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DESIGN THINKING TRANSFORMATION ON THE PLATFORM OF DIGITAL PROJECT CULTURE UNDER THE INFLUENCE OF INDUSTRIALIZATION

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The purpose of the study is to determine the relationship between design-thinking and traditional design creativity with the analysis of design thinking evolution in the discourse of project culture under the influence of industrialization, as well as to identify the peculiarities of Metcalfe's law implementation from the perspective of design creativeness. The research methodology is based on a system approach to determining the influencing factors of digital methods of virtual objects modeling to the generation and materialization of designer's decisions. The genesis of project culture and the evolution of design thinking were analyzed on the basis of historiographical analysis, the definition of the interrelation of design thinking and traditional design was implemented using comparative analysis, critical analysis was used to study the conditions of Metcalfe's law observance in the discourse of design creativity. Scientific novelty. The feasibility of using design thinking as a mediator of the design creativity concepts implementation was substantiated. It was shown that under the influence of digitalization the digital phase of project culture was formed, and design thinking was transformed into digital design thinking. In the process of research, it was revealed that in the discourse of design creativity Metcalfe's law remains in force for a limited number of recipients, which estimates of several dozens. The enhancing of the "utility" of network communications can be achieved by thematic selection of creative sources and filtering them according to the level of information uniqueness. Conclusions. In the course of industrial revolutions, the design goal remained unchanged, and the response to changing environmental conditions was transition of project culture in the digital phase. Design thinking on the platform of digital project culture transformed into digital design thinking with the expansion of the sphere of influence on social processes and concentration on individual needs of a person. Design thinking adaptation and digital competencies update are necessary for each of the areas of design to guarantee sustainable development of design on the platform of digital project culture.

Keywords: industrialization; project culture; design thinking; digital design; augmented reality; digital competencies.

Introduction

Analysis of society development over the past century shows that all significant social transformations took place under the influence of industrialization.

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Today, information technology has penetrated into all spheres of life, which has forced society members to adapt to innovations, including lifestyle, communication style and means of interaction. The phenomenon of "rapid growth" has generated new concepts and terminology base. The following concepts have emerged and are actively used in design activities through digitalization: digital design, digital project culture, raster/vector graphics, pixelation, 3D modeling, additive technologies for material design of artifacts, visualization of virtual designer ideas, animation of images and augmentation of reality. Among the newest terms that are in line with design, there is the concept of so-called "design-thinking", which is used to refer to an effective method for solving a wide range of human problems (The Stanford d.school, 2017). This term, albeit based on the concept of "design", originated in the business process management environment as an effective means of creative solution of consumer problems and needs, regardless of traditional design creativity. However, there is a lot in common between design creativity and design thinking in the context of creative problem solving algorithm.

In the theory and practice of design, digitalization of project culture actualizes a number of issues:

– Will new technologies be able to overcome their own potential of disruptive influence on the development of design and radically change the project culture of the future?

– How are the terminologically similar phenomena of design-creativity and design-thinking related?

– Can design thinking as an effective tool for solving a wide range of human problems play the role of a conceptual and methodological basis of design creativity in a digital environment?

Since design thinking and design creativity are based on the creative processes of generating ideas, it is expedient to analyze the possibility of using design thinking as a mediator for the implementation of design concepts in design practice. Therefore, the study of the ways of transforming design thinking under the influence of industrialization as a significant component of project culture is a topical problem, which aims to predict the key factors in the design development of the future.

Currently the world is experiencing a period of turbulent digitalization and as a result the tendencies of technologies and processes transfer in the digital environment attract attention of many researchers and consulting agencies. It is evidenced by the activity of publications in professional publications and reports of authoritative sources (Deloitte's Human Capital 2016; World Economic Forum 2016).

Since competition requires an accelerated generation of original design ideas, many of which can only be realized through digital technology, the pursuit of innovation in design-creativity is also transposed into the digital environment. Many publications are devoted to the description of new possibilities of innovative digital technologies in the design, manufacture and implementation of modern design products (Maeda J., 2016; Sculpteo, 2017).

From the point of view of assessment of the potential of design thinking application as the conceptual and methodological basis of design creativity, it

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should be noted that the project style of problem solving is effective not only for design, but also for a wide range of activities. There are many publications that describe examples of the impact of design thinking on enterprise competitiveness and the efficiency of governance in the public sector. Design was named the top trend in the report "Global Human Capital Trends 2016" in Deloitte University Press (Deloitte's Human Capital, 2016). The indicative role of design is described in the document of the Committee of the European Commission, entitled "Design as the Engine of Innovation Activity Targeted at People" (Commission of the European Communities, 2009).

Many publications are devoted to increasing the expressiveness of design images in their visualization processes using virtual and augmented reality technologies. Analysis of the materials of publications, exhibitions, descriptions of concrete implementations of technologies, reports at TED conferences (Technology, Entertainment, Design) gives grounds to conclude that VR, AR and AI technologies are successfully mastered by advanced designer brands, but mainly in the direction of business processes digitalization, fashion retail and communications "client-virtual store". The development of virtual/augmented reality technologies has greatly expanded the retail and marketing tools and generated new forms of virtual transactions and virtual stores where the buyer can test all the features of the design product, as well as try some things with the tactile sensation (TED Talk, 2016; Gerber Technology, 2018).

The analysis confirmed great attention of researchers to the problems of design development in the digital environment, but most publications are devoted to separate problems and examples of effective application of new technologies in marketing, retail and designing of design products. Reports and publications on the results of the design thinking potential analysis as a conceptual and methodological basis of design creativity, as well as the evolution of design thinking in the discourse of project culture during the industrial revolution have not been found.

The purpose of the article

The purpose of the research is to analyze the interconnection of design thinking and traditional design creativity, as well as the evolution of design thinking as an effective style of activity in the discourse of project culture, identifying the impact factors of industrialization on the conceptual foundations, design tools and basic competencies of design creativity.

Achieving this goal requires consideration of the peculiarities of project culture genesis from its inception to the present state characterized by the transition to the digital project culture phase. The evolution of design creativity is determined on the basis of historiographical analysis of design methods transformation from copying sketches manually to digital design technologies and techniques.

In parallel with the analysis of project culture genesis, the evolution of design-thinking in a digital environment is researched. Analysis of "analog" design thinking transformation in digital thinking is carried out on the basis

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of a systematic approach to determining the factors of digitalization impact on the design thinking ideation stage, comparing this stage with the stage of design decisions generating in the discourse of project culture.

The task of analyzing the influence of network communications on pre-project analysis in the context of the initial design information search for the initial phases of the design project and design thinking is also set. Possibilities of design information components extraction are investigated on the basis the network communications potential "utility" analysis in accordance with Metcalfe's law.

The results of design thinking transformation analysis in the digital environment and the basic competences on which it is based, are the basis of the search for the ways of adapting the designers of the new generation to work in the conditions of digitalization.

Presentation of the main material

In the first decade of the XXI century due to the rapid introduction of information technologies there appeared some risks of their disruptive influence on the sustainable development of various activities, which brought individual branches closer to the points of bifurcation. Innovative technologies put some traditional professions under the threat of degradation, which can only be confronted by a fundamental restructuring of technology and the tasks of the activity. In design, new technologies have expanded the range of design-creativity and "scope" of technological operations, but led to the convergence of related specializations and demanded to master new competencies.

Historically, design was formed as a mass design industry at the same time with the industrial economy formation, and at the initial stage it was associated with design bureaus, manual drawings and tracing. The second industrial revolution in the middle of the XX century formed the industrial mass production economy when the idea of project activity dominated in the design environment in terms of mass production, but gradually there came the understanding that project culture was not limited to technical projecting, and that projectivity was a determining element of contemporary thinking. As a basis for design thinking, projectivity is one of the most important typological features of modern culture related to human creativity, in particular it creates a common conceptual basis both for traditional design creativity and design thinking.

In the 1980s, the idea of project culture began to be actively used in a new style of thinking and became the center of a new conceptualization that transposed the theory of design into a new dimension. The question of the primacy of function or form, benefit or beauty is replaced with the problems of determining the role of high artistic value in project culture and projectivity in artistic culture. Issues of clarification of the project culture nature and its role in design are made actual. At the next stage of social development, the trends of individualization, generation of personal needs and acceleration of consumption change the understanding of the role of design in the designing,

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production and presentation of design products on the market. Instead of mass production there comes flexible production of small series, whose products are more precisely focused on the demand of narrow target groups.

The process of forming the concept of project culture is based on the peculiarities of human consciousness not to divide life into productive and creative activity, but to strive for the unity of expedient and meaningful being in beauty. Therefore, the design begins to function fully on the platform of project culture.

In parallel with modern design formation in the new millennium the concept of design thinking was formed. It is a method of developing a wide range of products and services with an emphasis on human problems and needs. In the course of evolution, this concept began to play the role of a creative approach to solving user problems.

Since the engine of design is a social order for harmonization of the man with the environment, formed under the influence of human needs and fashion trends; its practice is based on the integration of artistic and aesthetic, formalized and algorithmic processes. Such an interpretation is consistent with the modern concepts of project culture and design-thinking, and also correlates with the notions of the role of design and design-thinking in project culture. In the modern understanding, design is not seen as a process of designing the appearance of objects, but as a process that creates a new way of life of a person by organizing a common "intelligent" space around. In a more general understanding, design is the solution to a problem, the designer is the subject that solves the problem, and design thinking is a method for solving problems that arise in the development of user-oriented services, products, and services (The Stanford d.school, 2017). Objects of a modern design project are not products, but needs. Design is an approach to problem solving that can be applied in the private and public sectors to stimulate innovation in products, processes, services, society and even politics development (Interaction design foundation, 2016).

According to modern concepts, design is the basic component of project culture that represents a specific type of culture based on a combination of artistic and aesthetic creativity and formalized design techniques. Design activity plays the role of integrating part of artistic and figurative ideas, research, project, design, technological works, forming a single project culture.

The conceptual basis of design creativity and a significant component of project culture is the style of thinking, which is based on projectivity. This style of thinking has a common basis with design thinking. Design-thinking and design-creativity are based on the harmonious combination of processes of figurative heuristic and formalized algorithmic nature, their main stages are functionally similar, and they are based on the creative process of generating ideas. It is expedient to analyze the possibility of using design thinking in modern theory and practice of design as an effective system-heuristic thinking style in the discourse of project culture.

New forms of business running have generated a sharp increase in the flow of information that is required for accounting and management of business

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processes. The third industrial "computer or digital" revolution created the prerequisites for computer processing of large amounts of data and automation of routine operations, which stimulates the development of information technology in business and production on the platform of digitization.

The design refers to professions creative solutions of which are difficult to automate. But automated systems based on artificial intelligence can effectively perform routine, some structural and technological operations during the design project. Due to fundamental innovation, design can be transformed in accordance with changing conditions and requirements of the environment with the compensation of changes and design conditions due to the flexibility of forming methods, algorithms and design tools, as well as modernization and convergence of competencies synchronously with the advent of new technologies.

Integrated social communications in combination with three-dimensional visualization algorithms, additive material materialization technologies and interactive image-forming techniques in the virtual reality space have provided new opportunities for both designers and consumers of design products. New features require designers of a new generation, synchronous expansion of their competencies, which is possible, simultaneously with the transfer of both design thinking and project culture in the digital environment.

The results of design-thinking transformation analysis under the influence of industrialization indicate its transition, together with the project culture into a new, digital, phase. A number of questions arises: why do you need digitalization?; what does it give to design creativity?; why are the methods and algorithms of digital design different from analog design methods?; with what criteria does digital project culture and design-thinking outperform the traditional prototypes?

Digitalization is necessary because modern computers can work only with the finite amount of information presented in digital form, which corresponds to the information redundancy reduction of functions or processes representation. At the heart of this proposition is the theorem of responses, the essence of which in the representation of functions with a limited spectrum sequence of values of its responses, measured with a frequency exceeding the double boundary frequency of this function spectrum. The notion of "digitalization" has progressed during the industrial revolutions. At the start of informatization, it was associated with analog-digital signal conversion, in the transition period to the Fourth Industrial Revolution, it actually merged with the notion of informatization, which covered all spheres of society. The conceptual foundations of design creativity evolved during the industrialization from ensuring the unity of purpose, utility and beauty in mass production to targeted design, individualization and ecologization based on the synthesis of bio nano-information technologies achievements. "There is a new era in design, a new era in creativity that will take away from the design inspired by the nature, to the nature, inspired by design" (Oxman, 2016).

Analysis of the design creativity evolution during the periods of industrialization shows that the emergence of new technological opportunities

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in the field of processing, synthesis and reproduction of images stimulates the development of new design tools. Those design-project operations that were subject to automation were absorbed by new tools as components of more common processes. In order to prevent deactivation of competencies in a particular direction of design-activities, the designer needs to synchronize with the advancements in technology and master the expanded set of competencies, including new competencies that have emerged due to convergence of specializations and automation of routine operations. In the context of digitalization the new generation of designers must have basic, everyday, economic and social digital competencies and innovations in the field of project-designing. That is, the emergence of new technologies expands the toolkit of design creativity and modernizes the basic set of competencies, and the designer design style is transposed from an analog plane to digital space. Design thinking in the course of industrial revolutions has transformed into digital design thinking, project culture in digital project culture on which digital design is based. The digital project culture has also spawned new areas of design creativity – web design, interfaces design and computer gaming.

Digital design thinking has a number of advantages over traditional design thinking. In the design-creative discourse these benefits consist of increased flexibility in project result management and data capture capabilities throughout the project in real-time mode. This refers to the process of interviewing potential users, collecting statistics, analyzing trends, prototypes, testing the results and scaling the project at each stage (Tennø Helge, 2018).

As a rule, catalysts of generating relevant competencies during industrial transformations were disruptive technologies that required an updated integrated approach to design creativity. Virtual technology (VR) and augmented (AR) reality are the potential sources of influence on the transformation of design thinking. They greatly expand possibilities and expressiveness of traditional methods of visualizing design solutions, show potential prospects for the development of new design trends and fashion industry. At the same time, these technologies bear the risk of disruptive influence on traditional design-design techniques.

The mechanism of augmented and virtual reality influence on the technologies of design-creativity can be explained by their ability to change the consciousness of the individual with the effect of stimulating the creative generation of images. In the space of augmented reality, the recipient undergoes a transformation of consciousness from passive perception of the environment to active generation of a media environment in which innovative images of design objects emerge spontaneously. A synergistic effect is achieved as a result of synthesis of the image of a real prototype with a digital model of the virtual primary source. At the stage of the design product image formation, the impact of VR / AR technologies on design thinking is to expand the boundaries of figurative ideas generating.

Network communication, which is one of the most productive channels for obtaining information in modern society, has another potential impact on the design style of design creativity. The network effect of the interaction between

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the individual and the users of the network (recipients of communications) is described by Metcalfe's law: if a contact with one recipient can bring a person one unit of useful information, then with the increase in the number of contacts on the network, the usefulness of information increases in proportion to the square of the number of recipients – the participants of network communications.

Since designers need information about general tendencies, trends in this direction, prototypes and creative sources in order to achieve the relevance of the solution and give it novelty in the process of designing solutions search, the designer is looking for useful information in various sources, in particular in social local and global networks. In the networks, the designer defines a group of "useful" sources for further work. If the number of sources does not exceed several dozens, the law is followed under the condition of 100% information uniqueness of the sources. Since the recipients of the network are able to exchange information "everyone with each" with the establishment of an arbitrary number of other sessions, the uniqueness of information of each recipient may be reduced. Given the correlation between sources of information and constraints in the number of objects with which a person can work in parallel, the number of sources in which the information usefulness grows proportionately to the square of the number of recipient-participants in communications is limited to several dozen. Then the dependence gradually approaches the fixed level of the information usefulness.

To increase the maximum level of useful information to which Metcalfe's law is applied, the designer needs targeted selection of subjects of network communications by thematic orientation and filtration based on the level of uniqueness of their information with the use of technology of "big data" processing for structuring.

Artificial machine intelligence copes with these tasks (except for selection) more efficiently than a person. Modern technologies "big data" and "data mining" are intended for the search and processing of useful information in a multitude of unstructured data and can be used to search for primary sources, elements of media trends and prototypes of design solutions. Using the possibility of the powerful machine intelligence influence on the human mind in the context of stimulating imagery and creativity of design thinking and getting rid of routine operations such as processing unstructured data promises to produce fruitful results in the absence of inhibition of the imagination of the author – the generator of ideas. This possibility demonstrates yet another peculiarity of the digital project culture – the ability to synthesize human and machine intelligence with a synergistic effect in the process of generating images in an environment of augmented reality.

It is proved that in the course of digital and under the influence of the tendencies of the fourth industrial revolutions, the harmonization of project culture with the digital environment is underway. As a result, the digital phase of the project culture is formed, and design thinking is transposed into digital design-thinking. For sustainable development of design and preventing the devaluation of the axiological guidelines of design art on the platform of digital project culture, adaptation of design thinking and updating of digital

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competencies in each of the design directions is required. It has been found that in the discourse of design creativity Metcalfe's law acts on a limited number of network recipients, whose number is estimated by several dozen. The enhancing of the "utility" of network communications can be achieved by thematic selection of creative sources and filtering them according to the level of information uniqueness using the technology of "big data" processing for their structuring.

Conclusions

Since its inception, design has undergone an evolutionary path from copying manual sketches and drawing-boards to digital design, automation of routine operations, synthesis of human and artificial intelligence, cloud storage technologies, processing and extraction (mining) of information. Its toolkit has expanded considerably thanks to the additive technologies of prototype materialization, visualization and modeling of design artifacts in the space of augmented reality achieved through the synthesis of technologies and arts based on the digital project culture.

Since design is aimed at harmonizing the person with the surrounding reality, its goals have not changed during the industrial revolutions and have shown invariance with respect to the changes in the technologies of design artifacts creation. Design thinking has constantly expanded the coverage area with an emphasis on the person with their needs and expectations, which is in harmony with its use as an effective conceptual and methodological platform for design creativity. Evolution changed design objects from products to needs, analog concepts, design algorithms and digital tools, as well as expanded design products visualization and provided additional on-line product sales channels to the end user.

A new approach to design projecting was formed in the ecosystem "Citizens – Society" taking into account the cultural and historical context, the ethnosphere, ecology and individual human needs. The development of design using design-thinking as a conceptual and methodological base is aimed at harmonizing the relations of "man – society", "man – nature" and "man – everyday life" with the functions of a buffer link under the conditions of sharp changes of the environment by creating artifacts "for a person".

Under the influence of industrialization, project culture was transposed into the digital phase, and design-thinking was transposed from its analog form into digital design thinking, which has several advantages over the analog one. For sustainable development of design in a digital environment, project culture reengineering and its transformation synchronously with design-thinking into the digital phase and updating of digital competencies in each of the design directions is required. The main directions that can help the new generation designers to adapt to working under the conditions of digitalization are mastering (towards disruptive technologies in design-practice and design-education) the up-to-date complex of digital competencies and project tools innovations.

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Further research should be directed to finding ways to develop design in the post-digital period under the conditions of the fourth industrial revolution.

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ТРАНСФОРМАЦІЯ ДИЗАЙН-МИСЛЕННЯ НА ПЛАТФОРМІ ЦИФРОВОЇ ПРОЕКТНОЇ КУЛЬТУРИ ПІД ВПЛИВОМ ІНДУСТРІАЛІЗАЦІЇ

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Мета дослідження – розгляд взаємозв'язку дизайн-мислення і традиційної дизайнерської творчості з аналізом еволюції дизайн-мислення в дискурсі проектної культури під впливом індустріалізації, а також виявлення особливостей дотримання закону Меткалфа у ракурсі дизайн-творчості. Методологія дослідження ґрунтуються на системному підході до визначення факторів впливу цифрових методів моделювання віртуальних об'єктів на генерацію і матеріалізацію дизайнерських рішень. Генезис проектної культури та еволюція дизайн-мислення проаналізовані на базі історіографічного аналізу; визначення взаємозв'язку дизайн-мислення і традиційного дизайну реалізовано з використанням порівняльного аналізу; критичний аналіз застосований для дослідження умов дотримання закону Меткалфа в дискурсі дизайн-творчості. Наукова новизна. Обґрунтована доцільність використання дизайн-мисленні як медіатора реалізації концепцій у дизайн-творчості. З'ясовано, що під впливом інформатизації формується цифрова фаза проектної культури, а дизайн-мислення транспонується у цифрове дизайн-мислення. Виявлено, що в дискурсі дизайн-творчості закон Меткалфа діє на обмеженій множині реципієнтів мережі, чисельність яких оцінюється кількома десятками. Зростання «корисності» мережевих комунікацій можна досягти шляхом тематичної селекції мережевих творчих джерел та фільтрації за рівнем унікальності їхньої інформації. Висновки. В ході індустріальних революцій мета дизайну залишалася незмінною, а відповідь на зміну умов навколишнього середовища полягала в переході проектної культури в цифрову фазу. Дизайн-мислення на платформі цифрової проектної культури трансформувалося в цифрове дизайн-мислення з розширенням сфери впливу на соціальні процеси та концентрацією на індивідуальні потреби людині. Для сталого розвитку дизайну на платформі цифрової проектної культури необхідна адаптація дизайн-мислення та актуалізація цифрових компетенцій в кожному з напрямів дизайну.

Ключові слова: індустріалізація; проектна культура; дизайн-мислення; цифровий дизайн; аугментація реальності; цифрові компетенції.

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ТРАНСФОРМАЦИЯ ДИЗАЙН-МЫШЛЕНИЯ НА ПЛАТФОРМЕ ЦИФРОВОЙ ПРОЕКТНОЙ КУЛЬТУРЫ ПОД ВЛИЯНИЕМ ИНДУСТРИАЛИЗАЦИИ

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Цель исследования – рассмотрение взаимосвязи дизайн-мышления и традиционного дизайнерского творчества с анализом эволюции дизайн-мышления в дискурсе проектной культуры под влиянием индустриализации, а также выявление особенностей действия закона Меткалфа в ракурсе дизайн-творчества. Методология исследования основана на системном подходе к определению факторов влияния цифровых методов моделирования виртуальных объектов на генерацию и материализацию дизайнерских решений. Генезис проектной культуры и эволюция дизайн-мышления проанализированы на базе историографического анализа; определение взаимосвязи дизайн-мышления и традиционного дизайна реализовано с использованием сравнительного анализа; критический анализ применен для исследования условий соблюдения закона Меткалфа в дискурсе дизайн-творчества. Научная новизна. Обоснована целесообразность использования дизайн-мышления как медиатора реализации концепций в дизайн-творчестве. Выяснено, что под влиянием информатизации формируется цифровая фаза проектной культуры, а дизайн-мышление транспонируется в цифровое дизайн-мышление. Выявлено, что в дискурсе дизайн-творчества закон Меткалфа действует на ограниченном множестве реципиентов сети, численность которых оценивается несколькими десятками. Роста «полезности» сетевых коммуникаций можно достичь путем целевой селекции сетевых творческих источников по тематической направленности и фильтрации по уровню уникальности их информации. Выводы. В ходе индустриальных революций цель дизайна оставалась неизменной, а ответ на изменение условий окружающей среды состоял в переходе проектной культуры в цифровую фазу. Дизайн-мышление на платформе цифровой проектной культуры трансформировалось в цифровое дизайн-мышления с расширением сферы влияния на социальные процессы и концентрацией на индивидуальные потребности человека. Для устойчивого развития дизайна на платформе цифровой проектной культуры необходима адаптация дизайн-мышления и актуализация цифровых компетенций в каждом из направлений дизайна.

Ключевые слова: индустриализация; проектная культура; дизайн-мышление; цифровой дизайн; аугментация реальности; цифровые компетенции.