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DETERMINATION OF LEVELS OF VISUAL PERCEPTION OF THE MAIN TYPES OF FORMS OF ART OBJECTS

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Abstract. This article is a study of the main forms of art objects in the interior, where a system of levels of their visual perception is proposed for the first time. Such a system represents an effective way of solving practical issues, when at the first stage of design, the artist and designer solve the problems of the place of installation of this or that art object from the point of view of determining the necessary zone of its perception depending on the type of form. The main key emphasis in the research was made on the analysis of contemplation and perception of art objects of certain forms from different perspectives. 3D modeling of conventional art objects in virtual space was used as an experimental tool. The results of various experiments with three main types of forms were presented in the form of graphic drawings, diagrams with angular dimensions of perception zones, which reflect the content and structure of the studied problems. The method of systematization and generalization of the results made it possible to formulate the necessary levels of visual perception of the main forms of art objects in the interior, which consist of: First maximum level; Second intermediate level; The third minimum level. To test the reliability, the obtained research results were checked by student design practice. The research results were applied in real architectural projects, which made it possible to evaluate their effectiveness and practical value. The effectiveness of the formulated levels of visual perception of the main types of forms of art objects in the interior space was clearly demonstrated by the results of practical implementation. The results of the research can improve the theoretical basis in the design methodology and be recommended for implementation in the educational process, as well as for practical use in the development of art objects in various types of interiors. The proposed system of levels of visual perception can allow to expand the designer's toolkit and will contribute to the optimization of design solutions in the context of modern trends in the design of the object-spatial environment.
Keywords: art object, levels of visual perception, types of forms of art objects, design

Introduction

The study of artistic form in space is becoming more and more relevant in the context of modern approaches in the art design of interior spaces. In conditions where aesthetics and functionality strive for synthesis, studying the perception of artistic form allows for a deeper understanding of the organization of the visual environment. Visual perception plays a key role in the interior, where design as a visual art forms aesthetics and a sense of beauty. Spatial orderliness and emphasis on the main forms create a powerful visual impact, simplifying the perception of the structure (Meng & Cai, 2014).

The form mystically embraces the external contour of the objects, the interaction of elements in the space is a physical incorporation of structure and composition, playing a key role in achieving a balance between aesthetics functionality, and is also of paramount importance for creating a harmonious and effective design (Ching, 2007; Dodsworth & Anderson, 2015). Visual arts are mainly divided into flat forms (painting, graphics, photography, etc.) and volumetric forms (relief panel, sculpture, installations, etc.), which are distinguished by methods of creation and ways of perception. For example, painting exists in a plane, while sculpture and architecture develop in volumetric space. Each of these forms of art organizes space in its own way, influencing the perception of the surrounding environment and has its own strategies for the formation and configuration of form, with their inherent parallels and differences (Marcos et. al., 2024). Leon Batista Alberti wrote in his treatise that the human eye seeks to most clearly determine the qualities of surfaces, perceiving any object occupying a certain place in space. For the artist, this is expressed in the perception of silhouettes of objects, the combination of bodies and forms in space (Alberti, 1966). According to Itten, the basic geometric shapes – the square, triangle and circle – evoke different emotional responses and can be combined to enhance perception and artistic expression (Itten, 1975). Arnheim, based on Gestalt psychology, shows that people perceive works of art as whole images, and not as a collection of separate parts, which is key to understanding visual perception (Arnheim, 1974). Heidegger claims that in plastic arts, space and form are dynamic: we actively participate in their creation and interpretation, and do not simply perceive them passively. Form is constantly changing under the influence of our perception and interaction with the environment (Heidegger, 2009). Accurate perception of form is critical to the perception, identification, manipulation, and reproduction of objects. People are able to evaluate both objective (physical) and projective (retinal) form. Objective judgments benefit from a global approach that includes context to overcome the effect of viewing angle on object shape, while projective judgments benefit from a local approach to filter out contextual information (Robles et. al., 2022). Marković emphasizes that when perceiving a form, attention is focused on the visual and structural characteristics of the object, which strengthens the cognitive aspect of perception (Marković, 2012). Studies show that the starting point and viewing angle have a significant effect on the perception and memory of pictures. Spectators, especially those without artistic experience, more often fix their gaze in the center. Spatial scale and starting position can shift this focus, which emphasizes the importance of viewing angle and distance in perceiving the form and composition of artworks (Trawiński et. al., 2023). Aesthetic perception is highly dependent on the context in which it occurs, including the manner of viewing artworks, considering factors such as viewing distance, number of fixations and their duration, as well as the size and static properties of images (Fourier amplitude spectrum, fractal dimension, and entropy) (Estrada-Gonzalez et. al., 2020).

Accordingly, today the topic of visual perception of the main forms of art objects in space is relevant. Researchers consider it in various interdisciplinary areas, highlighting such aspects

as: the influence of form on the perception of distance and size, the role of psychological distance in the interpretation of works of art, and the cognitive mechanisms of form perception. But, unfortunately, there is a gap in the study of the perception of different forms of art objects from the point of view of choosing the best angles and viewing areas of planar and volumetric works of art. Understanding such aspects can help in the presentation and design of works of art to optimize their perception by viewers in interior spaces. The purpose of this article is to define, systematize and formulate the levels of visual perception of the main types of forms of art objects in the interior space.

Materials and Methods

The research used methods of analysis and a structural approach to the material, as well as their optimization, which made it possible to obtain significant results and formulate key conclusions.

- The methodological basis was a critical analysis of bibliographic sources, which allowed us to reveal the main aspects of the topic, as well as systematization of data for a deeper understanding of the problem. This study used the results of previous works by the authors, which laid the theoretical foundation for the analysis of visual perception of forms in architectural space. These studies provided important concepts of the relationship of art objects in the space of the environment, but did not solve the problem in terms of establishing different zones of visual perception of the main forms of art objects in the interior. Our previous studies have shown that the patterns of visual perception in the interior are subject to specific conditions of spatial relationship and require a separate analysis for a deeper understanding of the visual impact of forms and objects on the viewer (Pylypchuk & Polubok, 2022; Pylypchuk, 2024; Polubok & Pylypchuk, 2023).
- The method of experimental design using modeling of visual perception made it possible to obtain results on the example of the main types of forms – planar, semi-volumetric, volumetric. As an experimental tool, 3D modeling of conventional art objects in virtual space was used, which provided data fixation for further analysis. The results of various experiments with three main types of forms were presented in the form of graphic drawings, diagrams with angular dimensions of perception zones, which reflect the content and structure of the studied problems.
- The method of systematization and generalization of the results made it possible to formulate the necessary structural and instrumental means, which were important for further practical application. These tools ensured the effective use of data and contributed to the optimization of the processes of analysis and interpretation of information within the framework of the study.
- The reliability of the obtained results was checked through their implementation in creative practice. For testing, they were first integrated into student design practice (masters of interior design at the Kyiv National University of Construction and Architecture (KNUCA), Ukraine), where the created design solutions were analyzed. In the future, the research results were applied in real architectural projects (the implementation was carried out in Kyiv, Ukraine), which made it possible to evaluate their effectiveness and practical value. The method of field observations, realized interiors of world practice, aimed at studying the relationship between art objects and interior space, also provided the necessary material to confirm the research results and determine regularities.

Results

1. Structural analysis of theoretical provisions.

To substantiate the key provisions of the topic, a preliminary structural analysis of theoretical provisions was carried out, which made it possible to identify the following key aspects:

- Form in architectural space is defined by three key parameters: geometry, size, and location. It can be either two-dimensional or three-dimensional, possessing length, width, and depth. The structure of form often aligns with geometric outlines, such as rectangles, squares, triangles, trapezoids, semicircles, and others (Ching, 2007).
- There are three main strategies for the formation of space in the context of the genesis of form: addition, subtraction, and limitation. These approaches can be applied individually or in combination, particularly in sculpture (Marcos et al., 2024).
- Unlike painting, which creates only the illusion of spatial depth, sculpture and architecture exist in real space. The perception of volumetric objects depends on the number of visual impressions received from different angles and viewpoints (Ciftcioglu & Bittermann, 2013).
- The perception of form arises from the interaction of visual and psychological factors. It is an active process shaped by prior experience, context, and the interpretation of sensory information (Moles, 1981). For instance, knowledge of an object's actual size influences the perception of its shape and distance (Smeets et al., 2022). Helmholtz's theory posits that the perceived size of an object is determined by the viewing angle: larger visual angles make objects appear bigger, even when viewed from the same distance, while spatial relationships within the visual field also contribute to perception (Helmholtz, 1867). Gibson further argues that form perception is an active process involving the interaction between the observer and the environment, guided by available visual information and the observer's goals (Gibson, 1950).
- Foreshortening introduces visual shortening, where angles between lines increase as vision underestimates height reduction compared to smoother azimuth changes. Errors are most pronounced at tilt angles of 50-60°, due to differences in linear azimuth changes and the quadratic elevation function (Wnuczko & Kennedy, 2021). These phenomenological deviations result in systematic errors, with minimal distortions in vertical and horizontal directions but more noticeable distortions at oblique angles. Classical models of the field of vision fail to fully explain perception, as they do not account for environmental interaction mechanisms (Van Doorn et al., 2013).
- The field of view is a concept in geometric optics that describes a beam of rays captured by an optical system, distinct from subjective human perception (Koenderink et al., 2024). Binocular vision provides accurate depth information, enabling the perception of three-dimensional position and shape. However, depth perception in flat images differs significantly from that in real three-dimensional environments (Hibbard et al., 2023). The human binocular field of vision spans approximately 180 degrees horizontally and 130 degrees vertically, which differs from the "field of view" that includes eye movement. While most artworks capture only a small portion of this field, certain art forms require

a field of view of 180 degrees or more to achieve full spatial perception (Baldwin et al., 2014).

- The perception and memorization of geometry and shape in visual scenes are closely linked to the perception of indoor space (Oliva et al., 2011). This includes object position and visual orientation, both essential for understanding interior shape. Like objects, the shape of space is defined by contours and surfaces, with perception encoded in the brain. The point of view represents a cone of visible space, constrained by the human eye's aperture, covering approximately 90 degrees (theoretically up to 180 degrees). The median visible field is around 90 degrees, ranging from 10 to over 210 degrees. Wide angles create a sensation of seeing "behind one's ears", while narrow angles focus perception directly ahead. The field of vision varies both quantitatively and qualitatively among individuals (Koenderink et al., 2009).
- The two-stage angular processing theory proposes that the human visual system processes angular characteristics in two stages. First, the orientation of bounding lines is encoded. Second, angles are represented in an orthogonal internal frame of reference. This approach complements existing theories, such as Weber's law and line combination theories, by offering a new perspective on the integration of linear features to form a holistic perception of shape (Xu et al., 2018).

The structural analysis of the main theoretical propositions gave an understanding that the features of visual perception of any art object in the object-spatial environment are determined by the nature of its shape – volumetric, planar, half-volume. Each type of form needs its own directions, points of perception, which collectively make up zones of perception of a certain size. Art objects with a planar form are limited mainly to small zones of perception, the main frontal direction with limited lateral additional viewing angles (paintings, panels, paintings, super graphics and others). Art objects of semi-volumetric form have a much larger area of perception due to the sufficiently volumetric nature of the form, it has frontal and side viewing angles, which are equally important for the expressive perception of such a form (relief, high relief). Art objects with a full volumetric form have a circular zone of perception, which is due to the active development of such a form in the space in which it is perceived from all sides/viewing angles. All perspectives of the volumetric form are equally complete and important for the expressive perception of art objects of this type (sculpture, volumetric installation).

So, the characteristic features of the visual perception of an art object depend on the type of its shape (flat, semi-volumetric, volumetric) and consist in the principle of determining the level of visual perception, which is achieved by the method of establishing the ratio of different sizes of the perception zones of the main types of art forms objects in the interior space. Establishing the ratio of magnitude (in degrees) of different zones of perception was revealed as a result of measuring and comparing each separate zone of perception of each of the three main types of forms of art objects. Measurement and comparison of each individual zone of perception was carried out in the process of the author's scientific experiment – by the method of computer modeling of the object and its perception in virtual space.

2. Experimental procedure.

2.1. An experiment with a plane shape.

In the first experiment, the visual perception of a planar art object was investigated.

Examining the object in the frontal direction P1 (plan-scheme A1) of the perception zone, an image (A) was obtained, in which the art object looks with the full width of the picture plane and the proportions of the depicted objects. This direction of perception is the most optimal for considering art objects of the planar nature of the form. When examining the object in the direction of the extreme boundary of the perception zone on the left P2 (plan-scheme B1), an image (B) was obtained in which the art object already appears with an incomplete width of the picture plane and proportions of the depicted objects. The art object in the left perspective was examined at an angle of 35 degrees from the frontal direction of perception and obtained images with a reduced, but still quite recognizable width of the picture plane and proportions of the objects. With an increase in the angle of deviation from the frontal direction of more than 35 degrees, the width of the picture plane and the proportions of objects turned out to be distorted enough for their full perception in their original (initial) form. Therefore, a deviation from the frontal direction of approximately 35 degrees is the extreme limit of visual perception on the left.

When examining the object in the direction of the extreme boundary of the perception zone on the right P3 (plan-scheme C1), an image (C) was obtained in which the art object also appears with an incomplete width of the picture plane and proportions of the depicted objects. The art object in the perspective on the right was also examined at an angle of 35 degrees from the frontal direction of perception and obtained images with a reduced, but still quite recognizable width of the picture plane and proportions of objects. An increase in the angle of deviation from the frontal direction by more than 35 degrees affected the width of the picture plane and the proportions of objects, which also turned out to be distorted enough for their full perception in their original form. Therefore, a deviation from the frontal direction of approximately 35 degrees is the extreme limit of visual perception on the right. Thus, as a result of experimental modeling of the perception of a planar form in three main directions, a zone of perception of a planar art object of 70 degrees was obtained (Table 1).

2.2. An experiment with a semi-volumetric form.

In the second experiment, the visual perception of an Art object with a half-volume shape was investigated.

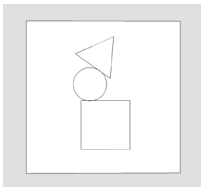
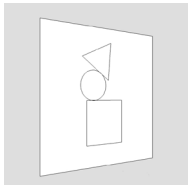
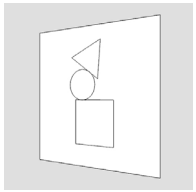
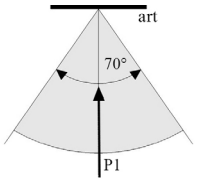
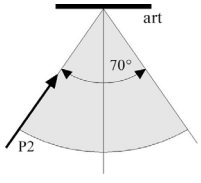
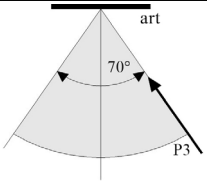
Considering the semi-volumetric object in the frontal direction P1 (plan-scheme A1) of the perception zone, an image (A) was obtained, in which the art object looks like a clear perfect silhouette of a relief volume, perceived with the help of falling shadows with full width and proportions of the depicted objects. This direction of perception is the main one for considering art objects of a semi-volumetric nature of form.

When examining the object in the direction of the extreme boundary of the perception zone on the left P2 (plan-scheme B1), an image (B) was obtained in which the art object already appears with incomplete width and proportions of the depicted objects, but with an expressive thickness of the relief. The art object in the left perspective was examined at an angle of 80 degrees from the frontal direction of perception and obtained an image with a reduced width, but a sufficiently expressive thickness of objects. With an increase in the angle of deviation from the frontal direction of more than 80 degrees, the width of the relief details almost disappears and is not perceived, and only the thickness remains expressive. Therefore, a deviation from the frontal direction of approximately 80 degrees is the extreme limit of perception on the left.

When examining the object in the direction of the extreme boundary of the perception zone on the right P3 (plan-

TABLE 1

Reflection of the process of experimenting with planar form (created by the authors)

Components	Frontal direction of the perception zone	The direction of the extreme border of the perception zone is on the left	The direction of the extreme border of the perception zone is to the right
Conventional representation of a planar form	 A	 B	 C
Plan-scheme	 A1	 B1	 C1

Note to Table 1: P – direction of perception; art – designation of an art object; images A-C, A1-C1 – developed by the author.

scheme C1), an image (C) was obtained in which the art object already appears with incomplete width and proportions of the depicted objects, but with an expressive thickness of the relief. The art object in the perspective on the right was examined at an angle of 80 degrees from the frontal direction of perception and obtained an image with a reduced width, but quite expressive thickness of objects. With an increase in the angle of deviation from the frontal direction of more than 80 degrees, the width of the relief details almost disappears and is not perceived, and only the thickness remains expressive. Therefore, a deviation from the frontal direction of approximately 80 degrees is the extreme limit of perception on the right. As a result of experimental modeling of the perception of a semi-volumetric form in three main directions, a perception zone of a semi-volumetric art object of 160 degrees was obtained (Table 2).

2.3. An experiment with volumetric form.

In the third experiment, the visual perception of an art object with a full volumetric shape in space was investigated.

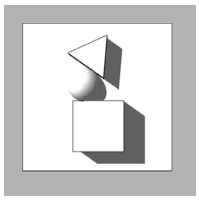
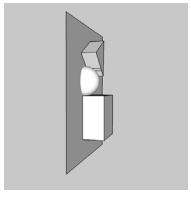
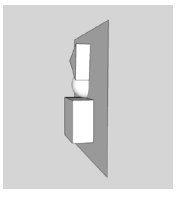
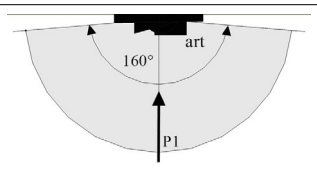
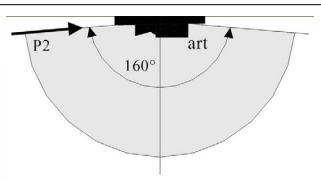
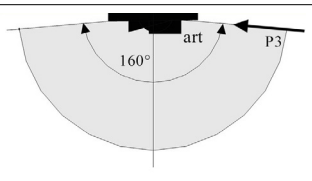
Looking at the volumetric object in the direction P1 (plan-scheme A1) of the perception zone, an image (A) was obtained, in which the art object looks like a full-fledged expressive silhouette and a volume that is perceived in this perspective with full width, thickness and proportions without any reductions or distortions of the shape of the depicted details. This direction of perception is also one of the main ones for considering art objects of a volumetric nature in space.

Looking at the object in the direction of P2 (plan-scheme B1) of the perception zone, an image (B) was obtained. In this image, the art object also looks like a full-fledged silhouette and a volume that is already perceived in another, but no less expressive perspective, with full width, thickness, and proportions without any reduction in the depicted details. This direction of perception is one of the main ones for considering art objects of a volumetric nature in space.

Looking at the object in the direction of P3 (plan-scheme C1) of the perception zone, an image (C) was obtained. The art object also looks like a full-fledged silhouette and volume, which is perceived from the other side in a third, no less expressive perspective with full width, thickness, and proportions without any reduction of the depicted details.

TABLE 2

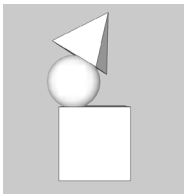
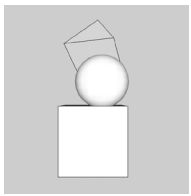
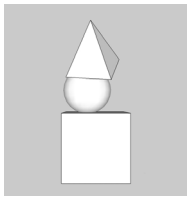
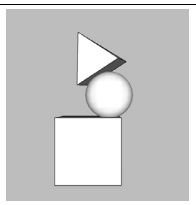
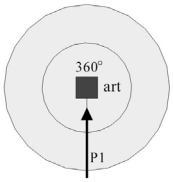
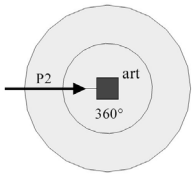
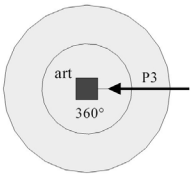
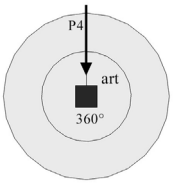
Reflection of the process of experimenting with semi-volumetric form (created by the authors)

Components	Frontal direction of the perception zone	The direction of the extreme border of the perception zone is on the left	The direction of the extreme border of the perception zone is to the right
Conventional image of a semi-volumetric shape	 A	 B	 C
Plan-scheme	 A1	 B1	 C1

Note to Table 2: P – direction of perception; art – designation of an art object; images A-C, A1-C1 – developed by the author.

TABLE 3

Reflection of the process of experimenting with volumetric form (created by the authors)

Components	The direction of the perception zone (P1)	The direction of the perception zone (P2)	The direction of the perception zone (P3)	The direction of the perception zone (P4)
Conventional image of a volumetric shape	 A	 B	 C	 D
Plan-scheme	 A1	 B1	 C1	 D1

Note to Table 3: P – direction of perception; art – designation of an art object; images A-D, A1-D1 – developed by the author.

This direction of perception is also one of the main ones for considering art objects of a volumetric nature in space.

Looking at the object from the direction P4 (plan-scheme D1) of the perception zone, an image (D) was obtained where the art object still appears as a full silhouette and volume, which is already perceived from the side opposite the first perception direction (P1) and also has a sufficiently expressive angle with complete width, thickness, and proportions without any shortening of the depicted details. This perception direction is also one of the main ones for the consideration of volumetric art objects in space.

As a result of experimental modeling of object perception, it was found that, for a complete observation of a volumetric shape in space, more than four directions of perception are necessary. Each intermediate direction among the main four provides additional, diverse, and equally expressive angles of the art object. Thus, the perception of art objects that are fully volumetric in nature requires a circular perception zone of 360 degrees (Table 3).

Analyzing and summarizing the obtained three different sizes of visual perception zones, a conclusion was made – the change in the shape of the art object also requires a change in the size of the perception zone with its increase from a planar, half-volume to a fully volumetric form. So, as a result of experimental modeling, three main zones of visual perception with different values in degrees were obtained: the first experiment determined – 70° perception of planar, the second – 160° perception of half-volume, the third – 360° perception of volumetric form.

3. Determination of the levels of visual perception of the main forms of art objects.

Based on the ratio of the various values of the three zones obtained, three levels of visual perception of the main forms of art objects were defined and formulated, containing the name and number, certain sizes of ranges in degrees, characteristics of the form of the art object and a visual image in the form of a plan-scheme. The revealed equalities are systematized and presented in Table 4.

The results of the conducted experiments determined three levels of visual perception of the main forms of art objects:

I Max level – is based on the features of visual perception of volumetric art objects, which require a circular viewing area with the possibility of observing the volume from different sides, each of which constantly forms a set of new fully expressive perspectives and new impressions from the perception of form. Thus, the perception of art objects of a full volumetric character in space does not have limited perspectives and requires a circular maximum perception zone of 360 degrees.

II Intermediate level – based on the features of visual perception of semi-volumetric art objects, which require a sufficiently wide viewing area with the possibility of observing the relief volume from the main frontal and a set of additional lateral directions of perception, each of which constantly forms new expressive perspectives and impressions from the perception of a semi-volumetric form. So, taking into account the somewhat limited volume of this nature of the form, a perception zone of a semi-volumetric art object of 160 degrees was obtained.

III Min level – determined on the basis of limited visual perception of planar art objects, which require a sufficiently small viewing area with the ability to observe the planar form from the main frontal and minimal set of additional lateral directions of perception. Therefore, taking into account the purely planar nature of the form, a perception zone of a planar art object of 70 degrees was obtained.

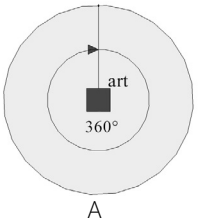
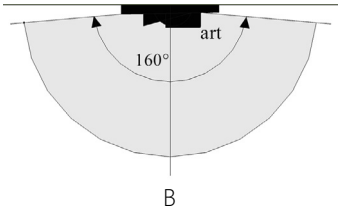
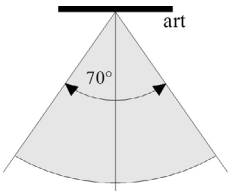
4. Implementation in creative practice.

To confirm the results of the research, 3D modeling was used and implemented in the diploma qualification works of master's students of the Design Department of KNUCA (Ukraine). An art object in planar, half-volume and volumetric form, created by hand or with the help of 3D modeling, was considered in relation to the corresponding angles and directions of visual perception, according to the placement plan in each design decision.

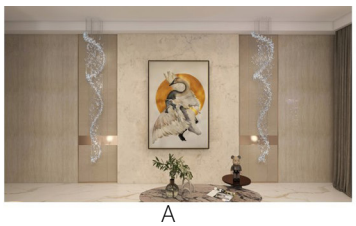
In the frontal direction of perception P1 (plan-scheme (D), Figure 1), an image (A) was obtained, in which the art object looks with the full width of the picture plane and the proportions of the details depicted in it. Image (A) shows that this direction of perception is the most optimal for viewing such a painting as an art object of the plane nature of the form. Examining the painting in the direction of the extreme border of the perception zone on the left P2 (plan-scheme (D)), an image (B) was obtained, in which it looks already with a slightly reduced width of the picture plane and the proportions of the details depicted on it. The painting in

TABLE 4

Levels of visual perception of the main forms of art objects (created by the authors)

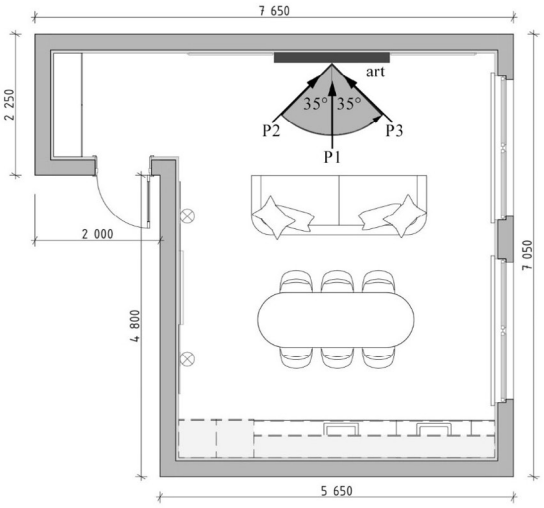
Levels	Perception zones in degrees	Characteristics of the form of the art object and the level of perception	Plan-scheme
I Max	160°-360°	volumetric art objects with a circular perception zone	 A
II Inter-mediate	70°-160°	Semi-volumetric art objects with a wide perception zone	 B
III Min	Up to 70°	Flat art objects with a limited perception zone	 C

Note to Table 4: P – direction of perception; art – designation of an art object; images A-C – developed by the author.


A


B


C



D

Fig. 1. The painting " Swan in Golden Rays" in the living room interior of a residential building. Project proposal by Oleksandra Kirmach, supervised by Oksana Pilipchuk;
A – frontal perception of the picture;
B – lateral perception of the picture (on the left);
C – lateral perception of the picture (right);
D – is a plan-scheme of the interior space with a planar art object (art) and directions of perception (P1, P2, P3) (authors' material)

the perspective on the left was viewed at an angle of 35 degrees from the frontal direction of perception and received an image with reduced, but still sufficiently distinct width of the picture plane and proportions of the details of the composition. With an increase in the angle of deviation from the frontal direction of more than 35 degrees, the width of the picture plane and the proportions of the details of the composition turned out to be quite distorted for their full perception in their original form. Therefore, a deviation from the frontal direction of approximately 35 degrees turned out to be the extreme limit of visual perception on the left.

In the direction of the extreme border of the perception zone on the right of P3 (plan-scheme (D)), an image (C) was obtained, on which the picture also looks with inferior width of the picture plane and proportions of the depicted details of the pictorial composition. The painting from the right angle was also viewed at a 35-degree angle from the frontal perspective, resulting in an image with a shortened but still sufficiently recognizable width of the pictorial plane and proportions of the details. Increasing the angle of deviation from the frontal direction by more than 35 degrees affected the width of the picture plane and the proportions

Fig. 2. Relief "Abstraction" in the 3D model of the interior of the creative studio. The author of the project proposal is Anna Pechonkina, supervisor – Andrii Polubok:
A – frontal perception of the terrain;
B – lateral perception of relief (left);
C – lateral perception of relief (right);
D – is a plan-scheme of the interior space with a half-volume art object (art) and directions of perception (P1, P2, P3) (authors' material)

of the details of the composition, which also turned out to be quite distorted for their full perception in their original form. Therefore, a deviation from the frontal direction of approximately 35 degrees is also the extreme limit of visual perception on the right. So, in the process of introducing a painting in the interior as a planar form, the results of the experimental design (the first experiment) were confirmed and a perception zone of 70 degrees was obtained, which corresponds to the third minimum level of visual perception.

In Figure 2, in the frontal direction of perception of P1 (plan-scheme (D)), the relief in image (A) has the appearance of a clear completed silhouette of a half-volume shape, which is perceived by means of falling shadows with the full width and proportions of the depicted details. This direction of perception is the main one for considering relief images as art objects of a semi-volumetric nature of the form. Looking at the relief towards the extreme border of the perception zone on the left of P2 (plan-scheme (D)), an image (B) was obtained, in which the object looks already with inferior width and proportions of the depicted details, but with a distinct thickness of the relief. The art object in the perspective on the left was viewed at an angle of 80 degrees from the frontal direction of perception and received an image with a reduced width, but a sufficiently expressive thickness of details. With an increase in the angle of deviation from the frontal direction over 80 degrees, the width of the relief details almost disappears and is not perceived, and only its thickness remains distinct. Therefore, the deviation from the frontal direction by approximately 80 degrees turned out to be the extreme limit of perception on the left. The direction of the extreme border of the perception zone on the right P3 (plan-scheme (D)) received an image (C), on which the relief looks also with inferior width and proportions of details, but with a distinct volume thickness. In the perspective on the right, the art object was viewed at an angle of 80 degrees from the frontal direction of perception and received an image with a reduced width, but a sufficiently expressive thickness of details. With an increase in the angle of deviation from the frontal direction over 80 degrees, the width of the relief details almost disappears and is not perceived, and

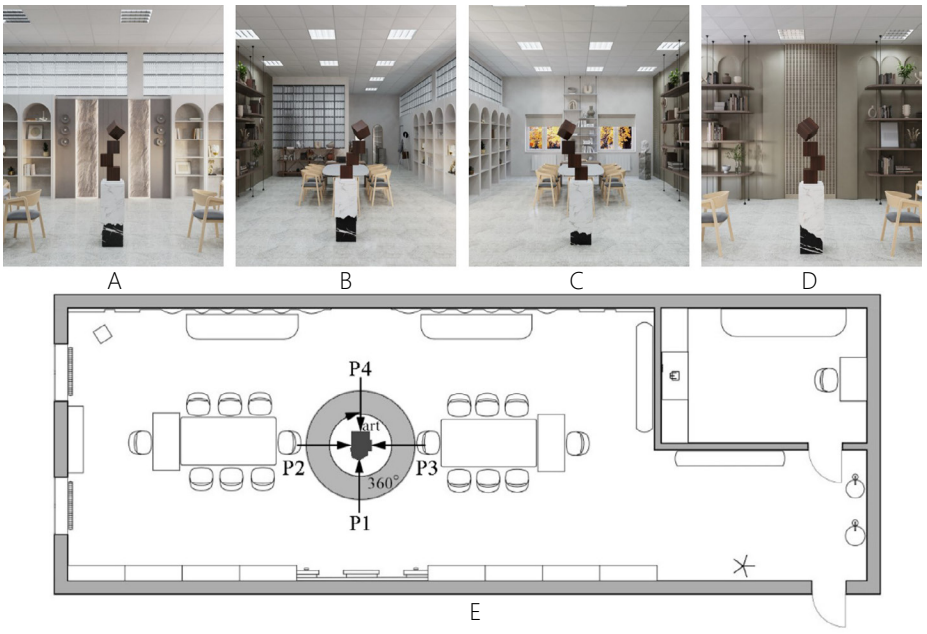
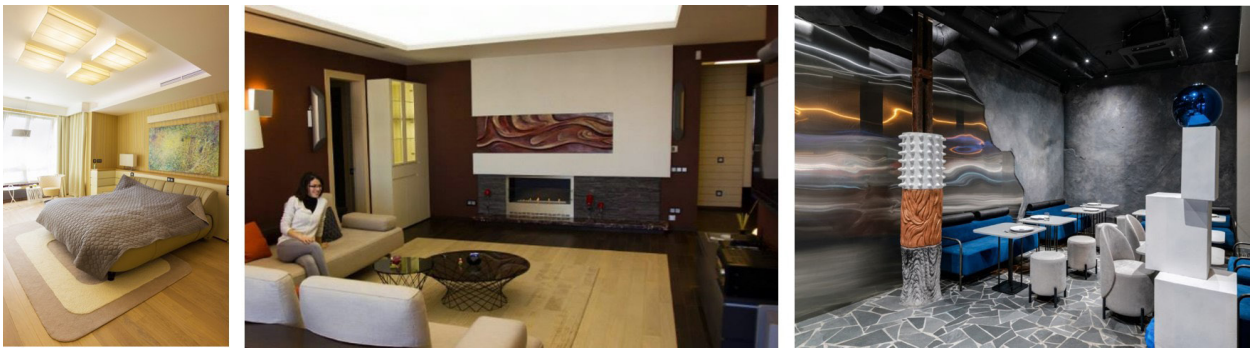


Fig. 3. The sculpture "Balance" in the 3D model of a creative studio interior. Project proposal by Anna Pechonkina, supervised by Andrii Polubok:
A – front view of the sculpture;
B – left-side view of the sculpture;
C – right-side view of the sculpture;
D – rear view of the sculpture;
E – is a plan-scheme of an interior space with a volumetric art object (art) with directions of perception
E – is a plan-scheme of an interior space with a volumetric art object (art) with directions of perception (P1, P2, P3, P4) (authors' material)



A B C

Fig. 4. Implementation of planar, semi-volumetric, and volumetric forms in various types of interiors in Kyiv (Ukraine): A – the painting "Tropical Forest" in a residential interior, artist – Oksana Pilipchuk; B – the relief "Abstract Fantasy" in a residential interior, artists – Oksana Pilipchuk, Andrii Polubok; C – the sculpture complex "Rhythms of the Universe" in the interior of a street food gallery space "BEE'S KNEES", architects – Hushel Vladyslav, Elena Kolesnikova (authors' material)

only the thickness remains distinct. Therefore, a deviation from the frontal direction of approximately 80 degrees is the extreme limit of perception on the right. So, in the process of implementing the relief in the interior as a semi-volumetric form, the results of the experimental design were confirmed (the second experiment) and a perception zone of 160 degrees was obtained, which corresponds to the second average level of visual perception.

When considering a volumetric object (abstract sculpture) in the direction of P1 (plan-scheme (E), Figure 3), an image (A) was obtained in which the sculptural composition appears as a fully expressive silhouette and volume. This angle allows for the perception of the complete width, thickness, and proportions of the shapes of the depicted objects without any reduction or distortion. This direction of perception turned out to be one of the main ones for considering the sculpture as an art object of the volumetric nature of the form in space. In the direction of P2 (plan-scheme (E)), an image (B) was obtained, in which the sculptural composition also looks like a full-fledged silhouette and volume, which is perceived already in a different, but no less expressive perspective with full width, thickness and proportions without any abbreviations of depicted details. Like the P1 direction, the P2 perception direction also turned out to be one of the main ones for a full consideration of art objects with a volumetric shape in space. When perceiving the sculptural composition in the direction of P3 (plan-scheme (E)), an image (C) was obtained, where it also looks like a complete silhouette and volume, which is perceived from the other side in a third no less expressive angle with full width, thickness and proportions of details without any reductions. This direction of perception also turned out to be one of the main ones for considering a sculpture of a volumetric character in space. When examining the object from the direction P4 (plan-scheme E), an image (D) was obtained where the sculptural form still appears as a complete silhouette and volume, perceived from the side opposite to the first perception direction (P1). It also has a sufficiently expressive angle with full width, thickness, and proportions of details without any reductions. This direction of perception is equally expressive as the previous ones and is also one of the main ones for considering the sculptural composition as a volumetric art object in the space of the interior.

As a result of the introduction of the sculpture as an art object of volumetric nature of the form, it was found that for its full observation in space, even more than four directions of perception are required. Among the main four, each intermediate direction gives other additional, but no less expressive perspectives of the volumetric form. Thus, in the process of integrating the sculptural composition into the interior as a fully volumetric form, the results of the experimental design (from the third experiment) were confirmed. A complete 360-degree visual perception area – the largest circular viewing area – was achieved, corresponding to the first level of visual perception.

The results of the implementation of various forms of art objects in interiors demonstrated the optimization of the main levels of visual perception during design. This made it possible not only to improve the aesthetics of the space, but also to more effectively use the perception of various forms of art objects in the interior. In addition, such an approach helps to increase the visual interaction between the space, its visitors and the art object, making the interior more expressive and individualized.

Discussion

Architectural structure in art implies that forms must conform to the laws of space perception, and not be random or arbitrary. Hildebrand focuses on the synthesis of visual and tactile sensations, emphasizing that effective art should not only visually affect, but also evoke tactile perception, which is especially relevant for architecture and sculpture. The optical impression in the sculpture is natural, but its quality depends on the shape of the object and the distance at which complete visual perception is possible (Hildebrand, 1908). Cutting, on the other hand, adds an evolutionary component, emphasizing the importance of movement for the perception of form and distance, which allows us to adapt to the surrounding environment (Cutting, 1986). On the other hand, modern art and design are developing in the context of the changing role of visual practices (Okeke et al., 2019). This is complemented by the ideas of Baldwin et al., who propose new methods of visual field mapping through direct observation, allowing designers to gain a deeper understanding of the perception of objects in space (Baldwin et al., 2014). But in the modern digital context, the perception of space is expanded due to information measurement, when human movement affects the creation of new elements of space. This "cyber layer" adds dynamism to architecture, transforming traditionally static elements into flexible and changing structures, which requires a revision of classical ideas about the perception of physical space (Posta & Tuncel, 2023). Researchers propose a method of merging different points of view to design complex spaces, which improves visual awareness and helps designers understand informed decisions when creating interiors and architectural objects (Ciftcioglu & Bittermann, 2013). Finally, the log-polar model introduces additional mathematical parameters, showing how shape perception preserves local details without distortions, providing a more accurate representation of spatial structure and its invariants. This opens new possibilities for designing

complex spaces, which is particularly useful in the context of virtual and augmented reality (Koenderink et al., 2018). All this leads to the idea that the perception of form and space is not only a matter of geometry, but also the result of a complex interaction of visual, motor and cognitive processes, which in the future will require further research and the search for new, more ideal approaches to solving this issue to create more harmonious and functional spaces in architecture and design. In this study, for the first time, a three-level system for assessing the visual perception of the main forms of art objects in the interior is proposed from the point of view of establishing the values of different perception zones. Such a system represents an effective way of solving practical issues, when at the first stage of design, the artist and designer solve the problems of the place of installation of this or that art object depending on the type of its form. The levels of visual perception of the main types of forms of art objects determined in the course of the study can be expanded due to the constant development of new theories and discoveries in the field of visual perception, as well as the evolution of visual practices in fine arts and design. The obtained results of the conducted experiments can make a significant contribution to scientific theory and have practical significance in the field of fine arts and interior design. This issue remains promising and requires further research, as the dynamics of visual approaches and technologies inevitably affect the understanding, perception and interpretation of artistic form and interior space.

Conclusions

As a result of the study, three levels of visual perception of the main types of forms of art objects in the interior space were identified and formulated, based on the consideration of various forms of art objects from the point of view of choosing the best angles and viewing areas of planar, half-volume and voluminous works of art.

- I Max level, which is based on the features of visual perception of volumetric art objects, with a circular viewing area with the ability to observe the volume from different sides, each of which constantly forms a set of new fully expressive perspectives with a maximum perception area of 360 degrees.
- II Intermediate level is based on the features of visual perception of semi-volumetric art objects, which require a sufficiently wide viewing area with the ability to observe the relief volume from the main frontal and a set of additional lateral directions of perception, each of which constantly forms new expressive angles with an average perception zone in the size of 160 degrees.
- III The Min level is determined based on the limited visual perception of planar art objects, which require a sufficiently small viewing area with the ability to observe the planar form from the main frontal and a minimum set of additional side directions with a minimum perception area of 70 degrees.

The results of practical implementation clearly demonstrated the effectiveness of the formulated levels of visual perception of the main types of forms of art objects in the interior space. The developed system of levels of perception of art objects can make a significant contribution to the development of the topic of artistic synthesis in the context of the visual relationship between art objects and the subject-spatial environment, as well as contribute to the improvement of the theoretical basis of systematization in design methodology. The proposed system of levels of visual perception is also recommended for use in the educational process in order to improve creative skills, as well as for use in the design of art objects of basic forms in various types of interiors.

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Kopsavilkums

Veiktais pētījums ietver izvērtējumu par galvenajām mākslas priekšmetu formām interjerā, kur pirmo reizi tiek piedāvāta to vizuālās uztveres līmeņu sistēma. Analizētā sistēma ir efektīvs praktisku jautājumu risināšanas veids, kad pirmajā projektēšanas posmā mākslinieks un dizainers risina tā vai cita mākslas objekta uzstādīšanas vietas problēmas no tā uztveres nepieciešamās zonas noteikšanas viedokļa atkarībā no formas veida. Pētījumā galvenais uzsvars tika likts uz noteiktu formu mākslas objektu komplektāciju un uztveres analīzi no dažādām perspektīvām. Kā eksperimentāls instruments tika izmantota tradicionālo mākslas objektu 3D modelēšana virtuālajā telpā. Rakstā iegūto dažādo eksperimentu rezultāti prezentēti grafisku zīmējumu veidā, diagrammas ar uztveres zonu leņķiskajiem izmēriem, kas atspoguļo pētāmo problēmu saturu un struktūru. Rezultātu sistematizācijas un vispārināšanas metode pētījumā ļāva formulēt nepieciešamos interjera mākslas priekšmetu galveno formu vizuālās uztveres līmeņus.