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Formation of biophilic design using graphic means

Abstract. The article's relevance lies in discussing the need for psycho-emotional ecological enhancement in the modern human living environment through biophilic design, which creates natural conditions familiar to humans through evolution using graphic means. This determination has led to the purpose of the study: to indicate the role of graphics in the formation of biophilic design to create a favourable emotional and psychological spatial environment. In the work process, general scientific research methods were employed: analysis and synthesis, semantic and comparative analysis, the analysis of scientific sources, the principle of determinism. The study's main results argue for the importance of applying biophilic design, as it has a positive effect on the physical and psychological well-being of individuals and their activities. The approaches to forming biophilic design have been outlined, which can be implemented with the help of graphic design. In urbanised society, graphics have various tools to harness the potential of nature's harmony for creating aesthetically and psychologically healthy architectural spaces. At the beginning of the 21st century, of intensive technological development, graphic techniques and methods rooted in drawing, painting, decorative and applied arts are being synthesised with digital technologies, leading to new contemporary developments in the graphic design field. Within the biophilic design realm, these contribute to the individual's psychological and physical comfort. The practical value of the work is that it highlights the synergy of various types of design to establish an optimal balance between the natural and artificial environments of human life, while also taking into account the level of development of information and visual technologies

Keywords: biophilia; graphic design; greening of the human environment; stylisation of natural forms; information and visual technologies

INTRODUCTION

Modern society in the era of political and economic cataclysms is experiencing constant stress that can be overcome which requires such an organisation of space that would contribute to the people's mental and physical

recovery. This, in particular, is helped by biophilic design. This is a direction of spatial design that, in arranging people's living environment, uses naturalness to level anthropogenic factors on people, tries to establish an optimal

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balance between natural and artificial environments, and promotes their maximum effective interaction. Knowledge of the principles of biophilic design and the ability to apply them in space design is defined as the necessary professional competence of modern architects. At the beginning of the 21st century, biophilic design is gaining special importance: its principles can become fundamental in the system of assessment of buildings and their certification. This determines the relevance of biophilic design as a way of designing a space that helps preserve the mental health of the people in it by creating proper conditions for work, development, and recreation.

Abroad, biophilic design became the subject of study for scientists since the 1980s, when biologist E.O. Wilson (1984) introduced his concept of biophilia. Contemporary scientists, such as J. De Bourca (2023), emphasise the prospects of using biophilic design. In the Ukrainian scientific discourse, research on biophilic design became particularly active in the early 2020s. I. Isachenko (2021) asserts that modern design trends do not reject natural forms but rather actively integrate them into the environment. This highlights the need for architects to develop skills in biophilic design – a concept that creates evolutionarily familiar natural conditions for humans. A. Bhan (2022) explored biophilic design in the context of shaping space for children. She emphasised the importance of creating spaces in urban environments that mimic natural conditions for play and child development. She outlined the components of optimal integration of biophilia into the design of children's playgrounds. R. Osmolova & T. Malik (2023) emphasised the importance of implementing biophilic design in health and rehabilitation centres. The absence of biophilic design would not promote the recovery and restoration of patients' ability to work. T.I. Kryvomaz *et al.* (2022) pointed out that prolonged concentration of attention in modern humans leads to fatigue, aggression, and irritability, which biophilic design helps to level out. The researchers outlined promising directions for its development in synergy with the concept of green building.

A person themselves determines the space in which they want to be and thus influences it by filling it with items that make their stay comfortable. But it's not just the person who affects the surrounding environment, it also determines the psychosomatic state of the individual. Optimising living spaces, in particular, involves adding either real or simulated elements of nature to them. Graphic design can be one of the means for achieving this. As a special form of artistic-aesthetic existence of society, graphic design noticeably influences other types of design, including biophilic design, which seeks to ecologise the human environment, as well as the environment itself. In the research of M.O. Wizer (2022) emphasis is placed on the ecological aspect of graphic design, where "approaches to creating ecological graphic design are considered, and advice is given on reducing the negative impact on the environment". I. Cherkesova (2019) pointed out the role of graphic design as an informational navigator, that creates

symbolic forms in all forms of reality and determines the focus of people's attention, as a result, and the vector of their behaviour. The scientist emphasised that low-quality graphic design negatively affects human development, and their ability to perceive moderation and beauty. If since childhood a person has been exposed to "an environment of ugliness (visual forms, sounds, smells), as an adult, they are unable to engage in full-fledged creative activity and are inclined towards destructive actions in society and towards themselves". A.V. Budnyk & I.O. Hoshko (2023) view graphics as a tool of art therapy and believe that its use in environmental design can have a significant positive impact on the mental health of the population. According to the opinion of scientists, aesthetically appealing and emotionally rich images promote creativity, self-expression, and relaxation, which is particularly important for people suffering from constant stress due to wartime events. Bright colours and positive imagery have a favourable impact on the mental, emotional, and physiological state of individuals, which aligns with the goals of biophilic design.

The aim of the study was to indicate the role of graphics in shaping biophilic design as a means of creating a favourable emotional-psychological spatial environment. This determines the goal of the article – to trace the ways of applying graphic tools in shaping various directions of biophilic design.

The scientific novelty of the research lies in the fact that, for the first time, it examines the synergy between biophilic and graphic design to create aesthetically appealing and visually and psychologically adapted spaces for human perception; enhances the role of graphic design in shaping a biophilic environment capable of leveling out visual-informational noise caused by the high demand of contemporary market society for information, which aggressively impacts the social and psychological space of individuals, disrupting their internal ecology through the consumption not only of dirty, hazardous products and inhaling polluted air but also through the consumption of "polluted", negative information.

MATERIALS AND METHODS

In the course of the work, general scientific research methods were employed. Analysis and synthesis helped identify sources that describe biophilic design as a relevant approach for harmonising the human environment and outline its expressive features. Semantic and comparative analysis allowed for the generalisation of aspects of biophilic design, recognising its theoretical and practical significance. Additionally, an analysis of scientific sources on modern design highlighted researchers' approaches to applying biophilic design in various architectural spaces and noted the underestimation of graphic means as tools for its formation. The principle of determinism is applied in two key areas: substantiating the impact of humans on the environment and the environment's impact on humans. Understanding that humans are part of nature promotes a careful attitude towards it and a desire

not to cause harm. Conversely, human existence is shaped by the conditions in which people live. Therefore, biophilic design – especially through graphic means – can create favourable conditions for a person's psycho-emotional well-being, encouraging constructive behaviour and mitigating stimuli that lead to destructive behaviours. A review of scientific and popular literature on design reveals that biophilic design has been of interest to foreign scientists since the 1980s and remains a topic of ongoing research (Kellert & Calabrese, 2015; Mehta, 2020; Bourca, 2023). In contrast, it began to be actively researched in Ukrainian science only in the 2030s. The following directions of analysing biophilic design in domestic science and practice can be outlined: the ability to form biophilic design as a core skill of modern architects (Isachenko, 2021); biophilic design in shaping the space of educational institutions using live nature, natural colours, eco-friendly materials (Bhan, 2022); the feasibility of using plants within biophilic design in urbanised areas (Kryvomaz *et al.*, 2022); and biophilic design as a means of rehabilitation in the interiors of health and rehabilitation centers (Osmolova & Malik, 2023). Graphic design as a method of stylising natural forms was studied, for example, by V.Ye. Mykhaylenko & S.V. Pryshchenko (2012) and S.V. Kliuchko & O.V. Maznichenko (2016). The important role of graphic design as a determinant of human behaviour was emphasised by I. Cherkeseva (2019). Graphic design was considered as art therapy by A.V. Budnyk & I.O. Hoshko (2023). Therefore, the analysis of the sources reviewed shows that graphic design has not yet been considered by scientists as a means of forming biophilic design (specifically in this terminological interpretation), highlighting the relevance of research.

RESULTS AND DISCUSSION

The visual component plays a primary role in forming a person's impression of the place where they are. The perception of an individual about the environment is formed within the first few seconds of observation, and a properly crafted design through the visual receptors of the recipient stimulates positive feelings in them. This is particularly facilitated by biophilic design, the purpose of which is to integrate elements of nature into the artificially created human environment. Biophilia, from ancient Greek, literally means love (φιλία) for life (bios). The concept of "biophilia" was introduced by the American psychoanalyst of German descent, E. Fromm (1973), in his work "The anatomy of human destructiveness", understanding it as "a passionate love for life and all living things". The American biologist E.O. Wilson (1984) developed this concept in his work "Biophilia", proposing the concept of biophilia. It suggested that humans should not separate themselves from nature but, on the contrary, should integrate it as much as possible into their everyday environment, which corresponds to the genetic need of humans as biological beings in nature. This is in line with the approach to space formation advocated by Koichi Takada – the Japanese architect proposed modernising the Bauhaus concept that form follows func-

tion by stating – form follows nature (Mehta, 2020). Biophilic design includes the use of natural materials, plants, and natural elements to create a healthy and natural environment that helps increase work efficiency and reduce stress, and improves the overall aesthetics and functionality of the space. Biophilic design criteria include the creation of a space for contact with nature, in particular: the use of plants and natural elements, the use of natural lighting and ventilation, the maximum imitation of natural conditions in the room in their absence (Kellert & Calabrese, 2015). Biophilic design does not require a radical reconstruction of space: it is capable of adapting to it by adding necessary "green" elements that contribute to the aestheticisation of the premises, improvement of air quality, its chemical, physical, and biological characteristics, as well as reducing noise levels.

Supporter of biophilic design O. Heath (2021a) positions it as a design for the well-being of individuals and the planet as a whole. The designer advocates a balance between nature and technology. An expert in eco-design asserts that due to the intensive pace of life and work, people are constantly in a state of stress, and their sympathetic nervous system does not have time to recover; therefore, it is the task of designers to create conditions for people to have the opportunity to distract themselves from everyday worries and relax. Biophilic design as an approach to space organisation takes into account everything: from strategy, planning, materials, lighting, to sensory reactions to space, which depend on the means of creating visual effects within it. Visualising biophilic design is made possible by graphic design, which demonstrates how colours, furniture, textures and other interior elements come together and fill the space of the room. Such visualisation also helps avoid mistakes in space planning before the start of renovations (Fig. 1).



Figure 1. Biophilic design in Oliver Heath's concept
Source: based on O. Heath (2021b)

Artificial elements, such as furniture, technical equipment, and lighting, give the space modern accents and organisation, setting it up for the implementation of its various activities. To restore strength, a person needs natural space. Therefore, it is important to maintain the balance between artificial and natural elements in the design. The synergy with the environment in biophilic design lies in the close relationship between the design and the natural environment. Biophilic design improves the living environment by integrating natural elements into the environment. Natural elements, such as plants, stones, or wood, can give the room an ecological, soothing look, improve its emotional perception. Biophilic design involves an ecologically conscious choice of materials and spatial elements that are as natural and safe as possible, avoiding harm to both people and the environment (Lyovochkina, 2004). This actualises the issue of reusing objects to reduce the negative impact of anthropogenic factors on nature. Natural forms, colour and texture harmonise the interior. Graphic design makes it possible to fill the environment with images, that will be associated with flora and fauna, and cause associations that will activate the necessary emotions in a person (Mykhaylenko & Pryshchenko, 2012). After all, on the one hand, graphic images of nature can create harmony; on the other hand, cause feelings of sadness, nostalgia, longing for true nature. Effective space arrangement balances both elements' types, creating a harmonious and comfortable environment for living and working.

Plants play a key role in human mental recovery. They add a soft visual texture to the interior, making it lively and rich, creating an atmosphere of peace, comfort and harmony. In addition, plants (with the right selection) purify the air, improve its quality, adjust the temperature and humidity of the room, and therefore contribute to a person's physical health. Graphic depiction of nature indoors can enhance the feeling of closeness to it. These can be drawings on wall panels, photo wallpapers that visually imitate plants or animals, their abstract images, photomontages, series of drawings of various types of plants and animals, digital reproductions of them (Fig. 2). The choice depends on the style of the room and the atmosphere that needs to be created in it.



Figure 2. Stylisation of bioforms by means of graphics
Source: developed by the authors

The biophilic space, which creates a healthy environment for living and a productive atmosphere for work, is also designed not to harm the surrounding environment. This involves, in particular, the use of energy-efficient technologies, renewable energy systems, water conservation and eco-friendly materials in construction and interior design. The implementation of biophilic design in the short term can alter the environmental conditions of human habitats, while in the long term, it can contribute to environmental cleanliness. Graphic design as a visual means aimed at influencing the recipient's behaviour can direct their attention to these aspects through motivational images. As a visual guide, it communicates information, ideas, and emotions through visual elements that attract users' attention, prompting them to perceive the represented information. This could be a logo, poster, brochure, banner, where fonts, images, colours convey abstract information compactly, in the form of symbols that, synthesising various graphic elements, evoke associations with specific concepts or meanings, facilitating their quick understanding. For example, conscious use of natural resources, such as energy obtained from power outlets, is promoted by the mandatory labelling of the energy efficiency class of certified household appliances. Taking into account the specifics of colour perception – from those associated with harmony, growth (green colour), to dark ones that evoke feelings of anxiety, such as those experienced in a dark room. Thus, the four upper levels, marked with the letter A, are indicated in green. The letter B can be placed on either a lime green background or a light orange one, C – on lime green or orange, D – on yellow or red, E – on mustard or red. The letters F and G, which are practically unused, have burgundy and dark burgundy colours respectively (Fig. 3).

A+++	Highest level of energy efficiency
A++	Very high level of energy efficiency
A+	High level of energy efficiency
A	Low power consumption
B	Average consumption of electricity
C	Low energy saving
D	High power consumption
E	High electricity consumption
F	Extremely high electricity consumption
G	The highest level of energy consumption

Figure 3. Labelling of energy efficiency classes of household appliances using graphic means
Source: European Commission (2024)

Nature will always have a significant impact on human life, as humans are a part of it. Human beings have extended beyond nature, creating their own artificially constructed world, which can both enhance and degrade human life. The modern urbanised environment largely disregards natural factors, perceiving green spaces as obstacles to development, leading to a disconnect between

humans and nature, which has resulted in inefficient use of natural light, ventilation, natural materials, forms, and vegetation. Biophilic design serves as a mediator between humans and nature, allowing humans to mimic the evolutionarily natural environment for them. Biophilia in design is intended to simulate the feeling of being in nature. It can be direct, through the use of live plants and eco-friendly materials in the interior. Forms, textures, and colours of natural objects, such as leaves, flowers, water, and sky, can serve as sources of ideas for creating graphic compositions in environmental design, giving it a more organic and attractive appearance (Kliuchko & Maznichenko, 2016). To create spaces that mimic natural environments, positively impacting the physical and mental health of people, enhancing their productivity, intellectual and creative potential, indoor areas can incorporate plants (in the form of living walls), natural lighting, eco-friendly materials, and water features. Graphics as an important aspect of art utilise various materials and techniques to express the designer's ideas. In this form of art, the texture of materials, ornaments, and decorative motifs play a significant role, creating a system of graphic signs – an artistic language for communication with the viewer. Graphic design shapes the visual-plastic context of a biophilic environment. The

components of graphic design, such as shapes, colours, textures and typography, as well as their interaction, form a harmonious, visually appealing whole. Optimal graphic design relies on the skillful manipulation of visual elements that mimic nature to effectively convey a message and capture the viewer's attention.

The second aspect of biophilia lies in the human response to the designed space. Creating spaces with open access, natural lighting and natural materials can contribute to reducing stress and improving mood. Lighting plays a key role in design as it influences the atmosphere of a space. Properly positioned light sources, both natural and artificial, can accentuate architectural details, spatial zones, and interior colours, promoting comfortable and safe occupancy indoors while enhancing productivity (Heath, 2021b). Thoughtfully designed spaces evoke feelings of comfort and harmony with the surroundings. Graphic design tools can also be used to ensure acoustic comfort, which is one of the goals of biophilic design, through the incorporation of appropriate interior details. An example could be acoustic partitions or fixtures with biomorphic forms that absorb sound waves, reduce reverberation levels and simultaneously create a visually and psychologically comfortable environment for work or relaxation (Fig. 4).



Figure 4. Desk and floor acoustic partitions, acoustic lamps that mimic natural forms

Source: Acoustic partitions for zoning LIVING FENCE (2024)

The third approach consists in indirect biophilia by imitating nature in photos, pictures, patterns, and textures. One of the means of indirect biophilia is graphics, which rely on such basic means of expression as a line outlining the external shape of an object, forming its silhouette; a stroke that conveys chiaroscuro makes it possible to perceive the object as three-dimensional; a dot as the smallest spot and the spot itself, which create the outline of an object or figure. As the oldest form of visual art, examples of which date back several millennia (found on the walls of caves where early humans lived), graphic design conveys information for visual perception through colour, form, texture, and composition. A person perceives information encoded in visual images faster than verbal language. Graphic design can create a multi-level visual reality, reflecting different perspectives, this allows to effectively simulate natural elements through graphic means. Visual effects used in graphic design can create the impression of depth, shades

and interaction between various natural objects. Graphic design helps to transform artificial objects into complex and interesting visual images associated with a natural environment that is comfortable for humans. The formation of graphic works is based on the synthesis of art and science, on the creation of a visual impression using both emotional and logical approaches. This provides graphic design with a wide range of tools for interpreting the surrounding world through objective and subjective views, for programming a person's mood, their psycho-emotional state, which is facilitated by their approach to nature.

In biophilic design, it is important to maintain a balance in the choice of colours, because a large number of colours is tiring. In graphics, colour is applied judiciously; its purpose is to enhance the visual effect, directing the viewer's attention to specific components in the image. Thanks to its specific features such as conciseness, brevity and understatement, graphics can dose the informational

impact on the recipient, directing them in a way to achieve a certain goal, including relaxation through the imitation of natural forms. Graphics tend towards monochrome, combining two colours: white or toned as the base and black as the accent to create a contrasting or nuanced relationship. At the same time, it highlights the main, most characteristic and expressive aspects, allowing the viewer to infer everything else, thereby becoming a co-creator of the artistic graphic image. Thus, by turning to their inner sensations and relying on their already formed emotional experience, a person identifies new impressions. The individual gains a deeper understanding of themselves, activating their own creative potential, and generating resources to address life's challenges.

Colour harmony in the formation of the object-spatial environment is facilitated by the choice of colours, their nuanced or contrasting ratio. The use of natural colours can create a harmonious and balanced environment to create an emotionally favourable atmosphere. Colours such as green (representing nature and growth), brown (representing stability and groundedness), blue (representing calm and serenity) and earth tones (such as beige, terracotta and olive) are often used to create an outdoor feel indoors. Thus, the graphic design trend of 2024 is, in particular, the presentation of images and colours that actualise environmental awareness. Such graphics imitate environmental materials and textures of materials like metal, glass, and wood. To reinforce the environmental message, natural forms, and elements are added, such as images of plants or the effect of ripples on water, and combined with earthy shades of green, brown and blue (Fig. 5).

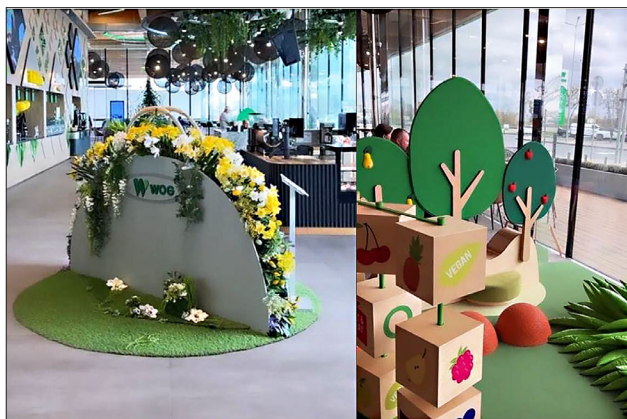


Figure 5. Arrangement of the WOG gas station in the style of biophilic design using graphics

Source: Where are the best gas stations? (2024)

The perception of colour, like lines and strokes, has an individual, subjective nature. However, there is a stereotypical, most common understanding of colour. For example, researchers N. Kalka *et al.* (2021) indicated that the colour red, if balanced and optimally dosed, embodies energy, life, passion, blood, instincts, self-confidence and concentration. If there is too much red colour, it activates

negative feelings: aggression, stress, anger, rebellion, excessive control. The blue colour is associated with calmness, depth, trust, authority, protection, nobility, space, infinity and order. The blue colour, mixed with a drop of red, that is, royal blue, signifies intuition and luxury. If the blue colour evokes negative feelings, they may include coldness, despotism, and anxiety. From a positive perspective, yellow is the colour of meditation; it is associated with the sun, joy, lightness, optimism, communication, self-esteem, self-confidence, thoughtfulness in decisions, and emotions. In imbalance, the yellow colour intensifies feelings of fear, disappointment, and anxiety. The orange colour is associated with energy, both physically (sun, fire) and psychologically (joy, expression, pleasure, optimism). The negative aspect of the orange colour lies in the fact that in excess, it embodies control, pressure, vulnerability to the influence of the environment. In balance, the green colour represents nature, freedom, development, novelty, harmony, and enjoyment of life. On the contrary, unbalanced green colour expresses coldness, and hidden negative emotions: disrespect, envy, anger, egocentrism. The violet colour in balance means balance, harmony, change, healing, mysticism, spirituality, service. From a negative point of view, purple colour is associated with indifference, loneliness, despair, unfulfilled desires. The blue colour evokes calmness, trust, measuredness, dreaminess. The golden colour emphasises feelings of respect, wisdom, as well as wealth and luxury. The crimson colour refreshes, restores strength, produces joy from the moment, care for others. The turquoise colour means self-expression and self-discovery through creativity, self-talk, and the ability to define personal boundaries. So colour can either balance feelings or sharpen them, nourish them.

The main tool in graphics is drawing, as, for example, in sculpture – plastic, in painting – colour, in music – melody. A graphic representation of nature in the interior is one of the elements of biophilic design. These could be narrative naturalistic paintings, individual images of plants or animals, executed in specific graphic techniques: linear, silhouette (depicting the outline of the form), tonal (expressive elements, such as stroke, dot, spot), chiaroscuro, or in their combination, conveying a certain mood – harmonious or disharmonious for the person in such an environment. The artistic images can evoke sorrow or joy, anxiety or calmness, heaviness or lightness. Thoughtful and purposeful use of animalistic, landscape or still-life graphic images in the interior will add natural features to such an anthropogenic environment, positively influencing the emotional state of individuals at a genetic level, allowing them to psychologically unwind.

To convey the natural world by graphic means, first of all, stylisation is used, which may involve a partial simplification of the real shape of the subject form while preserving the volume and subject colours, to formalisation – extreme abstraction based on geometric shapes or curvilinear spots. Such artistic images can be in colour or black and white, depicted on a plane using points, lines,

spots or their combinations, close to realistic or formalised. Graphic design makes it possible to transform a natural object into an artistic iconic form, adapted to human perception and filled with a certain meaning. Exact observance of proportions, anatomical, optical, physical and colour relationships are not mandatory in the design. The criteria of creative formation of the material world through the means of graphics are conventionality, conciseness, generalisation; revealing the essential content of a characteristic image being depicted; achieving expressiveness through line and spot. Stylised artistic forms emerge as artistic images, which are, on one hand, the result of the artist's creativity, and on the other hand, a distinctive symbol that should seamlessly integrate into the design concept and fulfill a functional, constructive, and aesthetic role in the planned environment. The creation of conventional forms based on nature imitation occurs through creatively processing natural analogues, simplifying their characteristics and preserving their fundamental features. The graphic representation reflects only the essential, typical traits of the natural prototype, acquiring a special meaning that should correlate with the overall spatial formation concept, avoiding artificiality or disharmony.

The following methods of stylising natural forms are distinguished: the method of analogies, involving the alteration of the silhouette of the overall form or individual details; the method of transformation, consisting of changing proportions, deformation, and imparting grotesque features; the method of associations, used to create graphic and colour forms imitating a natural analogue; the combination method, which entails partially incorporating bioform elements into the design development; the method of formalisation, enabling the reproduction of the natural environment in the form of geometric shapes and abstract spots.

In graphics, composition plays an important role, which involves arranging visual elements, such as shape and colour, to make it aesthetically appealing and convey the artist's intention. To create compositions, graphic designers use balance, contrast, alignment, proximity, repetition, rhythm, proportion. It is important to consider the layout, hierarchy and general arrangement of elements in graphic design to create a coherent and visually harmonious impression on the viewer.

A stylised image of living nature in the interior, which corresponds to the style and purpose of the room, harmonises and aestheticises it, creating a certain mood. For example, images in the style of romanticism and realism need a classic interior, a country or eclectic style is possible. If the space is decorated in a modern style (loft, minimalism), then modernist images, black and white work will be organic in it.

Graphic images of nature add natural charm to the interior. These can be landscape photos that balance the artificial space with a sense of nature. Graphic images of realistic plants can add natural greenery to the interior without the need to care for them. Abstract natural motifs: images of water, forests, mountains or the sky can create

a sense of blue harmony. Other art projects inspired by nature can add beauty and personality to a space. Any of these images can be used to create a natural feeling in the interior, depending on your preferences and style.

Graphic design is rapidly evolving, acquiring new possibilities for expression, including through innovative technologies (Lekarieva, 2020). Computer graphics allows for realistically depicting objects in three-dimensional space, creating dynamic visual effects, altering them using various tools, applying shades across all ranges as per user needs, interpreting natural objects and properties, and modelling natural phenomena using acoustic effects. Natural visual effects can be created using two-dimensional and three-dimensional graphics, combining various elements such as drawings, shapes, colours, and textures to enhance the visual language of graphics. Modern digital tools, in particular special programs for drawing on gadgets, provide ample opportunities to imitate any form of art, for example, to create digital replicas of paintings or sculptures of famous masters (Hula, 2020; Bozhko & Arefiev, 2023). Creative cultural industries actively use the digital graphic format to promote their projects. For example, it is becoming traditional to show paintings in museums using augmented virtual reality in the format of a multimedia show (Havryshova, 2020). This makes it possible, within the limits of biophilic design, to enliven images of nature, make them more realistic, creates the effect of complete immersion in the natural environment (Fig. 6).



Figure 6. Digital graphics in the practice of modern museums as a means of imitating the natural environment

Source: A large colour projected display of Van Gogh's art... (2023)

Various programs and artificial intelligence are used to create compositions using two-dimensional and three-dimensional graphics. They allow graphic designers to experiment with different techniques and styles to create unique and creative visual works. An example would be compositing, where two-dimensional graphic objects (such as pictures, text and shapes) interact with three-dimensional objects (models or animation) to create an interesting effect of depth and movement. This allows for dynamic and attractive visual stylised biological images that attract viewers' attention.

CONCLUSIONS

In the conditions of increasing informational pressure on modern man, there is a need for an environment where he can recover physically and emotionally. This actualises the need for biophilic design, which involves incorporating elements of the natural world into the human environment, resulting in positive effects on physical health: improvement in physical fitness, reduction in blood pressure; in psychological well-being: feelings of coziness, comfort, and safety help reduce stress, improve emotional state; in behaviour: individuals become more productive and efficient in their activities. There are three approaches to forming biophilic design: direct contact with nature (actual interaction with nature: natural light, air, plants, animals, water, landscapes); perception of space and place (spatial characteristics that allow individuals to feel comfortable in the environment: perspective, mobility within the space, orientation), and indirect, or mediated, contact with the environment (through materials, forms, textures, images that mimic nature).

As a special field of artistic and project activity, designed to visualise the information environment through the formation of graphic components for the environment, graphic design plays an important role in each of these directions. Adding natural elements and patterns

to architecture and interior design contributes to a person's sense of connection with nature formation, actualises the eco-approach to the physical and spatial environment. Graphics in the conditions of an urbanised society have various tools to use the potential of the harmony of nature to create an aesthetic and psychologically healthy architectural space. In the 20s of the 21st century, in the period of intensive development of technologies, graphic methods and techniques based on drawing, painting, decorative and applied arts are synthesised with digital technologies and cause new modern developments in the field of graphic design, which, within the limits of biophilic design, should contribute to the psychological and physical comfort of a person. The prospects for further research lie in exploring the integration of graphic and biophilic design to green the modern anthropogenic environment, taking into account the level of development of information and visual technologies.

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CONFLICT OF INTEREST

None.

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Формування біофільного дизайну за допомогою графічних засобів

Анотація. Актуальність статті полягає в обговоренні необхідності психоемоційного екологічного покращення сучасного середовища проживання людини за допомогою біофільного дизайну, що створює природні умови, знайомі людині через еволюцію, використовуючи графічні засоби. Це визначення зумовило мету дослідження: окреслити роль графіки у формуванні біофільного дизайну для створення сприятливого емоційного та психологічного просторового середовища. У процесі роботи використано загальнонаукові методи дослідження: аналіз і синтез, семантичний та порівняльний аналіз, аналіз наукових джерел, принцип детермінізму. Основні результати дослідження аргументують важливість застосування біофільного дизайну, оскільки він позитивно впливає на фізичний і психологічний стан індивідів та їх діяльність. Визначено підходи до формування біофільного дизайну, які можуть бути реалізовані за допомогою графічного дизайну. В урбанізованому суспільстві графіка має різні інструменти для використання потенціалу гармонії природи з метою створення естетично та психологічно сприятливих архітектурних просторів. На початку XXI століття, ери інтенсивного технологічного розвитку, графічні прийоми та методи, які використовують у малюванні, живописі, декоративному та прикладному мистецтві, у своїй діяльності митці синтезують із цифровими технологіями, що призводить до нових сучасних досягнень у сфері графічного дизайну. У межах біофільного дизайну вони сприяють психологічному та фізичному комфорту особистості. Практична цінність роботи полягає в тому, що вона актуалізує потребу в синергії різних видів дизайну для встановлення оптимального балансу між природним і штучним середовищами побутування людини з урахуванням рівня розвитку інформаційних та візуальних технологій

Ключові слова: біофілія; графічний дизайн; екологізація середовища існування людини; стилізація природних форм; інформаційні та візуальні технології