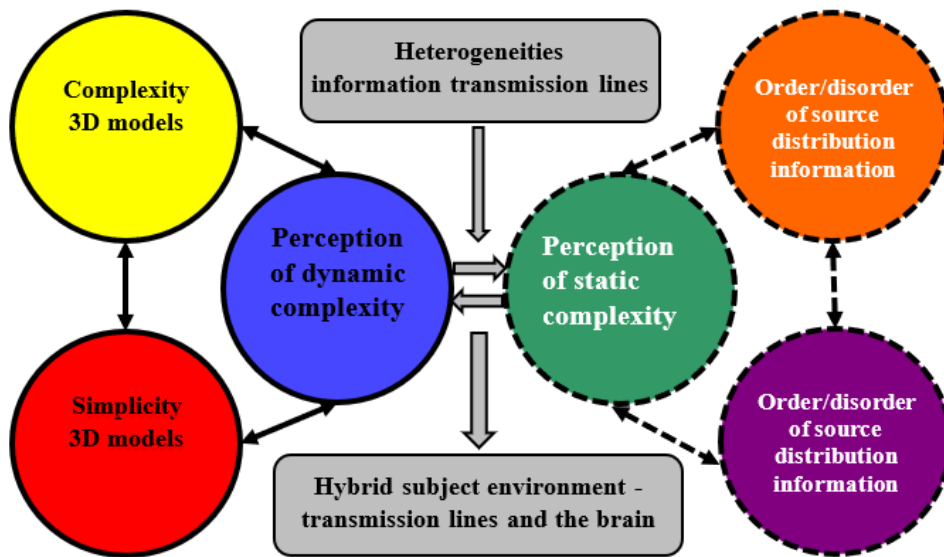


Fig. 1. A heuristic metamodel for the perception of dynamic and static complexity by a designer

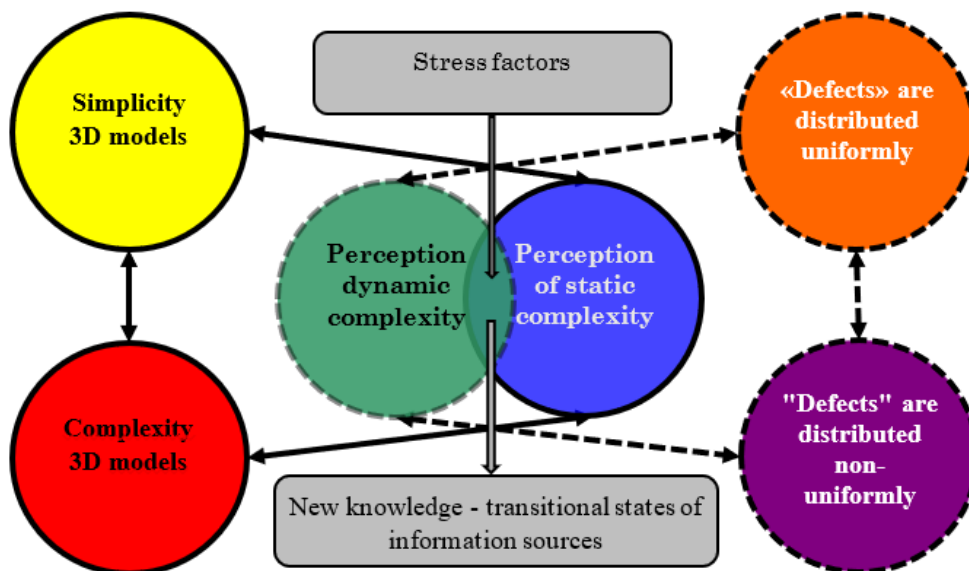


Fig. 2. A heuristic meta-model of perception of physical and virtual reality by a designer-conceptualist in which dependent cycles of cognition are associated with the inversion of the structure and its balance

**Individuality of emotional experience.**

The relationship between the consciousness and subconscious of an individual is formed by the subject learning environment [16]. In conceptual design, any idea or solution cannot arise without many explicit and hidden relationships between the conscious and subconscious. Therefore, the individuality of emotional experience determines the emergence and development of an idea based on the emotions of previous decisions, observation results, known patterns and concepts. At the same time, the balance of statics and dynamics is relevant, which is achieved through the inversion of structure and harmony of perception of opposites. The induced complementarity of space-time relations manifests itself in intuition, which is based on the activity of the unconscious carried out here and now. It is associated with consciousness, the activity of which determines emotional intelligence and perception of physical reality. Therefore, intuition and intelligence are the process of becoming aware of the unconscious.

It should be noted that the basis for the ideas of the research object is the worldview of both the subject-designer and the consumer (the dominant worldview in society). Therefore, the concepts of global evolutionism and the theory of self-organization in both living and inanimate nature acquire worldview methodological status.

**Relationship between dynamic and static complexity.** Conceptual design combines creative idea and pre-design research, viewing them as:

- a unified process of shaping an integral subject-design environment;
- practice of processes of transversion of things into signs and signs into things;
- the opportunity to study the objectivity of subjectivity and vice versa the subjectivity of objectivity.

The meta-model of the connection between cycles of dynamic and static complexity takes into account the individuality

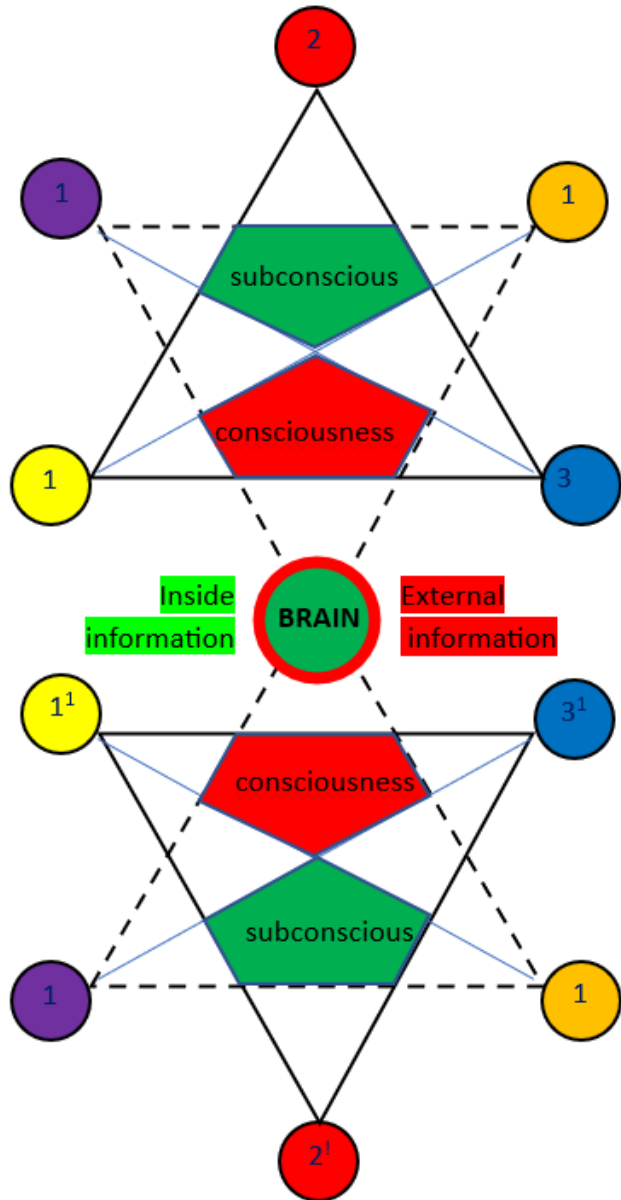
of the holistic perception of the topology of physical reality, which designers model through a variety of triangular elements.

It is obvious that external and internal stress factors induce complementarity in the perception of the dynamic complexity of the CDS, as well as the static complexity of many of its elements. This allows, through inversion, to identify new universals in which the structures of explicit and hidden relationships appear.

**Emotional inheritance.** Today, cognitive distortions influence, and sometimes even determine, the cognitive essence of a person – a schoolchild, a student, an employee, an operator, a designer, a risk manager. Therefore, the search for new ideas to solve the problems of cognitive distortions acquired in the process of activity and inherent in each individual, as well as hidden genetically inherited ones, has become very relevant [8; 9]. In the works [15; 16] a new idea is considered about the complementarity of hidden relationships in metamodels of natural computer science, which is based on balance of triads of conjugate opposites; harmony in the perception of hidden relationships; transitions from triad to duality and vice versa from duality to triad.

**3M-metamodel of the concept of cognitive mind.** The era of digital technologies determines the characteristics of metathinking, metacognition and metamemory, which are formed not only by family, school, but also by university. Today, the new generation is dominated by three factors: 1) the exciting quality of instant contact; 2) unlimited flow of information; 3) virtual games and virtualization of personal life. The diversity of information interaction is most fully reflected by the generalized metamodel of the concept of cognitive mind, which includes mind, reason, opinion, attention and thought (Fig. 3).

Therefore, the structure of the relationships of the dynamic balance of opposites is so important, which in the synthesis of the metamodel was achieved through: inversion of triads of opposites, the use of Goethe's natural circle of colors when



**Fig. 3.** A generalized cognitive metamodel for the formation of metathinking of a designer-conceptualist, which is based on the spatio-temporal balance of explicit and hidden relationships, the cognitive visualization of which contributes to the search for harmony in the process of experience-oriented learning and creative activity through semiotic tools

coloring, and the perception of spatio-temporal disharmony of the hybrid environment.

As can be seen from Fig. 3 the structure of information exchange is represented by a set of triads, the structure of the relationship of which reflects three metamodels. In the center of Fig. 3 the first M-metamodel is shown in the form of two contrastingly colored circles, identical triads (B,1,1), which display the external physical world of space-time (red), as well as the internal world, which is colored in

contrasting green. The second metamodel is displayed by two conjugate Stars of David, the stability of which is due to the inversion and conjugate pentagons built into the hexagons, as well as the opposite orientation of the two hexagons.

As we can see, the self-organization of metamodels ensures the stability of the hybrid cognitive environment and is its 3S metamodel, the structure of which promotes self-learning, self-regulation and self-reflection of the

individual [2]. In this model, the level of phenomenal consciousness links together the phenomenal (subjective) and neurophysiological (physical) levels. They underlie the integrative methodology of computer modeling of interaction in a hybrid subject environment and in a social environment, as well as in furniture design [11] and clothing design [7].

**Synergy of 3S and 3M metamodels and optimization of learning style.** Based on the fact that an individual is a unique person with his own life experience, principles, mental and physiological characteristics, David Kolb identifies nine learning styles [5; 6]. Having found his individual style, a person will be able to optimally move through the learning cycle, going through all four stages. Your learning style is not an innate characteristic; rather, it is a state of being at every stage of life.

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**Experience-based learning styles according to David Kolb.** The number of connections between conjugate triads of the generalized metamodel is nine, which coincides with the number of experience-oriented learning styles according to David Kolb.

According to Kolb's theory, the acquisition of knowledge and skills occurs during a cycle that consists of four stages (phases):

- Concrete experience – acquiring new experience or rethinking and transforming old experience;

- Reflection and observation – observing new experiences. It is important to understand that experience itself and awareness of experience are not always identical to each other;

- Abstract reflections – creating new ideas and transforming existing abstract ideas and conclusions;

- Active experiments – testing knowledge, applying new experience gained in practice.

**Synergy of 3S and 3M metamodels and learning style optimization.** Based on the fact that an individual is a unique personality with his own life experience, principles, mental and physiological characteristics, David Kolb identifies nine learning styles. The learning cycle includes transformation and awareness of experience, during which 9 thinking styles are formed. For each of them, the balance of opposites is important, which in the synthesized heuristic models looks like the Star of David. This allows to overcome interdisciplinary barriers through new universals; to objectify subjective emotional experience; to generate new ideas.

Their complementarity contributes to the optimization of the learning style of a designer and an architect.

A comparison of the structures of the Colby cycles and the 3M metamodel and 3S metamodel showed that their relationship allows us to develop an universal criteria for determining the quality of design objects using GenAI; a method for identifying triads of interconnected opposites in information sources of various natures, the visualization of which simplifies interdisciplinary interaction between designers; a generalized meta-model of explicit and hidden spatio-temporal relationships, the cognitive visualization of which contributes to the innovative activity of the individual.

**The innovative potential of complementarity and emergence of the 3S and 3M metamodels.** The development of training according to D. Kolba and the synergy of metamodels contribute to the optimization

of creative activity and has a high innovative potential. In particular, the use of the metamodel of the cognitive mind (3M-metamodel) in the form of a double Star of David in the process of creative activity demonstrates the optimization of balance when:

- The transition from one Star of David to another through inversion, which reflects the harmony of physical reality and the fractality of nature.
- The transition from one pentagon to another through inversion reflects the stability of the relationship between consciousness and subconscious.
- Superpositions of oppositely oriented hexagons and pentagons, which indicates the stable influence of asymmetry of the brain hemispheres on the formation of metathinking.

Apparently, the 3S meta-model maps the dual cycle of a pentagon into a hexagon, making their superposition an effective means of cognition, control and evaluation by GenAI.

Thus, the emergence of the 3S and 3M metamodels reflects the inversion of structure and the balance of conjugate triads of opposites, as well as the harmony and contrast of dualities. This allows for the formation of creative-critical metathinking through emotional experience and self-learning.

***Emotional experience and hybrid learning environment in post-war Ukraine.*** A person learns about his environment and survives in it through mutual adaptation and transformation of metathinking skills and the development of new tools. Therefore, the problems of creative activity that are induced by digitalization have led to development of predominantly abstract thinking; formation of fragmented knowledge; the impact of digital interaction on learning effectiveness.

Harmonization of interaction in the digital world through the development of interconnected natural sciences and humanities allows to reduce the risks associated with the human factor; to increase the innovative value of complementary interpretations of the Star of

David; to increase security – physical, functional and informational.

New universals are presented that open up new opportunities for the formation of balanced creative and critical thinking in the learning process. A new approach to assessing creative activity in science and objective criteria for its assessment are proposed.

To develop balanced creative-critical thinking of an individual, complementary means are offered based on identifying the characteristics of an individual's thinking using human-oriented AI; hybrid online and offline learning and intelligent dialogue with artificial intelligence; implementation of UNESCO recommendations on transdisciplinarity of education in the 21st century.

#### **Conclusion.**

Key findings:

- The structural complementarity of the author's meta-models of physical and digital reality contributes to their synergy and optimization of experience-oriented models of learning and self-learning of the individual.
- The interrelation of metamodel structures and their complementarity are the basis of successful activities in a hybrid learning environment, which facilitates the transfer of emotional and intellectual content between objects and subjects of the digital world.
- The development of experience-oriented learning according to D. Kolb contributes to the optimization of creative activity within the framework of the 3M-3S metamodel, the use of which contributes to the development of creative-critical thinking.

***Self-learning in the process of creative activity with GenAI.*** The problems of GenAI and new opportunities for individual creative activity are discussed in our articles, which draws attention to the possibility of creating a personal e-assistant, e-consultant, and e-opponent. The increasing complexity of information processing has led to the fact that the quantitative approach to information is exhausting itself, but the qualitative one is not. Indeed, an individual's worldview and



worldview is determined by the quality of information interaction, which depends on the characteristics of the functional asymmetry of the brain. Therefore, structural and functional asymmetry in the process of experience-oriented training of a designer contributes to the formation of not only creative thinking, but also balanced creative-critical thinking.

At the same time, there is no sharp dividing line between the spheres of science, art and design, and the uncertainties that arise make the assessment of creative works subjective. At the same time, the main attribute of creativity is the triad (beauty/harmony/balance), the criteria for objective assessment of which are crucial for self-motivation. After all, the ratio of beauty/harmony/balance, as a rule, becomes

synonymous with truth not only in design and art, but also in engineering psychology and metaergonomics. Therefore, the cognitive metamodel of the structure of hidden relationships in the process of forming metathinking essentially visualizes the criteria for self-assessment of creativity, which will contribute to the self-development of designers and the identification of their identity.

In our opinion, this opens up new opportunities for humanizing AI, that is, making it commensurate with the individual. In other words, AI as an assistant, consultant and motivator, the complementarity of which will contribute to the creation of quality objects and a comfortable living environment.

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## ГІБРИДНИЙ ПІДХІД ДО НАВЧАННЯ НА ОСНОВІ ЕМОЦІОНАЛЬНОГО ДОСВІДУ І РОЗВИТОК ІННОВАЦІЙНОГО МЕТАМИСЛЕННЯ В ПОВОЄННІЙ УКРАЇНІ

**Мета.** Метою дослідження є синтез узагальнених метаевристичних та метакогнітивних моделей, використання яких у проєктній культурі сприяє формуванню інноваційного креативно-критичного метамислення особистості.

**Методологія** дослідження творчої діяльності і підготовки дизайнера базується на постнеокласичній парадигмі наукового знання, суб'єкт-об'єктній цілісності системи відносин та взаємозв'язків, що діалектично розвиваються, в гібридному інноваційному середовищі навчання. Методологія також включає нові методи міждисциплінарного дослідження та моделювання реальності, що інтегрують фізичну та соціальну онтологію. Показано, що подальший розвиток структурно-функціонального підходу до сприйняття фізичної та цифрової реальності враховує особливості мозкової діяльності особистості.

**Результати.** Основними отриманими результатами є тріада узагальнених авторських метамоделей, а саме:

1. Евристична метамоделювання постнеокласичного сприйняття фізичної реальності дизайнером, в якій незалежність циклів пізнання, а також додатковість парадигм (синергетична, тріадична та семіотична) поєднує фізичну та соціальну онтологію, що створює нові можливості для формування творчого метамислення дизайнера в процесі дослідно-орієнтованого навчання та його діяльності.

2. Евристична метамоделювання постнеокласичного сприйняття та рефлексій фізичної і віртуальної реальності концептуальним дизайнером, у якій залежність циклів пізнання, а також додатковість евристичних метамоделей досягається через універсальні трикутники (фрактальні, Паскаля, Серпінського), структури яких сприяють інноваційній діяльності концептуального дизайнера.

3. Когнітивна метамоделювання формування метамислення дизайнера-концептуаліста, в основі якого лежить просторово-часовий баланс явних та прихованих зв'язків, когнітивна візуалізація яких сприяє пошуку гармонії у процесі дослідно-орієнтованого навчання та творчої діяльності за допомогою семіотичних засобів.

**Наукова новизна** визначається взаємодоповнюваністю структур авторських метамоделей фізичної та цифрової реальності, синергія яких сприяє оптимізації дослідно-орієнтованих моделей навчання та самонавчання. Взаємозв'язок структур метамоделей та їх взаємодоповнюваність є

основою успішної діяльності у гібридному навчальному середовищі (реальному фізичному та віртуальному математичному), що сприяє передачі емоційного та інтелектуального змісту між об'єктами та суб'єктами цифрового світу.

**Практична значущість** додатковості та взаємозв'язку нових метамоделей метамислення дозволяє розробити:

- універсальні критерії визначення якості об'єктів дизайну за допомогою ГенШІ;
- метод виявлення триад взаємопов'язаних протилежностей у джерелах інформації різної природи, візуалізація яких спрощує міждисциплінарну взаємодію дизайнерів;
- створити персонального електронного помічника, електронного консультанта, електронного експерта із використанням ГенШІ.

У повоєнній Україні міждисциплінарний обмін ідеями, методами та успішним досвідом надзвичайно актуальний у рамках гібридного підходу до розуміння гармонії фізичної та цифрової реальності, що сприяє успішній творчій діяльності на основі сприйняття гармонії природи для досягнення недосяжного. Подальший розвиток дослідного навчання через формування метамислення необхідне поліпшення психічного здоров'я та адаптації до неминучих соціальних трансформацій.

**Ключові слова:** метанаука, метадизайн, свідомість, підсвідомість, знаки, символи, творче мислення, критичне мислення.

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**Цитування за ДСТУ:** Mygal S. P., Mygal V. P., Mygal G. V. A Hybrid Approach to Learning Based on Emotional Experience and the Development of Innovative Metathinking in Post-War Ukraine. *Art and design*. 2024. №3(27). С. 86–97.

[https://doi.org/  
10.30857/2617-  
0272.2024.3.7](https://doi.org/10.30857/2617-0272.2024.3.7)

**Citation APA:** Mygal, S. P., Mygal, V. P., Mygal, G. V. (2024) A Hybrid Approach to Learning Based on Emotional Experience and the Development of Innovative Metathinking in Post-War Ukraine. *Art and design*. 3(27). 86–97.