MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
Kyiv National University of Technologies and Design

ART AND DESIGN

Volume 9, No. 1

Established in 2017
Issued quarterly

2026

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
Київський національний університет технологій та дизайну

ART AND DESIGN

Том 9, № 1

Заснований у 2017 році
Видається чотири рази на рік

2026

ISSN 2617-0272
e-ISSN 2617-0280

DOI: 10.30857/2617-0272.2026.1

Publisher:
Kyiv National University of Technologies and Design

Recommended for printing and distribution
via the Internet by the Academic Council
of Kyiv National University of Technologies and Design
(Minutes No. 8 of April 9, 2026)

State Registration:
Media identifier R30-05422
Decision of the National Council of Television
and Radio Broadcasting of Ukraine No. 2520 dated 08.08.2024

**The scientific journal is included in category «B»
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https://art-design.com.ua/en

ISSN 2617-0272
e-ISSN 2617-0280

DOI: 10.30857/2617-0272.2026.1

Видавець:
Київський національний університет технологій та дизайну

Рекомендовано до друку та поширення
через мережу Інтернет Вченою радою
Київського національного університету технологій та дизайну
(протокол № 8 від 9 квітня 2026 р.)

Державна реєстрація:
Ідентифікатор медіа R30-05422
Рішення Національної ради України з питань телебачення
і радіомовлення № 2520 від 8 серпня 2024 року

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ЗМІСТ

ISSN 2617-0272, e-ISSN 2617-0280

ART AND DESIGN
Journal homepage: https://art-design.com.ua/en

9(1), 2026

Received 27.11.2025 Revised 20.02.2026 Accepted 09.04.2026 Published: 10.04.2026

UDC 7.01:003.32:519.17:745:76 DOI: 10.30857/2617-0272.2026.1.1

Structural study of character isomorphism in Chinese character graphics

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Abstract. Character isomorphism is a prevalent form in Chinese character graphics design. Compared to other techniques, the arrangement of internal components plays a more prominent role in conveying meaning, making structural factors pivotal to design success. The aim was to explore the formal mechanisms of isomorphic character design in Chinese graphics and explain how positional layout based on the characteristics of Chinese characters can enrich visual expression. An interdisciplinary approach was used, integrating the morphology of Chinese characters, Gestalt psychology, and semiotic theory. Representative examples were systematically studied through literature review and formal analysis. Findings indicated that character form, arrangement sequence, and metaphor constitute the three primary dimensions influencing structural composition. Character form compatibility forms the foundation of isomorphy, determining the feasibility of component combinations; arrangement sequence directly impacts information reception accuracy via linear and non-linear spatial relationships, while metaphorical mechanisms effectively convey cultural connotations and abstract concepts through the projection of visual imagery. Based on the analysis of these three dimensions, recommendations and methodology for enhancing the graphic expressive efficacy and cultural recognisability of Chinese characters were summarised. These findings not only provide creative strategies and formal guidelines for Chinese character graphics design but also chart viable pathways for visual communication across cultural contexts, thereby facilitating the efficient transmission of thematic information

Keywords: formal mechanism; arrange order; metaphor; visual cognition; cultural connotation

INTRODUCTION

Character isomorphism in Chinese character graphics links multiple character elements through structural reorganisation to express unified thematic meaning. Common in logos, posters, and publications, it combines form and meaning, reflecting the unique morphology and ideology of Chinese characters. Each component relates to the whole, and changes in form, position, or proportion alter semantics. Exploring structural laws is essential for creation, offering designers creative guidance and helping audiences interpret Chinese character graphics in cross-cultural contexts. In ancient China, character isomorphism was primarily used in the design of traditional auspicious patterns, adorning the living environment. B.B. Song & J. Zhou (2024) pointed out that the essence of national design concepts and techniques is embedded in these works, which have a

Suggested Citation:
Li, X., & Kolosnichenko, O. (2026). Structural study of character isomorphism in Chinese character graphics. *Art and Design*, 9(1), 9-19. doi: 10.30857/2617-0272.2026.1.1.

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profound influence on contemporary design. On the other hand, M. Yang & C. Gao (2024) contended that as China's cultural exchanges with the world intensify, numerous outstanding Chinese character graphics have gained prominence on the international stage, demonstrating a clear tendency towards an internationalised graphic language. This showed that the form of character isomorphism began with the inheritance of tradition, while it was developed and improved in the multicultural mingling.

In terms of practical creation, F.Y. Liu (2023a) mentioned that the design key point of character isomorphism is the structural disassembly and reorganisation of each character, based on its own morphology. This requires designers to conduct in-depth research during the preliminary design phase into the origins of Chinese characters, the structural patterns of individual characters, the rules governing compound character formation, and the habits of the people in using Chinese characters. According to A.P. Zhang (2020), the inherent nature of Chinese characters dictates that each component invariably carries semantic information. Research in character study provides a robust theoretical foundation for structural decomposition and recombination, ensuring characters retain legibility amidst formal transformations. Z.Y. Jiang & S. Dong (2024) further elaborated: structural frameworks must share similarities and intrinsic semantic relevance between characters, thereby enabling their potential connection. Within the framework of design objectives, the selection of Chinese character elements is often strictly constrained, while the character form exerts a decisive influence on the application of isomorphy strategies. Both represented immutable factors, thereby highlighting the pivotal role of flexible typesetting techniques in design. J.R. Pan (2022) noted that traditional Chinese character graphics design lacks the fixed structural constraints of grid systems. Under its influence, contemporary design seldom employs geometric analysis or proportional calculations, instead adapting dynamically to varying conditions and requirements to devise suitable organisational solutions.

S.G. Cui (2022) categorised several fundamental types of character isomorphism based on the differing points of structural connection between their components, including character composition, shared strokes, and figure-ground relationships. These techniques possess distinct stylistic characteristics, capable of being employed independently or combined to generate novel forms. J. Zhu & C.T. Wang (2021) summarised multi-character structural design into two dimensions: firstly, the orderly arrangement of characters; secondly, the proportion, shape, and angular treatment of internal components within characters. These elements maintain an interdependent relationship within the overall composition. Originating from distinct independent entities, their connection necessitates meticulous adjustment to achieve a high degree of harmony at the junctures. In ancient China, characters were arranged vertically in everyday writing. H.P. Li (2024) analysed the advantages of vertical arrangement in ancient Chinese writing from the perspective of character morphology, arguing that this orientation reduces structural confusion in visual recognition. He extended the consideration of factors influencing arrangement from traditional writing media to functional levels, offering insights that broaden the scope of research into Chinese character graphics. Moreover, aesthetic creation remains a crucial consideration. Despite the diverse organisational forms of Chinese character structures, they all adhere to principles of balanced symmetry and stable order (Liu, 2023b).

Judging by the outcomes, prior research has predominantly focused on formal classification and design processes, tending towards macro-level summarisation. In contrast, studies exploring common characteristics under variable factors based on the form and meaning of Chinese characters, and thereby deducing structural strategies, remain relatively scarce. To address this, the present study was grounded in analysing the mechanisms of structural composition. It aimed to elucidate how effective decisions should be made during the conceptual phase, whilst explaining the rationale behind such decisions.

MATERIALS AND METHODS

The study used visual analysis to examine the isomorphism of symbols in Chinese hieroglyphic graphics, focusing on compositional techniques, structural features, and functional aspects of signs in various design categories. The analysis covered traditional forms, including paper cutouts, as well as contemporary examples of logos and posters, which made it possible to assess the expressive potential of symbol isomorphism in cultural and communicative contexts. In terms of research methodology, this study adopted an interdisciplinary and comprehensive analysis strategy, organically combining Chinese character morphology (Wang, 2015; Feng & Zhan, 2017), Gestalt psychology (Arnheim, 1974; Gombrich, 2015; Jiang & Dong, 2024), and semiotics theories (Barthes, 2008; Van Mulken *et al*., 2010; de Saussure, 2011) to form a three-dimensional and in-depth analysis system. In addition, contemporary approaches to visual semiotics (Bolognesi, 2017; Guo, 2018) have been taken into account.

In the preliminary stages of this research, a systematic review of prior scholarly work was conducted through literature analysis, establishing a robust academic foundation for subsequent investigations. Subsequently, various common formal types were presented in tabular form, illustrating the structural connections between textual components within works and their consequent semantic functions. Building upon this, formal analysis is then employed to conduct an

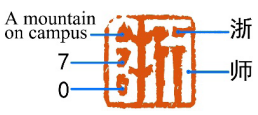
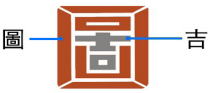
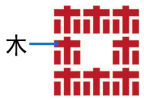
in-depth deconstruction of representative cases, focusing on the three key dimensions: character construction, arrangement order, and metaphorical expression. Among these, the morphological characteristics of textual components, their combinatorial logic, and their ideological functions are dissected, with selected exemplars undergoing experimental deconstruction and reconstruction. The authors focused on examining the spatial relationships, scale, and visual hierarchy of components, comparing the similarities and differences between the original work and the reconstructed work from both visual presentation and expressive effect perspectives. This process not only reveals the dynamic generation mechanism of character isomorphism in visual communication but also verifies the effectiveness of the design strategy, which helps to effectively interpret the designer's design intention. In this research, Chinese character morphology established the foundational principles of form composition for graphic design. Gestalt psychology focused on revealing the constitutive relationship between the whole and its parts, alongside its guiding role in visual cognition. Semiotic theory, meanwhile, emphasised elucidating the formation mechanisms of visual metaphors within structural relationships, and their expressive function in conveying cultural connotations and abstract concepts.

RESULTS AND DISCUSSION

Visual structures in Chinese character design. As highly abstract and simplified visual symbols, characters are the basic building blocks of Chinese character graphics. In the form of character combinations, their meaning mainly relies on the synthetic effect of characters in their organisational relationships, rather than on borrowed figurative patterns. In character isomorphism, structure is the carrier of text components, and the so-called internal relationships are also formed within the structure. Even in pictorial works composed of characters, the images and their meanings are the result of structural presentation. There is no denying that structure is one of the core decisive factors in the synthesis and transformation of meaning.

In Chinese character graphics based on character isomorphism, most text components often exist in structural inclusion or connection relationships. Inclusion can be partial, one side including the other, or even mutual interweaving. Connections can form when the strokes of different characters are connected, or when multiple characters are combined to form a complete pattern. Even components that lack direct stroke connections may, through deliberate organisation of adjacent areas, be integrated into a visually coherent structure. These methods of combining characters are very common in actual design (Table 1).

Table 1. Common forms and examples of character isomorphism in Chinese character graphics

Structural form	Work	Structural decomposition diagram	Design explanation
Non-inclusive relation			The protruding point above "大" is embedded in the depression below "北".
Figure-ground relation, inclusion relation			The figure is "浙", the ground is "师", and "70" is embedded within "浙".
Inclusion relation			"吉" is inside "圖", Forming "吉图", the abbreviation for Jilin Provincial Library.
Repetition of characters			Eight "木(wood)" form a square, resembling a building and suggesting interior design.
Sharing and interweaving of components			Using sharing radicals and interweaving strokes to show "拥抱 (embracing)".
Picture composed of characters			The teapot's shape resembles "喜气满堂," which means auspiciousness fills the hall.

Source: based on Xinwenhua Daily (2009), Peking University (n.d.), Zhejiang Normal University (n.d.), Interior Design (n.d.), WeChat (2020), Huaban (2024)

However, to create a successful piece of work, simply understanding the types of techniques is insufficient. The design content related to structure involves various visual elements and their attributes of the components. Furthermore, the relationships between components, as well as the relationship between components and the whole, are all aspects requiring consideration. Based on the ideographic objective, design strategies are typically developed and implemented around three core dimensions: character form, arrangement order, and metaphor. In practical projects, the key indicators for evaluating the feasibility and effectiveness of formal applications also lie within these dimensions.

Character shape as a determining factor. The meaning of a symbol is not determined exclusively by the linear combination of symbols, but also depends on the category to which the symbol belongs; choosing the corresponding components is important (Corro, 2018). In character isomorphisms, characters are arranged according to grammar in a linear relationship on the Syntagmatic Axis. The choice of specific character components depends on the category relationship on the Paradigmatic Axis. In a paradigmatic relationship, there may be more than one character option that meets the meaning requirement. However, not all of them have the prerequisites for shape combination in the overall system. This means that the suitability of Chinese character components in the structure depends not only on their semantic relevance, but also on the shape relationship between the components. Since characters are the main structural elements in character isomorphism works, in many cases, there are no other forms of graphics that intersect with them, and the character shapes are fully displayed. Therefore, the influence of character shape factors on the structure is particularly prominent.

R. Arnheim (1974) mentioned that the so-called shape has two distinct visual properties: one is the artistically created boundary; the other is the structural skeleton created in visual perception. The two often do not coincide. Following this line of thinking, the shape of Chinese characters is also manifested by their overall contours and the layout framework. The contours of the characters are the external manifestation of the layout framework, indicating the internal structure by outlining the edges. The layout framework is the internal support of the contours and provides them with rationality and order. The outline of a single stroke is the smallest constituent unit of the overall outline of a character. In character construction, there are eight basic strokes in Chinese characters, including horizontal (一), vertical (丨), left-down stroke (丿), right-down stroke (㇏), dot (丶), up-stroke (㇀), hook (亅, etc.), and bend (乛, etc.). These basic strokes can be expanded in type through composite construction and deformation, forming higher-level character components – radicals (Fig. 1). Although writing implements and typefaces may influence stroke contours, provided the path of the stroke lines remains unchanged, the fundamental characteristics of the contours remain constant and contribute to visual recognition.

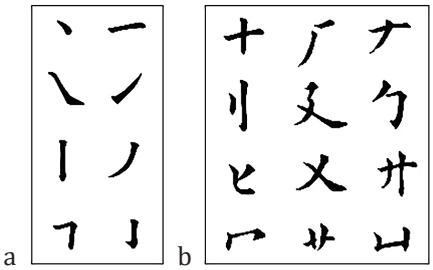


Figure 1. Components of Chinese characters
Note: a – 8 basic strokes; b – some common radicals'
Source: drawn by the authors

Furthermore, from the perspective of the structural framework, Chinese characters, as a typical type of square script, essentially divide the rectangular space. These layout variations are extremely rich. Based on the Unicode Consortium (n.d.) character set international standard, N. Wang (2015) summarised seventeen common frameworks, including single-body structure, left-right structure, upper-lower structure, and surrounding structure (Fig. 2). Z.W. Feng & H.W. Zhan (2017) further subdivided these into eighty different types. In horizontal comparisons between components, the complexity of character contours and spatial layout does indeed present significant challenges. However, in terms of plasticity of form, this characteristic does provide more possibilities for rich combinations in design.

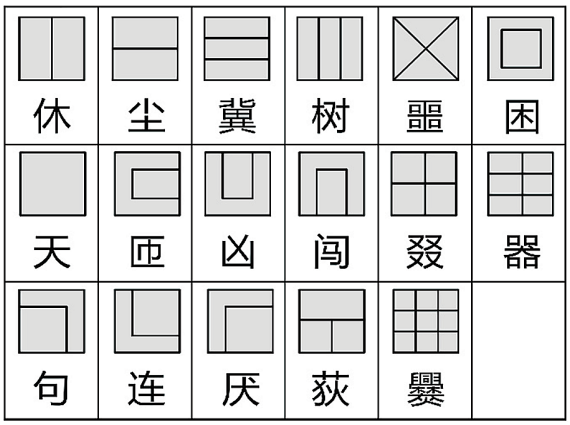


Figure 2. 17 basic frame patterns of Chinese characters and examples of their forms
Source: N. Wang (2015)

In design, attention to character forms is actually integrated throughout the entire process, from formal decisions to specific operations. At the beginning of a project, considerations of character isomorphism are often based on the physical similarity of character components. That is, in an aggregation relationship, Chinese

character components with semantic connections must have identity or similarity in terms of stroke contours or frame structures. This identity or similarity can be between character components or between components and the whole. For example, the poster "韩朝统一 (Korean Reunification)" (Fig. 3) combines the characters "韩 (Korea)" and "朝 (North Korea)", which face opposite directions, to represent the political status of the two countries. Both characters belong to the left-right structure and share the same radical "卓 ". Coincidentally, "卓 " has a symmetrical shape both horizontally and vertically, creating conditions for the rotation and combination of the characters. This coincidence is irreproducible and is one of the reasons why this work has become a classic. In addition, different combinations of Chinese characters have different shape conditions. In some cases, the same or similar conditions that rely on isomorphism can undergo formal transformations, manifesting as echoing relationships such as complexity and simplicity, concavity and convexity, and presence and absence. In any case, the formulation of character isomorphism schemes must be based on character shape compatibility.

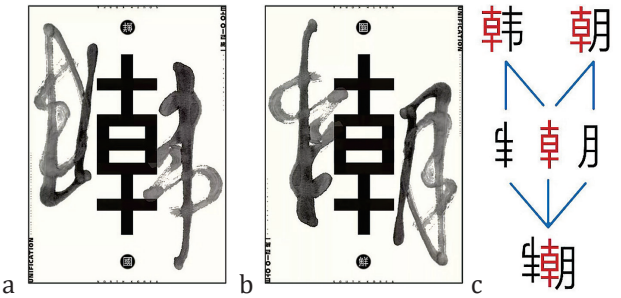


Figure 3. Poster "Korean Reunification", author Kan Tai-keung, 1997
Note: a, b – poster rotated 180 degrees; c – separation and combination of "韩" and "朝"
Source: Most Design (2019)

The subsequent deep processing involves establishing a composite framework and adjusting the details of the contours. To achieve a fusion effect, designers will perform various decompositions and reconstructions within the character isomorphism, causing the character shapes to deviate to a greater or lesser extent. If the shape of the characters cannot be effectively recognised, it is difficult to construct meaning. It can be seen that character shapes are not only the basis of character isomorphism, but also a key factor influencing formal effectiveness. At this point, what designers need to do is to combine the characters and then highlight them through necessary separation and contrast techniques. For example, in the poster "Korean Reunification" (Fig. 3), designer Kan Tai-keung deliberately designed the shared radical "卓 " in the middle in a modern, unadorned style to distinguish it from the handwritten calligraphy effect of the radicals "月" and "韦" on the left and right. It is important to note that in graphic design, the core elements influencing structural perception and reader comprehension are not limited to geometric forms but also include colour. As E.H. Gombrich (2015) noted, in picture design, a single colour can be effective in establishing a sense of order, while combinations of multiple colours can have the effect of disrupting order. Traditional Chinese character graphics with character isomorphism mostly use a single colour, and the text components are mainly distinguished by their shape. However, in contemporary works, the superimposition of shapes has increased significantly. In this case, the use of multiple colours can strengthen the visual grouping of components and facilitate text recognition in complex hierarchical relationships.

In summary, the determining role of character shape reveals that the visual structure of Chinese characters is not merely a passive container of meaning but an active generator of formal and semantic relationships. The interaction between contours, frameworks, and component compatibility forms a systematic foundation for character isomorphism, enabling designers to achieve both recognisability and expressive transformation. Ultimately, the effectiveness of such design depends on the designer's ability to balance structural coherence with creative manipulation of form, ensuring that meaning is communicated through both visual unity and intentional variation.

Efficient ordering of character elements. Arrangement order is a key factor in the meaning of character isomorphism works, directly affecting the synthesis of meaning and the accuracy of information reception. According to F. de Saussure (2011), symbolic meaning does not exist independently; it depends on the position of the symbols in the system, as well as the relationship between the symbols. The surface structure of a symbolic system is composed of syntagms. Syntagms emphasise the co-occurrence and order of symbols in the temporal or spatial dimension, manifested as directly observable symbolic arrangements. Segmenting syntagms into combinatorial units for decomposing meaning can effectively help to understand the mechanisms by which combinations correspond to meaning (Barthes, 2008). In character isomorphism systems, Chinese characters themselves are independent combinatorial units. Their special structural properties inevitably cause the arrangement of syntagms to inherit the characteristics of the language system, which is partly manifested in a linear structure. On the other hand, visual works have their own characteristics. Combination segments are not only manifested as the adjacent arrangement of components but also as spatial relationships. Under different organisational treatments, the meaning of textual components can also present different hierarchical structures and sequential orders. These spatial relationships can ultimately be

converted into a logical arrangement, influencing the formation of semantic relationships and the reinforcement of key information.

In ancient China, due to the combined influence of writing tools, reading habits, and cultural traditions, Chinese characters were generally arranged from right to left and from top to bottom. In the 1950s, under the influence of reforms initiated by official state-run newspapers, people gradually adapted to the horizontal arrangement from left to right (Gong, 2011). In the 21st century, vertical arrangement has not disappeared and is still widely used in Hong Kong, Macao, Taiwan, and other regions. Some classical publications in mainland China also use it to highlight cultural characteristics. In practical applications, the arrangement of Chinese character graphics is influenced by the readability of the text and presents a flexible and diverse artistic appearance. As a graphic style widely used in China throughout history, the interpretation of character isomorphism has long been subconsciously formed into a national visual experience. Typically, such compositions include a limited number of characters, most often ranging from two to four. Even when the reading order is not immediately recognised, readers are usually able to adjust their interpretation rapidly. Consequently, the recognition of reading order in the context of Chinese character design is generally met with a high degree of tolerance and adaptability.

The shape of Chinese characters provides excellent conditions for the varied layout of Chinese character graphics. The rectangular framework of the characters is extremely malleable, making it easy to round the contours or change the ratio of length to width. In the Chinese character system, many characters can express meaning independently. The final meaning of a group of Chinese characters must be determined based on the order. In a non-linear spatial environment, readers may interpret a group of Chinese characters in different orders, leading to significant differences in meaning. In the early stages of design, experienced designers filter out text components that may cause ambiguity. In addition, based on the basic character structure and project requirements, they also employ flexible design techniques to guide the reader's visual flow. This approach undoubtedly reduces the time spent by the general public in exploring arranged order and avoids misinterpretation of meaning.

Taking a four-character combination as an example, if the text is divided into two lines with both horizontal and vertical alignment, the arrange order typically follows one of three patterns (Fig. 4a). In the poster "两岸同福 (Blessings on Both Sides) (Fig. 4b), the creator leveraged the similarity of strokes between horizontally arranged Chinese characters to establish a visual connection through partial overlap (Fig. 4c). Under the Gestalt psychology principle of proximity, these interconnected characters form alliances with each other. The four Chinese characters, which were originally balanced, are transformed into two groups of characters with an upper-lower relationship. After reading the first line, people will continue to the second line, thus establishing a horizontal reading order. This consideration leads to a further question regarding the rationale behind the creator's choice of a horizontal arrangement. Indeed, a vertical arrangement can similarly direct the reader's eye by means of stroke connectivity. This observation returns the discussion to the morphology of individual characters, which is determined not only by the configuration of adjacent strokes but also by the relative density of those strokes. In an isomorphic system, the number of strokes between characters can sometimes vary greatly, and inappropriate combinations of shapes can easily cause an imbalance in density. The two characters "两岸 (both sides)" have a relatively equal number of strokes and are easy to handle in terms of shape. However, the character "福" has the most strokes, which can easily lead to excessive density. Combining it with the relatively simple character "同" helps to adjust the space ratio by taking advantage of complementary factors. Placing the two characters side by side allows the dividing line between them to be moved to the left, leaving more space for the strokes of "福". On the other hand, multiple adjacent vertical strokes also create favourable conditions for overlapping. In contrast, in vertical arrangement, there are fewer identical or similar strokes between adjacent characters (Fig. 4d). Especially between "同福 (shared blessings)", it is challenging to use shared strokes to balance density. Although reducing the thickness of the strokes in the character "福" can alleviate the issue of uneven compositional force, the overall visual comfort of the arrangement still falls short of the horizontal layout's ideal effect.

In Chinese character graphics based on character isomorphism, different structural methods have different effects on the arrangement order. For example, in positive-negative graphics, the background and image are composed of different but related Chinese characters. In the visual process, the text that is seen as the image is usually recognised before the text that is seen as the background. Another example is that, in some works, one Chinese character contains another Chinese character. When observing, characters that appear externally in an enveloping manner have greater visual weight and thus often occupy the forefront of visual order. Such cases are not uncommon. Additionally, different formal techniques may be applied simultaneously. Although structure only plays a guiding role in visual order, and visual order does not equate to a hierarchical relationship of meaning, the influence of structure on meaning is undeniable. It is worth noting that regardless of how the form changes, Gestalt psychology always plays an important role in visual organisation in shape recognition. This is precisely the core difference

between written characters and ordinary text in their grammatical structure, reflecting the characteristic of linear and non-linear mixed arrangement for the translation of meaning.

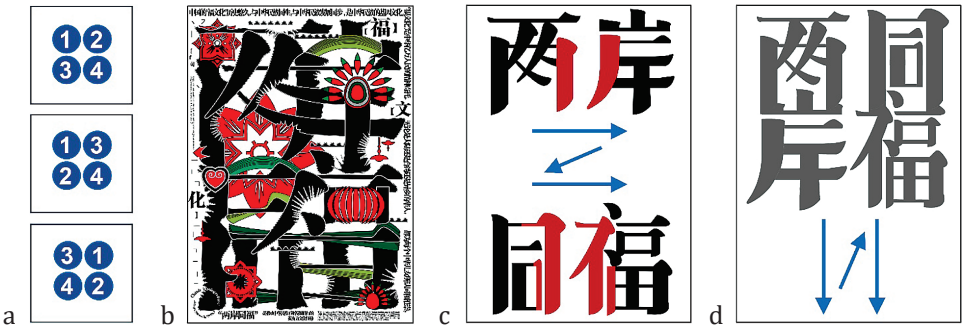


Figure 4. Syntactic analysis of four-character homophonic structures
Note: a – possible arrange order for four-character arrangements; b – poster "两岸同福 (Blessings on Both Sides); c – blue arrows indicate arrange order, red indicates overlapping strokes; d – vertical arrangement, connecting strokes between upper and lower words
Source: interpretation drawn by the authors, Character Creation Alliance (2023) poster

The role of structural metaphors. A metaphor is the use of components or overall imagery to project one thing onto another, thereby conveying cultural connotations and abstract concepts. Visual metaphors use images as a medium of transformation, i.e., they use visual language to make comparisons (Guo, 2018). In Chinese character graphics design, structural factors shape metaphors, mainly in the form of visual metaphors that combine linguistic elements. Among these, spatial layout determines the relationships and hierarchy between elements, guiding the viewer's gaze and emphasising the focus of the metaphor. Proportion and scale determine the relative sizes of visual elements, conveying information such as strength and importance. Additionally, the formation of Chinese characters originated from pictograms, and their forms are concrete, visual graphic symbols. For example, the shape of the Chinese character "山(mountain)" is a depiction of a real mountain. It is both an independent character and a radical. In compound Chinese characters, all characters with the radical "山" have meanings related to mountains. Furthermore, depending on the position of the radical, the meaning of the character will also differ. This pictographic feature of Chinese characters extends to character isomorphism, which can also be a powerful factor in the creation of metaphors.

Compared with linguistic metaphors, visual metaphors have their own expressive advantages. Images are intuitive, making it easier for observers to agree on the shared characteristics of metaphorical terms (Bolognesi, 2017). Relevant experimental studies have shown that cultural factors do not constitute a prominent influence in the cognition of visual metaphors (Van Mulken *et al*., 2010). Even in different cultural contexts, when faced with purely graphic works, the patterns of mental associations triggered by image structures are relatively similar. However, for textual graphics, the formation of metaphors must be based on language cognition, which in turn heavily relies on cultural factors. Therefore, understanding such metaphors requires the combined influence of psychological consensus, cultural cognition, and individual experience. During the cognitive process, people read shape and structural information, integrate it with the meaning of the words, and advance their associations and deepen their understanding, thereby successfully interpreting the meaning of the metaphor.

In the logo of the College of Economics and Statistics, Guangzhou University (Fig. 5), the main graphic was composed of two characters, "經 (economics)" and "統 (statistics)". As the common radical of these two Chinese characters, "糸" was originally a pictographic character, imitating the shape of a bundle of silk threads. The original meaning of this radical was "silk thread", which was later extended to mean "connection". The structure on the right side of the logo is formed by the overlapping strokes of the characters "巠" and "充". Figure 5a showed the final design scheme, where the internal lines are uniformly thick. This implies that "economics" and "statistics", as distinct academic disciplines, are integrated and collaborative in the development of the college. The shared use of the radical "糸" is a clever design choice by the artist, leveraging the coincidental similarity in character forms, to subtly reinforce the intended meaning (Fig. 5b). Compared to the final solution, the discarded design solution (Fig. 5c) was identical in terms of the layout arrangement of the text components. However, the strokes of the character "統" use thinner lines, which could easily be interpreted as shadows or spatial depth for the character "經". It unnecessarily adds a hierarchical relationship between the two characters, leading to an incorrect interpretation where "economics" is the primary meaning, and "statistics" is secondary. While

the varying line thicknesses aid in visual distinction between the characters, this design deviates from the requirement to clearly convey the core theme, thereby dooming it to failure.

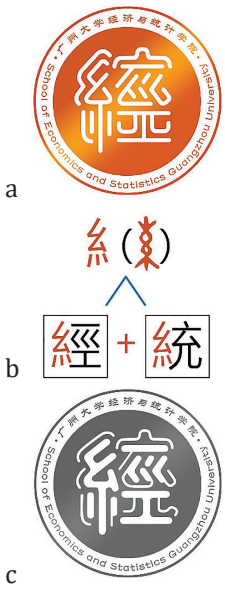


Figure 5. Logo of the College of Economics and Statistics, Guangzhou University
Note: a – final design; b – common radical "糸" and its pictographic pattern; c – in the rejected design, the strokes of the character '統' are thinner
Source: interpretation drawn by the authors, Baijiahao creators (2022)

As one of Kan Tai-keung's masterpieces, the success of the poster "Korean Reunification" (Fig. 3), can also be attributed to the use of structural metaphors. In the image, the characters "朝 (North Korea)" and "韩 (South Korea)" share the same radical, "卓 ", but are rotated 180 degrees and facing away from each other. The shared structure of the characters represents the unavoidable similarities between the two countries, while the direction reveals the stance of the people. Therefore, the structure of this work essentially implies that North and South Korea are two countries of the same ethnic group but are currently in a state of political opposition. In character isomorphism, metaphors derived from structure can be expressed in many other ways, such as inclusion, repetition, and size, involving various visual elements. These include implied subordination, limited repetition meaning infinite quantity, and size being interpreted as importance, which are familiar to the general public. It is important to note that these structural elements do not exist in isolation or as rigid formulas. For example, in the logo of the Jilin Provincial Library (Table 1), the character "吉" is contained within the character "图", but interpreting this as a subordinate relationship would be a misinterpretation. This demonstrates that structural metaphors only function effectively when combined with character meanings, thereby accurately conveying the intended thematic information. In addition, there is a special type of character isomorphism called "Picture composed of characters". This type of work uses multiple Chinese characters to form a complete and figurative image. Direct shape modelling can present more specific meanings. The visual rhetoric may be metaphorical, or it may be a direct description or explanation. The meaning here is essentially the result of communication between text and images, which makes the metaphorical nature of pictures composed of characters unique, forming a clear distinction from other forms of character isomorphism.

Within academic circles, research into the graphic design of Chinese characters is grounded in the theoretical framework of Chinese character morphology. For instance, A.P. Zhang (2020) took the pictogram nature of Chinese characters as the foundational condition for their graphic meaning, whereas Z.Y. Jiang & S. Dong (2024) focused on the similarity of character outlines and their impact on the applicability of design techniques. Their attention to form essentially centred on the shape of individual characters, with comparisons of form being limited to partial aspects rather than encompassing the whole. This study centred on structural issues, aiming to move beyond isolated discussions of component shapes and further emphasise the grasp of systemic relationships. Within isomorphous design, the impact of overall frameworks on cognition is more easily overlooked than that of partial contours. P.Y. Lu (2023) presented a set of experimental works in his article, where the meaning of departure is conveyed through significant misalignment of internal components within characters. As the creator himself noted, when multiple characters are combined, their positions become closely intertwined; altering the fundamental framework of a single character thus renders text recognition challenging. The structural issues examined in this study are discussed within the context of the overall system, concerning both the internal organisational relationships within individual characters and the relationships between characters themselves, as well as between characters and the work as a whole. This reflects a quintessentially systemic approach to thinking.

Moreover, maintaining textual legibility within multi-character combinations cannot be achieved solely through knowledge of Chinese character morphology. The introduction of Gestalt theory provides operational guidance for design and offers formal explanations. Z.Y. Jiang & S. Dong (2024) emphasised that within isomorphous works, the principle of wholeness plays a positive role in achieving visual unity. However, they do not mention that effective visual separation of character forms by Gestalt principles is equally essential for recognising text within such combinations. Y. Zhou & M.Y. Xie (2020), meanwhile, employed

principles such as proximity and closure to explain mechanisms enabling character recognition despite deformation, partial omission, or occlusion. Regrettably, this research was confined to single Chinese characters and paragraph-level texts serving linguistic documentation purposes. The present study examined how character recognisability is maintained within character isomorphism works under Gestalt theory, alongside the guiding role of connecting forms in visual order. Compared to prior research, this paper adopts a distinct focus.

Regarding research on arrangement sequences, N. Chen (2021) utilised textual combinations found on seals, roof tiles, and bronze coins as case studies, demonstrating that ancient Chinese individuals possessed conventionalised arrangement patterns and reading habits when encountering works characterised by character isomorphism. Meanwhile, H.P. Li (2024) compared the visual effects of horizontal versus vertical arrangement of Chinese characters, explaining ancient Chinese preference for vertical layout from the perspective of preserving text legibility. Both scholars focused their research on traditional formats. However, as contemporary Chinese characters have undergone significant transformations in their application mediums and dissemination methods, the arrangement of their Chinese character graphics now exhibits new characteristics shaped by the era. Drawing upon the essence of prior research, this study posited that contemporary Chinese character graphics design represents a fusion of traditional and modern features, thereby fostering diverse developmental trajectories. From the perspective of contemporary practical application, the influence of multiple factors on the formulation of arrangement strategies, alongside the integration of character form variation techniques, is analysed.

In the field of Chinese character graphic metaphor design, scholars have generally shown greater research interest in pictorial-textual integration, primarily due to the perceived expressive advantages of imagery. C. Zhu (2022) contended that pictures serve as a vital vehicle for metaphor; embedding them within Chinese character graphics facilitates the breaking down of cultural cognitive barriers, thereby enabling cross-ethnic and cross-regional cultural dialogue. C.Z. Yuan & B. Liu (2024) contend that the relatively rigid correspondence between Chinese character form and meaning limits their expressive extensibility, whereas pictorial elements can compensate for this deficiency by guiding readers towards rich associations and imaginative interpretations. Nevertheless, the primary element in character isomorphism remains the character itself.

Although Chinese characters possess pictograms, most forms have become highly abstracted and are not entirely identical from an effective recognition perspective. In such instances, the role of structural metaphor, detached from figurative elements, becomes particularly prominent. This study demonstrated through case analysis that strokes and radicals – as abstract elements within characters – can form metaphors through alterations in proportion, position, or orientation. This confirmed that structural patterns can induce complex cognitive effects in viewers. Whilst currently in its preliminary stages, this research reconstructs the generative logic of Chinese character graphics metaphors at a theoretical level, whilst its feasibility has been validated in practice.

CONCLUSIONS

It has been found that in Chinese character graphics design with character isomorphism, character shape, order, and metaphor are intrinsically related. The shape of the character provides the necessary precondition for the use of techniques. The arrangement of the characters, on the other hand, takes the matching degree of their interconnection as the core consideration, and fully considers the result of the overall layout of the purposeful reading. Thus, the expression of abstract concepts is realised in the projection of imagery, highlighting the sensual qualities of graphics. Comprehensively speaking, the structural design principle of character isomorphism can be summarised by the use of systematic thinking.

The study also showed that design approaches related to sign isomorphism are not limited to Chinese writing, but share common patterns with practices in other cultures and language systems. This is particularly noticeable in multilingual logo design, where the combination of Chinese and foreign fonts has become a practical necessity. It has been found that many designers tend to favour structurally conservative solutions – for example, a clear separation of English and Chinese text, as in the emblem of the School of Economics and Statistics at Guangzhou University. Although such configurations minimise the risk of visual confusion, they often turn out to be too straightforward and can create an effect of aesthetic fatigue. Overcoming these limitations requires methodological innovations – the use of positive-negative graphics, figurative images, or combinations of strokes. The perceptual overlap between letters and components of Chinese characters in mixed compositions creates both challenges and opportunities: on the one hand, clear formal differences are needed to maintain recognizability; on the other hand, it is this feature that opens up the possibility for flexible structural combinations and the formation of new meanings.

Despite successful precedents, academic articulation and systematic summarisation of such design experiences remain limited. Given the expanding scope of international exchange, the topic of cross-script character isomorphism is poised to grow in scholarly relevance, with potential to enrich creative practice and support more effective intercultural communication. Future research may focus on developing a more formalised theoretical model of mixed-script

isomorphism, clarifying how structural and perceptual mechanisms operate across different writing systems.

FUNDING
None.

ACKNOWLEDGEMENTS
None.

CONFLICT OF INTEREST
None.

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Структурне дослідження ізоморфізму символів у графічному дизайні китайських ієрогліфів

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Анотація. Ізоморфізм символів є поширеною формою у графічному дизайні китайських ієрогліфів. У порівнянні з іншими техніками, розташування внутрішніх компонентів відіграє більш важливу роль у передачі значення, що робить структурні фактори ключовими для успіху дизайну. Метою було дослідити формальні механізми ізоморфного дизайну символів у китайській графіці та пояснити, як позиційне розташування, засноване на характеристиках китайських ієрогліфів, може збагатити візуальне вираження. Використано міждисциплінарний підхід з інтеграцією морфології китайських ієрогліфів, гештальтпсихології та семіотичної теорії. За допомогою огляду літератури та формального аналізу систематично вивчено репрезентативні приклади. Результати показали, що форма символів, послідовність розташування та метафора становлять три основні виміри, що впливають на структурну композицію. Сумісність форми символів є основою ізоморфізму, визначаючи можливість комбінацій компонентів; послідовність розташування безпосередньо впливає на точність сприйняття інформації через лінійні та нелінійні просторові відносини, а метафоричні механізми ефективно передають культурні коннотації та абстрактні поняття через проекцію візуальних образів. На основі аналізу цих трьох вимірів було сформульовано рекомендації та методологія для підвищення графічної виразності та культурної впізнаваності китайських ієрогліфів. Ці висновки не тільки надають творчі стратегії та формальні рекомендації для графічного дизайну китайських ієрогліфів, але й окреслюють реальні шляхи візуальної комунікації в різних культурних контекстах, сприяючи тим самим ефективній передачі тематичної інформації

Ключові слова: формальний механізм; порядок розташування; метафора; візуальне сприйняття; культурне значення

ISSN 2617-0272, e-ISSN 2617-0280

ART AND DESIGN
Journal homepage: https://art-design.com.ua/en

9(1), 2026

Received 15.12.2025 Revised 02.03.2026 Accepted 09.04.2026 Published: 10.04.2026

UDC 7.04:27]-044.933:725.95:730]:001.891.3(045) DOI: 10.30857/2617-0272.2026.1.2

Images of inspiration: Monuments to the poet Adam Mickiewicz within the range of European sacred art

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Abstract. The relevance of the study lies in the need for an interdisciplinary and comparative interpretation of monuments to Adam Mickiewicz and Taras Shevchenko as a component of the European monumental discourse of the nineteenth-twentieth centuries. The aim was to analyse the transformation of ancient and Christian iconography in the depiction of the poet's creative inspiration through the monuments to Adam Mickiewicz in Lviv (1904, A. Pöppel), Paris (1909-1929, A. Bourdelle) and Odesa (2004, O. Kniazyk). Iconographic, iconological, cultural-historical, semiotic, comparative and artistic-stylistic methods were applied. The connection of the image of the poet with the sacred iconography of apostles, saints, and geniuses in the art of the Renaissance, Baroque, Classicism, and Romanticism was examined. The influence of ancient and Christian traditions on the architectonics of the monuments was established, in particular the symbolism of the column as the Axis of the World and of the altar as the idea of sacrifice. In the Lviv monument Adam Mickiewicz was depicted as a mediator between the earthly and the heavenly; in Paris – as a prophet, drawing on the iconography of the Apotheosis of Rome and the allegory of freedom; in Odesa – as an image of inner inspiration referring to Greek kouroi. The compositions combined sacred and secular motifs, creating a synthetic image of the poet. A typological kinship was revealed with the monuments to Taras Shevchenko in Kharkiv (1935) and Lviv (1992-1996), which underlined the universality of the image of the poet as a spiritual leader. The results revealed the sculptors' innovative approach to the synthesis of sacred and secular images, reflecting a link with European traditions. The study is useful for art historians, cultural studies scholars and researchers of the interrelationship between literature, sculpture and urban space

Keywords: Taras Shevchenko; monumental sculpture; ancient and Christian iconography; symbolism; creative method; intertext

INTRODUCTION

The growing interest in the transformation of ancient and Christian iconography in monumental art, particularly in the context of representing poets as spiritual leaders, determines the need to address this issue. In modern conditions of rethinking national identity, monuments to literary figures such as A. Mickiewicz (1798-1855) and T. Shevchenko (1814-1861) function as symbols of the synthesis of sacred and secular motifs. The poets contribute to the harmonisation of urban space and the formation of collective memory, demonstrating how art reflects spiritual values and influences contemporary culture and society.

An analysis of the literature showed that scholars' interest in the role of monuments in shaping national identity and their connection with sacred traditions is growing, yet there are few studies devoted directly to memorials. Thus, A. Dlugozima & K. Rybak-Niedziolka (2022) noted that urbanisation pressure increases the need to protect the urban landscape as a sociocultural construct that is an important part of history and memory. K. Farah (2024) demonstrated that local monuments combine national and regional narratives, which has parallels with Ukrainian monuments, where sacred motifs are intertwined with patriotic ones. The

Suggested Citation:
Tarasenko, A. (2026). Images of inspiration: Monuments to the poet Adam Mickiewicz within the range of European sacred art. *Art and Design*, 9(1), 20-33. doi: 10.30857/2617-0272.2026.1.2.

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study by S. Purici & H. Mareci Sabol (2021) showed that the transformation of monuments in Chernivtsi reflects not only artistic or architectural changes, but also serves as an important marker of local and national identity in the context of changing political regimes. The authors analysed a number of monuments and revealed that changes in their composition, location, and symbolism reflect processes of adapting cultural memory to new socio-political contexts and emphasise the role of monuments as active participants in the formation of public consciousness.

The theme of the poet's inspiration and the construction of monuments to A. Mickiewicz is closely connected with Romanticism and the study of the canonisation of literary figures. Comparative analysis with contemporary research, in particular J. Rodger (2022), has shown that monuments to poets perform not only an aesthetic function, but also serve as instruments for shaping national and regional identity. Similar to monuments to Burns, Ukrainian monuments to Mickiewicz and Shevchenko combine sacred and secular motifs, become centres of collective memory and symbols of cultural self-determination, which underlines the interdisciplinary significance of monumental art in the context of memory politics and contemporary culture. The study by T. F. Robinson & J. Savarese (2022) showed how shifts in paradigms in the visual arts of Romanticism emphasise the multifaceted nature of this movement and its impact on modern culture. M.S. Rusu (2023) found that the memorialisation of the Romanian poet M. Eminescu through monuments and toponymy underlines the author's status as a national symbol and influences regional features of cultural memory. In a subsequent work, M.S. Rusu (2024) considered the impact of the spatial policy of memorialisation on social well-being through symbolism and local identity.

The ideas and studies presented in the book by D. Damjanović & A. Łupienko (2022) showed that architectural objects of the previous time were assessed not only for their aesthetic qualities, but also fulfilled the role of markers of national memory. The authors emphasised that the formation of national narratives around architectural heritage was an important element of nation-building in the nineteenth century, and the processes described in the book are directly relevant to understanding how contemporary societies politicise heritage and interpret monuments in urban space. I. Schemper-Sparholz (2021) reviewed the history of research on monumental sculpture in the former Habsburg Monarchy during the nineteenth century. On the one hand, the main focus was on sculptors, their origins, educational paths and fields of activity in the years of political upheavals from a centrally governed multinational state to the independent nations of Central Europe. On the other hand, the author emphasised that language barriers and the "Iron Curtain" interrupted cross-border research.

The contemporary interest in the cult of poets and writers is manifested primarily in studies by literary scholars and cultural theorists, which highlights the need to involve an art-historical analysis of the image of the poet A. Mickiewicz in monumental sculpture of the twentieth – early twenty-first century. The aim of this study was to identify the features of the transformation of iconography in monumental sculpture of the twentieth – early twenty-first century through the analysis of the image of the poet A. Mickiewicz in the monuments of Lviv, Paris and Odesa, as well as to establish their typological kinship with monuments to T. Shevchenko in order to reveal the synthesis of sacred and secular motifs in the formation of the image of the creative personality.

MATERIALS AND METHODS

The study was based on the iconographic and iconological method (Panofsky, 1955; 1960), which involved the analysis of monuments to A. Mickiewicz at three levels: factual (depiction of figures and compositions), conventional (iconographic motifs associated with the theme of poetic inspiration) and symbolic (deep cultural and spiritual content reflecting the sacrality of the poet's image). Iconography made it possible to identify the links of the monuments with the traditions of Christian sacred art, in particular with compositions in which the image of the poet is interpreted as a spiritual ascetic. Iconology deepened the analysis, revealing the dialogue between the art of different epochs and cultures, which broadened the temporal and spatial boundaries of the interpretation of the monuments to Mickiewicz. The theory of archetypes by C.G. Jung (1968) was applied to study universal motifs such as the column as the Axis of the World, the cultural hero, the genius, the creator, which reflect the collective unconscious. For art-historical analysis, a number of monuments were selected, which are presented in Table 1 with brief reference data.

Table 1. Objects of the study

Type	Object and years of creation	Details	Place of preservation (location)
Monument	Monument to Adam Mickiewicz (1904)	Sculptor: Antoni Pöppel, Mykhailo Parashchuk. Architects: Yulian Sosnowski, Alfred Zachariewicz. Material: granite, bronze.	Mickiewicz Sq., Lviv, Ukraine
	Monument to Adam Mickiewicz "Polish Epos" (1909-1929)	Sculptor and architect: Antoine Bourdelle. Material: bronze.	Place de l'Alma, Paris, France

Table 1. Continued

Type	Object and years of creation	Details	Place of preservation (location)
Monument	Monument to Adam Mickiewicz (2004)	Sculptor: Oleksandr Kniazyk. Architect: Markos Murmanov. Material: bronze, granite.	Prospekt Ukrainskykh Heroiv, Odesa, Ukraine
	Monument to Taras Shevchenko (1992-1996)	Sculptor: Vasyl Sukhorskyi, Andrii Sukhorskyi. Architects: Yurii Dyba, Yurii Kromei. Material: bronze.	Prospekt Svobody, Lviv, Ukraine
	Monument to Taras Shevchenko (1935)	Sculptor: Matvii Manizer. Architect: Yosyp Langbard. Material: bronze.	Shevchenko Park, Kharkiv, Ukraine
	Monument to Joshua Reynolds (1903)	Sculptor: Alfred Drury. Material: bronze.	Burlington House, London, United Kingdom
	Monument to Joseph Haydn (1887)	Sculptor: Heinrich Nutter. Material: bronze.	Square by the Mariahilferkirche, Vienna, Austria
Column (pillar)	Column of Trajan (113)	Sculptor/architect: Apollodorus of Damascus. Material: marble.	Forum of Trajan, Rome, Italy
	Column of Antoninus Pius (161)	Sculptor: unknown Roman master. Material: marble.	Vatican Museums (pedestal), Rome, Italy
	Marian Column (1638)	Sculptor: unknown. Material: stone.	Marienplatz, Munich, Germany
	Colonne Vendôme (1810)	Architects: Pierre-François-Léonard Fontaine, Charles Percier. Material: bronze.	Place Vendôme, Paris, France
Altar	Sculptural altar with a figure of John the Evangelist (1778-1780)	Author: Johann Wagner. Material: wood.	Ebrach Abbey, Ebrach, Germany
	Carved altar with statues of saints (1733)	Authors: Thomas Huder, Konrad Kutschenreiter. Material: wood.	Church of Saint Andrew, Lviv, Ukraine

Source: created by the author

Beyond the tabular list, the article considered a number of sacred and visual objects involved as iconographic and typological parallels. These included architectural and sculptural ensembles of a sacred character, in particular Baroque and Rococo altar compositions of Southern Germany and Galicia, fresco paintings of monastic and parish churches of the eighteenth century, as well as authors' sketches of monumental projects of the nineteenth-twentieth centuries used to analyse the process of forming the artistic conception. A separate group consisted of examples of easel and decorative sculpture which served as sources for comparative analysis of vertical composition, symbolism of gesture and hierarchy of figures. The indicated objects are not considered as independent subjects of the study, but perform the function of contextual material necessary for reconstructing the artistic origins and inter-genre interrelations in the European monumental tradition.

The monuments were analysed as part of a cultural-historical dialogue, in which contemporary sculptors synthesise sacred images of different epochs with the mentality and stylistics of their own time, using intertextual, iconographic and comparative approaches to comprehend their spiritual and national symbolism. The artistic-stylistic method makes it possible to deepen the analysis of the formal features of the monuments, while the historical-cultural method makes it possible to place the monuments in the context of European culture, emphasising the interaction of local traditions with global sacred motifs. The analysis of the monuments was carried out with consideration of Romantic traditions on the periphery of Europe. This approach made it possible to reveal the monuments to A. Mickiewicz as a unique synthesis of Romantic aesthetics, sacred art and national identity, highlighting their significance within the range of the European cultural dialogue.

RESULTS AND DISCUSSION

The monument to A. Mickiewicz in Lviv (1904): Symbolism of columns and the iconography of revelation. The career of the sculptor Antoni Pöppel, author of the monument to Adam Mickiewicz in Lviv, is a vivid example of the operation of the same artistic and educational mechanisms that I. Schemper-Sparholz & C. Mang (2021) identified as key to the formation of the sculptural environment of Central Europe. The sculptor's studies at the Vienna Academy of Fine Arts in 1885-1888 enabled Antoni Pöppel, on Pöppel's return to Lviv, to apply this disciplined technique and

artistic language to embody the image of the Polish national poet-prophet. The symbolism of the monument to A. Mickiewicz in Lviv reflects local traditions. During its construction (Fig. 1) the concept of A. Krekhovetskyi was adopted, which consisted in the column being the basis of the monument. The idea of the column was linked to an orientation towards the monument to King Sigismund III Vasa in Warsaw (1643). Considering the symbolism of the column in the culture of different times and peoples, J. Tresidder (1997) defined it as an emblem of divine power and pointed to an obvious parallel with the Axis of the World. As an archetype of the European monument, the column is historically associated with the imperial heritage of the culture of Ancient Rome, where statues of gods and emperors close to the gods were placed on the tops of columns. The statue of A. Mickiewicz was installed on the site where, until 1904, there had been a fountain with a statue of the Virgin Mary. The renaming of Mariacka Square in honour of the poet testifies to the assertion of the secular principle over the religious worldview.

Figure 1. Monument to Adam Mickiewicz (1904)
Note: column 21 m, figure 3.3 m
Source: R. Masyk (2008)

The sculptural figure of the poet is placed by the column in the central part of the monument and set on a high, stepped pedestal that functions as a semantic boundary between the earthly and transcendent spaces of the composition. The character's costume (frock coat and cloak) corresponds to the chronological period of the poet's life. In the upper part of the composition a winged Messenger is depicted in dynamic motion, descending from above and handing the poet a lyre – the attribute of Apollo, which in a symbolic dimension represents the idea of the harmony of the universe. In Plato's dialogue "Phaedrus", the symbolic significance of wings is revealed as being intended to raise the body upwards, to the abode of the gods (Plato, 1925). There is an evident connection between the allegorical images and stylistics of the monument to A. Mickiewicz and the monumental-decorative design of the Lviv Opera House (1900): in particular, A. Pöppel's image of the Genius with a lyre is close to the allegory of the Genius of Music with a lyre by the sculptor P. Viitovych, installed on the right side of the pediment. The attribute of the figure of Glory crowning the theatre is a palm branch, as at the poet's feet in the monument.

From the time of the establishment of Christianity, figures of saints began to be placed on pedestals freed from pagan triumphal images. Thus, on the top of Trajan's Column in Rome (Fig. 2) an image of an eagle was first placed, later a statue of Trajan, and in 1588 a sculpture of the Apostle Peter. The Marian Column in Munich (1638) is crowned by a figure of the Virgin Mary. The imperial style of Ancient Rome found an echo in the Empire stylistics of the nineteenth century, an example of which is the Colonne Vendôme (1810) in Paris.

Figure 2. Trajan's Column (113)
Note: 38 m with pedestal
Source: Encyclopedia Britannica (n.d.)

The upper part of the monument in Lviv was created by the sculptor M. Parashchuk. The column, which symbolises simultaneously the *Axis mundi* and the Tree of Life, is crowned with a capital. The spirals of the volutes, arranged in pairs around the shaft, personify the eternal movement of life: birth – blossoming – death – rebirth. Between the volutes an ornament in the form of egg-shaped ovals ("ov") is placed, and below, around the circumference, metrically repeated garlands of plants are presented. The canonical motif of the "unfading flower", characteristic of ancient temples, houses, sarcophagi and altars, was revived in the architectural

décor of the Renaissance and the modern era. The composition is completed by a flame above a sacrificial tripod, guarded by lion masks that allude to the name of the city. Fire as the highest form of energy recalls the heart – a symbol that is particularly significant for the Catholic tradition. Its plastic form goes beyond a closed structure, which is typical of Baroque stylistics.

The symbolism of the monument was understandable to contemporaries with a classical education founded on the heritage of ancient culture. Art-historical analysis of the Lviv monument to A. Mickiewicz revealed its kinship with the iconography of sacred sculpture: similar to Christian ascetics, the poet appears as a mediator between the absolute and the earthly principles. In the art of the modern era – in theatre, the visual arts and music – distinctive matrices, expressive "rhetorical figures", were formulated. An example is the treatise by Mykola Dyletsky, "Musical Grammar" (1681). In the secular art of the Catholic branch of European Christianity at the turn of the nineteenth-twentieth centuries, the iconography of saints based on the traditions of the Renaissance, Baroque and early Classical style is repeated. The parallels presented in Figure 3 can serve as clear examples of related images between the monument to A. Mickiewicz and the sacred sculpture of Lviv. It is precisely through these parallels that the continuity of artistic solutions is traced, linking secular monuments with established canons of sacred art.

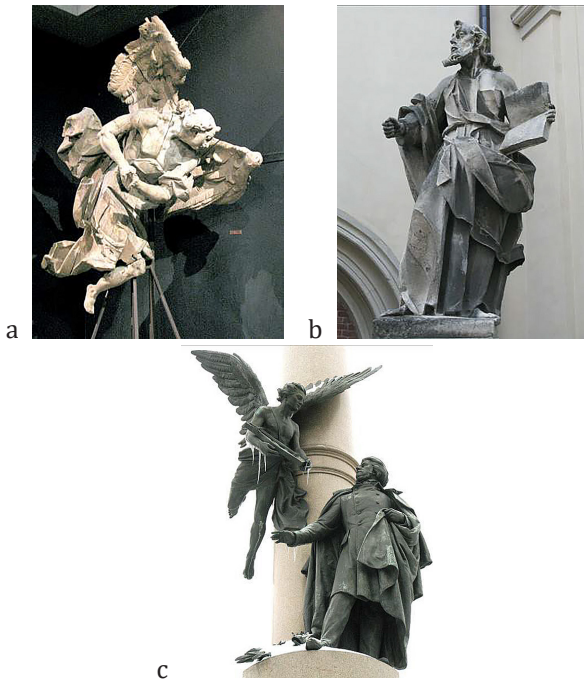

Figure 3. The image of divine revelation in the sculpture of Lviv in the eighteenth-twentieth centuries
Note: a – J.-G. Pinsel, "Angel" (1750s); b – J.-G. Pinsel, Saint with an open book (1765-1776); c – A. Pöppel, monument to A. Mickiewicz, fragment (1904)
Source: photo by A. Tarasenko

The connection between the composition of the monument to A. Mickiewicz and the iconography of the Revelation of John the Theologian and Annunciation scenes in Renaissance graphics and monumental painting (Fig. 4) is evident. Such a comparison makes it possible to reveal the deep sources of the figurative language of the monument, where biblical subjects find resonance in the artistic quests of the modern era. In the Lviv monument, the poet is presented in direct dialogue with the heavenly messenger. The theatricalised expressiveness of gestures, polished by the experience of generations, forms canonical models. The pose, gesture and placement of the statue of the poet by the column correlate with depictions of apostles and other saints portrayed at the moment of divine revelation.

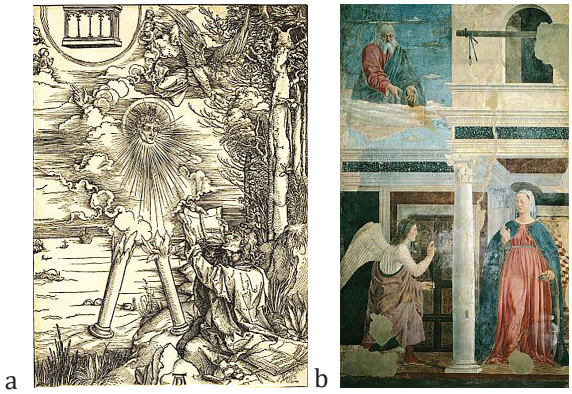

Figure 4. The image of divine revelation in the art of the Renaissance
Note: a – A. Dürer, "Saint John Receives the Book of Revelation" (1497-98). Woodcut, 39×28 cm; b – Piero della Francesca, "Annunciation" (1452-1466). Fresco, 329×193 cm
Source: The Metropolitan Museum of Art (n.d.), Piero della Francesca (n.d.)

The commonality of iconographic construction can be traced in Western European sacred ensembles. An example of related iconography is the high altar of the monastic church in Eberbach (Figs. 5a, 5b). The movement of John the Evangelist reproduces the ecstatic state of the apostle at the moment of contemplating a miracle. The sculptural images created by J. Wagner in the stylistics of the Baroque and early Classicism are distinguished by carefully constructed rhythm in the folds of the saints' garments, which forms clear and expressive plasticity. The texture of the eagles' wings of the angels – witnesses of the descent of the Holy Spirit upon the apostles in the church in Munich (Fig. 5c) – also acquires significant expressiveness. Thus, the iconographic parallels extend across a broad spectrum of European sacred art, creating a common foundation for the perception of the Lviv monument. Columns, the gestures of saints and the presence of angels are close to the iconography of the monument to A. Mickiewicz.

Figure 5. Architectural and sculptural elements of Baroque churches of the eighteenth century
Note: a, b – J. Wagner, High altar and fragment – statue of John the Evangelist, Kloster Eberbach, Ebrach (1778/80); c – Heilig-Geist-Kirche, Munich (1730)
Source: Eberbach Monastery (n.d.), Heilig Geist Munich (n.d.)

The pose, gesture and placement of the statue of the poet by the column correlate with depictions of apostles and other saints portrayed at the moment of divine revelation (Fig. 6). In particular, the vertical orientation of the figure, the slight raising of the hands and the gaze directed upwards create a sense of spiritual elevation and connection with the transcendent. The columnar composition emphasises the central axis of the hierarchy of the figure, recalling the architectural and sculptural devices of sacred ensembles in which saints are depicted in the act of receiving divine revelation. The gesture of the poet can be interpreted as a symbolic message to the viewer, which unites the spiritual, moral and cultural functions of the monument, while the mutual placement of the statue and the architectural column creates the effect of a dialogue between the human being and the sacred space, analogous to the traditions of Renaissance and Baroque iconography.

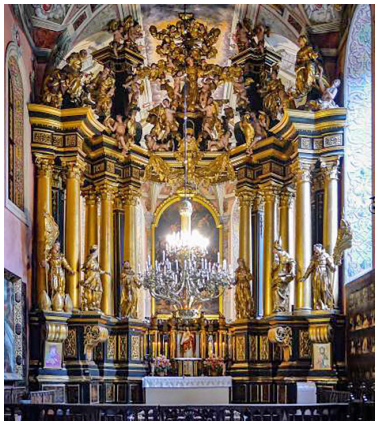

Figure 6. Church of Saint Andrew, Lviv
Note: T. Huder and K. Kutschenreiter. Carved altar with statues of saints (1733)
Source: photo by A. Tarasenko

An example of the use of the heritage of sacred art in secular monuments of Europe can be seen in the roughly contemporary monuments to the English artist J. Reynolds and the composer of Viennese Classical music J. Haydn (Fig. 7). Common to both monuments is the state of inspiration, expressed in poses, gestures and faces turned towards the sky. Architecture decorated with columns of the classical order serves as a background for the figure of the composer. The placement of the statue of J. Haydn in the open space of a city square is virtually related to the central image in the altar composition of a church interior.

Figure 7. Use of the heritage of sacred art in monuments to poets and artists
Note: a – A. Drury, Monument to J. Reynolds (1903), Burlington House, London; b – H. Natter, Monument to Joseph Haydn (1887) by the Mariahilf church, Vienna
Source: Royal Society of Sculptors (n.d.), Vienna (n.d.)

The comparative analysis undertaken between the monument to A. Mickiewicz and Christian iconography finds typological kinship in the monument to

the Ukrainian poet T. Shevchenko (Fig. 8). O. Yakymova (2023) noted that the formation of historical-national (symbolic) images in monumental art of Eastern Galicia at the beginning of the twentieth century, in particular images of heroic figures, became an expression of national revival and often synthesised the secular and the sacred, as in the monument to Taras Shevchenko in Lviv, where the poet acquires features of a sacred composition. This confirms the universality and vitality of the artistic mechanism of synthesis of the arts and symbolic iconographic borrowings for creating the image of the spiritual leader of the nation, which the researcher identified in the art of the first third of the twentieth century.

Figure 8. Statue of Taras Shevchenko in Lviv
Source: Discover Ukraine (n.d.)

The monument in the central part of Lviv was created in 1992-1996 by the sculptors V. Sukhorskyi and A. Sukhorskyi in collaboration with the architects Yu. Dyba and Yu. Kromei. The monumental statue of the poet, 4.45 m high, is set on a low pedestal, which ensures its spatial proximity to the pedestrian zone of Prospekt Svobody. T. Shevchenko's gesture is directed towards the stele "Wave of National Revival", 12 m high, whose relief surface represents the history of Ukraine. The compositional solution of the stele is associatively correlated with the altar apse of an Orthodox church and the iconography of the Cossack icon "The Protection of the Mother of God". Its crowning with the image of the Virgin Orans reveals an iconographic echo with the mosaic of the altar apse of Saint Sophia of Kyiv of the first half of the eleventh century, forming a symbolic link with the thousand-year history of Rus'-Ukraine. Such a compositional structure affirms the idea of heavenly intercession and emphasises the role of the poet as a spiritual leader of the nation. The art-historical study carried out testifies to the universality of the use of sacred iconography in forming the image of the poet-guide.

The monument to A. Mickiewicz in Paris (1909-1929): The role and place of the poet in the structure of the universe. A monument to A. Mickiewicz was also erected in Paris on the commission of the Franco-Polish Committee and was named "Polish Epos" (Fig. 9a). The programme of the monument was developed by the sculptor A. Bourdelle, who presented three themes: reliefs based on the poet's poems (at the base), the allegory of the Polish Epos (in the middle part), and at the top the figure of the poet. The column symbolises the tree of Poland's freedom. The symbolic content is expressed in the architectonics of the monument, presented in the form of a sword, on the top of the hilt of which stands the figure of the poet with a pilgrim's staff. The sculptor compared A. Mickiewicz with a prophet, a biblical preacher whose fiery word is a spiritual sword. The bard's raised hand recalls the canonical gesture of a Roman orator (for example, the statue of Aulus Metellus from Etruria, late second – early first century BC) (Fig. 9b). The plasticity of the figure of the poet as leader, guide, can be compared with Moses or a Christian apostle, represented in particular in the sculpture of A. Rodin, in whose studio A. Bourdelle was a pupil and assistant from 1893 (Fig. 9c).

Figure 9. Comparative iconography of the image of the poet-prophet
Note: a – A. Bourdelle, "Polish Epos" (1909-1929), height 12.60; b – Orator. Statue of Aulus Metellus (100s BC), height 179 cm; c – A. Rodin, "Saint John the Baptist" (1878-1880)
Source: V&A South Kensington (2002); Saint Louis Art Museum (n.d.), Artsy (n.d.)

The expression of the figure depicted in a wide stride is characteristic of the theme of the path, widespread in various forms of the plastic arts, literature, and music of the modern period. Such a motif of movement embodies not only physical displacement but also the symbolic dimension of spiritual and national progress. In sketches for the monument to Shevchenko, F. Krychevsky depicted the figure in turbulent motion (Fig. 10a), which is related to the monument to A. Mickiewicz in Paris, where the dynamics emphasise the poet's prophetic mission. In the 1935 monument (Fig. 10b) T. Shevchenko, placed on the top of a stepped pedestal, points the way to the freedom of the people, personified by the heroes of the author's works, thus forming a unity between the artistic image and the national idea. This comparison made it possible to see the commonality of ideas and artistic language in the embodiment of the figures of national geniuses in different cultural traditions.

a  b 

Figure 10. Sketch and pedestal for T. Shevchenko, related to the figure of A. Mickiewicz

Note: a – F. Krychevsky, "Sketch of the figure for the project of the monument to T. Shevchenko" (1933); b – M. Manizer, Yu. Langbard, "Monument to Taras Shevchenko in Kharkiv" (1935)

Source: V. Rudenko (2020), Library of the P. Vasilenko Kharkiv National Technical University of Agriculture (n.d.)

In affirming the role of the poet in the monuments of A. Pöppel and A. Bourdelle, a common feature is the use of images of musical instruments. In the reliefs of the lower part of the Paris monument, heroes of A. Mickiewicz's poem "Konrad Wallenrod" (1825) are depicted: alongside Konrad armed with a sword appears the spiritual warrior – the bard Halban with a harp (Fig. 11). The sketch of this image was created in 1909. The combination of a weapon and a musical instrument accentuates the two dimensions of struggle – physical and spiritual – which appear in harmonious unity. It is worth noting that the theme of angels playing musical instruments occupies an important place in the sacred iconography of the Renaissance. The harp, like the lyre, belongs to the emblematic attributes of heroes of classical art.

Figure 11. Relief of the monument to A. Mickiewicz in Paris, lower part

Source: Sketchline (n.d.)

The work of A. Mickiewicz in sculptural interpretation is comprehended through the prism of the artist's individual emotional perception of the idea of freedom, which is confirmed by the documentary source M.-T. Diupero (1995). The female image of the Genius of the Polish Epos functions as an allegorical embodiment of Freedom. The motif of a soaring figure with a sword is semantically linked to the image of the heroine of A. Mickiewicz's epic poem "Grażyna". The semantic parallel between the literary original and the sculptural image correlates with the aesthetic tenets of G. Hegel (1975), who defines the novel as a "bourgeois epic", stressing its representation of the panorama of social life and expression of the interests of significant social strata. In a mythopoetic dimension, the image of the heroine of the monument can be interpreted as a modified version of a Valkyrie from R. Wagner's operatic cycle (1849-1856).

In ideological and iconographic terms the continuity of A. Bourdelle's bas-relief "Genius of the Polish Epos" with the monumental canvas by E. Delacroix "Liberty Leading the People" (1830) and the high relief by F. Rude "The Departure of the Volunteers" or "La Marseillaise" (1836) on the Arc de Triomphe at the Place de l'Étoile in Paris is evident. Such a comparison reveals a common tradition of revolutionary Romanticism that formed the artistic canon of European monuments of the nineteenth century. In turn, these masterpieces have a temporally mediated iconographic connection with the reliefs of Ancient Rome. For example, the symmetrical mirroring of flying genii with a portrait of the deceased in a circle of eternity is canonical for Greco-Roman sarcophagi. The winged genius is presented at the centre of the scene of the Apotheosis of the Emperor and the Emperor's wife on the relief of the high pedestal of the Column of Antoninus Pius (161 CE) (Fig. 12).

Figure 12. Pedestal of the Column of Antoninus Pius
Source: Column of Antoninus Pius (n.d.)

The embodiment of the idea of Poland's freedom in the monument to A. Mickiewicz in Paris proved to be more significant than the classical allegory of poetic inspiration presented in the form of a winged Pegasus in the 1909 design for the monument. In the image of A. Mickiewicz there is a synthesis of literary, musical and philosophical ideas, which makes a poet a universal symbol of freedom. In the sculpture of A. Bourdelle, as one of the leaders of sculpture of the late nineteenth and early twentieth centuries, the legacy of ancient art is combined with innovation, expressed in the ideological content of a complexly constructed composition. The expressiveness of A. Bourdelle's artistic language influenced the renewal of the form of sculpture in the twentieth and early twenty-first centuries. Its echoes can be traced not only in French but also in Eastern European sculpture. In particular, the plastic language of A. Bourdelle had a mediated influence on the style of the Ukrainian sculptor O. Kniazyk.

The monument to A. Mickiewicz in Odesa (2004): The significance of the monument in the harmonisation of the urban environment. In 2004, on the central avenue of the port city of Odesa, the monument to A. Mickiewicz was unveiled (Fig. 13). Unlike the grandiose architectural monuments of Lviv and Paris, the monument in Odesa has a chamber character. It belongs to park sculpture and is successfully integrated into the green environment of the city's central avenue. The architect limited the place of its placement by shifting it into an autonomous zone and including it in the form of a circle enclosed by a low kerb. The monument is of small size: the three-metre bronze statue is set on a pedestal 1.5 m high, close to the stable form of a cube. Grey and polished pink granite, alternating rhythmically in colour, frame the figure of the poet, located on the central axis of the circular platform. In the peculiar geometric architectural "frame" of the sculptural image, the geometric forms of the cube (a symbol of the earth) and the enclosing circle, which symbolises the infinity of the sky, alternate.

Figure 13. "Monument to A. Mickiewicz"
Note: Odesa (2004)
Source: photograph by A. Tarasenko

To express the state of inner creative impulse, O. Kniazyk depicted the poet striding swiftly in inspiration. It was necessary to find the degree of conventionality in conveying movement. The internal structure, proportionality of forms and conciseness correspond to the creation of the expressiveness of the image. In the search for a solution to a complex plastic problem, the sculptor turned to the principles of the architectonics of Greek archaic art. Ancient sculptors did not depict the real rhythm of the opposite movement of arms and legs, therefore the basis was the formula of restrained dynamics of Greek kouroi, where, with the conventional depiction of the legs in stride, the calm of the torso is preserved (Fig. 14).

Figure 14. Munich kouros, 540-530 BC
Source: University of Cambridge (n.d.)

In creating a sculpture from dark metal, it is particularly important to take into account the expressiveness of the silhouette from different viewpoints. In the statue of A. Mickiewicz, in frontal view the silhouette is sustained by the vertical surge of the figure thanks

to the face raised to the sky and the open shoulders; in profile there is an added restrained aspiration forwards, emphasised by the expressive rhythms of the graphic lines of the hair and the folds of the cloak-mantle, which billows in the gusts of wind. The clothing of the figure also carries symbolic meaning: the hood is associated with wings, and the frock coat and cloak reproduce the features of the historical period. The concise solution of the pedestal and the sculpture directs the viewer's attention to the expressive face of the poet, raised to the sky (Fig. 15). O. Kniazyk carefully studied documentary lifetime images of Mickiewicz, as well as the image created by A. Bourdelle in sculpture. The face of A. Mickiewicz changed, but the characteristic feature remained the pose of self-absorption.

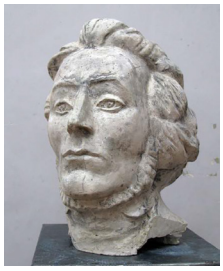

Figure 15. Fragment of the plaster model of the monument (2004)
Note: Odesa branch of the Union of Poles in Ukraine
Source: photo by A. Tarasenko

In creating the image of A. Mickiewicz, artists expressed their own perception of the genius personality. On the building of the Richelieu Lyceum in Odesa, where A. Mickiewicz worked, a memorial plaque has been installed (Fig. 16). The profile image makes it possible concisely to convey the characteristic features of the hero's face. It is no coincidence that such a viewpoint was used in coats of arms, coins, and medals. The expressive silhouette of the poet's face is inscribed in the stable form of a square. Kniazyk's "round" sculpture makes it possible to perceive it over time from different viewpoints.

Figure 16. S. Holovanov, Memorial plaque to A. Mickiewicz
Note: Odesa (1975)
Source: photo by A. Tarasenko

O. Kniazyk succeeded in creating a poetic mood in the urban environment of the southern city by the sea. The sculpture is distinguished by the absence of pathos. The figurative and stylistic analysis of the monument showed that the source for the Odesa master was not only literary texts but also works of fine art covering a wide range of historical stages of development: from Greek archaic art to the art of modernism. This indicates the author's profound knowledge of artistic tradition and the ability to synthesise different stylistic directions to create a new, original artistic language.

Comparison of the results in the context of scholarly art-historical discourse. The results of the study demonstrated that the monuments to Adam Mickiewicz in Lviv (1904), Paris (1909-1929) and Odesa (2004) are complex memorial constructs that use sacred iconography as an instrument for shaping national and local identity in different historical and political contexts. These conclusions are confirmed and developed in dialogue with contemporary research in the field of memory studies, cultural studies and urban studies. It was revealed that each monument actualised a different aspect of the archetype of the poet-leader. As M. Ruczaj (2014) showed using the example of parallels between Mickiewicz and Patrick Pearse, the canonisation of poets in monumental form is often based on messianic symbolism. The monument in Lviv fully corresponds to this model, interpreting the poet as a mediator between the earthly and the divine through the symbolism of the column as *Axis mundi*, which resonated with the theory of archetypes of C.G. Jung (1968). However, as the research of Y. Biryulov (2015) showed, this universal scheme was realised through a specific synthesis of classicism and Romanticism in the environment of Lviv at the beginning of the twentieth century, emphasising the role of the local context in shaping the memorial narrative.

D. Davies (2023) emphasised that the three-dimensional properties of material in sculpture function not as a decorative basis but as a direct means of artistic representation. This observation correlates with the analysis of the monuments to Adam Mickiewicz: in the Lviv monument (1904) the column and the vertically oriented figure of the poet actualise three-dimensionality as a spatial and semantic factor of spiritual elevation, giving the image the function of a symbolic link between the earthly and the transcendent. Likewise, in the Paris monument (1909-1929) Bourdelle used volume and mass to create the image of a prophet, which confirms Davies's conclusion about sculpture as an active spatial medium. In the scholarly context, the interaction of sculpture, architecture, and poetry is interpreted as a shared field of spatial thinking. J. Gill (2023) treated poetry as an art which, turning to architecture, reflects on its own form through the categories of scale, volume, light, shadow, and movement in space, stressing that "there is no poetry outside

space". In monumental sculpture these same categories become a universal language that unites the poetic image with the architectural organisation of the environment: an example is the monuments to Adam Mickiewicz, where the height of the pedestal, the scale of the figure and the structure of the square form not only the composition but also the way of "reading" the poet as a cultural symbol. Thus, poetry, architecture, and sculpture appear as interconnected forms of monumentalisation in which spatial parameters are directly transformed into emotional and semantic structures of cultural memory.

The Paris monument by Antoine Bourdelle reveals a strategy for presenting a national hero in a transcultural space. The iconography of the poet-prophet with a sword, which has obvious parallels with Roman sculpture and the works of O. Rodin, served to integrate the figure of Mickiewicz into the canon of European heroism. This process is consistent with the conclusions of D. Damjanović & A. Łupienko (2022) that national traditions in nineteenth-century art were actively constructed through recourse to the universal classical heritage. However, unlike the conclusions of R. Koropeckyj (2010) regarding the emphasis on messianic sacrifice in the literary myth of A. Mickiewicz, Bourdelle's sculpture stresses the active, leading role of the poet as actor, pointing to the difference between literary and visual representations.

The Odesa monument (2004) represented a contemporary paradigm of memorialisation focused on harmonisation with the urban environment and the creation of a personal, reflective experience. This approach fully corresponds to the principles set out by A. Długozima & K. Rybak-Niedźiołka (2022), who emphasised the protection of the sociocultural landscape as a component of collective memory. The chamber character and integration of the monument into the park space contrast with the vertical dominance of the Lviv and Paris variants, indicating an evolution of public commemoration from imperative, nationalising forms to more differentiated and inclusive practices.

F. Bellentani (2023) stressed that the face in monuments is a key means of communication, conveying emotions, establishing a connection with the viewer and symbolising spiritual identity. In the monument to Adam Mickiewicz in Odesa, the poet's face plays precisely this role: it is raised to the sky, the gaze directed upwards and slightly to the side, expressing a state of deep introspection and inner inspiration. The expression of the face – calm, concentrated – conveys a moment of creative impulse, which resonates with Bellentani's description of the face as an interface between the material and the transcendent. Compared with the Lviv and Paris monuments, where A. Mickiewicz's face is more dynamic or prophetic, the Odesa face accentuates introspection, which makes the monument chamber and close to the viewer, highlighting the universality of the face as a symbol of spiritual leadership and cultural memory.

E. Cotta Ramusino (2024) described the process of monumentalising the poetic figure in William Butler Yeats, where the poet turns poems into monuments to the author and friends through inscriptions on stone and autobiographical meditations. This process is parallel to the sculptural immortalisation of A. Mickiewicz: just as W.B. Yeats makes the word a material sign of presence in history, so Pöppel, Bourdelle and O. Kniazyk transform the image of the poet into a three-dimensional monument embodying spiritual leadership and the national idea. W.B. Yeats realised monumentalism in poetry as a symbolic analogue of the monument in sculpture: the author's texts function as stable forms of cultural memory. Similar to the sculptural monument, which fixes the historical figure in material, Yeats's poetry "immortalises" people, places and movements, turning these into signs of Irish identity. Thus, the poetic word in Yeats performs the same memorial and ideological function as the monument in the plastic arts, standing against time and oblivion. The conceptual framework proposed by J. Quin (2022), in which sculpture is considered not as a source of static analogies but as a dynamic language of competing ideas ("solid or liquid, permanent or momentary"), provides a key to the interpretation of the Lviv monument to Adam Mickiewicz.

Y.-f. Wu (2022) showed how the Romantic poets J. Keats and R.M. Rilke turned to ancient sculpture to comprehend their creative identity. In the author's unfinished poems about Hyperion, Keats attempted to embody the image of Apollo but rejected imperial ideology and left the project incomplete. R.M. Rilke, by contrast, saw in fragmented sculpture (non-finito) a source of vital force: the fragments of ancient statues, thanks to modelling, become "vibrating", combining the internal and the external, matter and spirit. This principle of transformation and rebirth through the fragment resonates with the monumental monuments to Adam Mickiewicz as an eternal symbol, in which the material form becomes a medium of spiritual elevation and resilience. Comparative analysis with the monuments to Taras Shevchenko confirmed the existence of a shared cultural code in the region that uses sacred iconography to legitimise figures of national revival. The identified parallels, such as the use of the motif of the Mother of God Oranta in the Lviv monument to T. Shevchenko, demonstrated how identical visual forms can be filled with different ideological content. This conclusion is confirmed by the study of S. Purici & H. Mareci-Sabol (2021) on the transformation of monuments in Chernivtsi as a reflection of changes in political regimes.

N.A. Cáceres Santacruz & X.E. Páez Coello (2024) interpreted the monument to Juan Montalvo in Ambato (1911) as a visual model of hispanophilia. The sculptor Pietro Capurro represented Montalvo as a young

writer with attributes of creativity and the allegory of the Genius of Poetry, emphasising the status as the "Ecuadorian Cervantes". Similar to the monument to Juan Montalvo, the monuments to Adam Mickiewicz (Lviv, Paris, Odesa) employ bronze, verticality and allegorical symbolism with the aim of sacralising the figure of the poet as the bearer of national identity. At the same time, the difference lies in the semantic dominants: the image of Montalvo articulates the idea of cultural continuity and symbolic alignment with the Spanish colonial tradition, whereas the monuments to A. Mickiewicz focus on the discourse of national liberation, messianism and spiritual leadership, defining sculpture as an instrument for constructing collective memory.

The analysed monuments to A. Mickiewicz are active participants in the formation of collective identity, combining local, national and European discourses. These monuments function not only as signs of the previous time, but also as cultural markers that actively interact with contemporary socio-political and cultural contexts. Thus, these monuments should be regarded not as static objects of the previous time, but as dynamic elements of the cultural landscape that continue to function under current conditions of rethinking historical heritage and national identity.

CONCLUSIONS

In the monuments to A. Mickiewicz studied, the motif of creative inspiration predominated. It was established that in their search for artistic tradition, architects, and sculptors turned to epochs with an integral model of worldview embodied in symbolic and figurative form. The interpretation of canonical compositions on the theme of spiritual revelation in the monuments to the poet testified to the preservation of the deep content of the images. In the monument erected in the square in Lviv (A. Pöppel, 1904), the architectonics of the structure emphasised the central place of the poet in the structure of the universe. Typological analysis of the iconography of the Catholic cathedrals of Munich, Ebrach and Lviv revealed a conceptual parallel in depicting the poet as a mediator between the earthly and the higher principles. In the Paris monument (A. Bourdelle, 1909-1929) A. Mickiewicz appears in the role of an apostle, raised to the top of a column – where, in the ancient Roman tradition, emperors, and saints were depicted. From a witness of events, the poet was transformed into the main protagonist, acquiring a god-like status. The use of the column and the saturated narrative content of the composition (reliefs with inscriptions) indicated the mediated use of the iconography of apotheosis in ancient monuments. From the analysis of the sculpture in Odesa (O. Kniazyk, 2004) it was revealed that the theme of poetic inspiration is devoid of social context, as evidenced by the inscription on the monument. The location of the statue on a low pedestal in the chamber space of the park integrated the image of the Polish poet into the environment of the southern city. The inner state of A. Mickiewicz is conveyed through the expressive movement of the figure, which is oriented towards the images of heroes of Greek archaic art (kouroi).

In all the monuments to A. Mickiewicz considered, the symbolism of wings as a sign of spiritual elevation and freedom can be traced. The poet appears at different levels of the axis of the universe, performing the role of mediator between the earthly and the transcendent. The pedestals or summits of the monuments (Lviv) are associated with altars, personifying the classical ideal of the citizen ready for sacrifice for the sake of the public good. The artistic and stylistic analysis carried out revealed the thematic and figurative kinship of the monuments to A. Mickiewicz with the monuments to T. Shevchenko. In the perception of the ideological content, the place of installation, the time of creation and the inscriptions played an important role. The image of the poet appears alive, combining the cultural traditions of the previous and present times and organically integrating into the urban environment. A promising direction is a comparative analysis of the transformation of the iconography of inspiration in the monumental sculpture of other European poets and musicians, as well as in the global context of post-colonial societies. Particular attention should be paid to the impact of digital technologies on the perception of monuments: the creation of virtual and augmented-reality memorials, interactive projections and digital archives may radically change the role of the poet's face as a medium of memory.

ACKNOWLEDGEMENTS

The author of the study is grateful to the editorial board of the journal for their valuable comments and technical assistance.

FUNDING

None.

CONFLICT OF INTEREST

None.

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Образи натхнення: монументи поету Адаму Міцкевичу в діапазоні сакрального мистецтва Європи

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Анотація. Актуальність дослідження полягає в потребі міждисциплінарного та компаративного осмислення пам'ятників Адаму Міцкевичу й Тарасові Шевченку як складової європейського монументального дискурсу XIX-XX століть. Метою був аналіз трансформації античної та християнської іконографії у зображенні творчого натхнення поета через монументи Адаму Міцкевичу у Львові (1904, А. Поппель), Парижі (1909-1929, А. Бурдель) та Одесі (2004, О. Князик). Застосовано іконографічний, іконологічний, культурно-історичний, семіотичний, компаративний, та художньо-стилістичний методи. Досліджено зв'язок образу поета з сакральною іконографією апостолів, святих і геніїв у мистецтві Ренесансу, бароко, класицизму та романтизму. Встановлено вплив античних і християнських традицій на архітектоніку монументів, зокрема символіку колони як Осі Світу та вівтаря як ідеї жертовності. У львівському монументі Адам Міцкевич постав посередником між земним і небесним; у Парижі – як пророк, що спирається на іконографію Апофеозу Риму й алегорію свободи; в Одесі – як образ внутрішнього натхнення, що відсилає до грецьких куросів. Композиції поєднали сакральні та світські мотиви, створюючи синтетичний образ поета. Виявлено типологічну спорідненість із пам'ятниками Тарасу Шевченку у Харкові (1935) та Львові (1992-1996), що підкреслило універсальність образу поета як духовного лідера. Результати розкрили новаторський підхід скульпторів до синтезу сакральних і світських образів, відображаючи зв'язок із європейськими традиціями. Дослідження корисне для мистецтвознавців, культурологів та дослідників взаємозв'язку літератури, скульптури й урбаністичного простору

Ключові слова: Тарас Шевченко; монументальна скульптура; антична та християнська іконографія; символізм; творчий метод; інтертекст

ISSN 2617-0272, e-ISSN 2617-0280

ART AND DESIGN
Journal homepage: https://art-design.com.ua/en

9(1), 2026

Received 13.10.2025 Revised 26.02.2026 Accepted 09.04.2026 Published: 10.04.2026

UDC 7.05:004.92

DOI: 10.30857/2617-0272.2026.1.3

Digital transformation of sketching in artistic and design activities

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Abstract. Despite the emergence of advanced design and modelling technologies, graphic sketching remains one of the primary tools for solving numerous professional tasks in design. The study aimed to identify priorities and the scope of the application of sketching, particularly its digital counterpart, in modern design practices and to evaluate its efficiency and rationality in communication, creative, and presentation tasks. The research employed methods including the analysis of information sources in design theory, examination of the properties of tools for shaping objects in architectural, industrial, and environmental design, as well as structural-system analysis and the generalisation of research findings. It was found that, in design practice, sketching is an effective visualisation tool capable of conveying key design concepts and assumptions through a system of graphic symbols reflecting the author's style. The speed of capturing an image, the freedom of modelling, and the naturalness of image creation inherent in sketching determine its rational use in creative processes and in the modelling of design forms. It was also found that digital sketching has expanded functionality: it simplifies geometric construction, supports the integration of 3D and CAD models, and provides extensive possibilities for colour and texture variation and for the transformation of graphic elements. Based on the analysis of sketching software, priorities have been identified regarding the use of digital sketches in representational visualisation tasks. Their arsenal of form-shaping resources and potential productivity has been outlined both at the stage of creative idea generation and at the stage of modelling morphological, colour-textural, constructive, and functional properties of designed objects. Prospects for synthesising digital technologies with hand-drawn graphics in the form-making process were considered. The practical significance of the results lies in the potential application of theoretical principles in artistic design practice, their integration into the educational process for art and design specialisations, and further studies in art history, cultural studies, architecture, and design

Keywords: project visualisation; graphic modelling; visual communication; artistic shaping; design process

Suggested Citation:
Berdynskykh, S., Yaremchuk, O., & Pashkevych, K. (2026). Digital transformation of sketching in artistic and design activities. *Art and Design*, 9(1), 34-43. doi: 10.30857/2617-0272.2026.1.3.

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INTRODUCTION

The beginning of the 21st century marked the digitisation of design culture, prompting a transformative shift in the perception of fundamentally new tools for visualising design objects. The phenomenon of re-evaluating the role of traditional graphic tools in communicative and formgenerating processes coincides with their convergence with computer technologies aimed at continually expanding the arsenal of modelling capabilities. Research on graphic tools for project presentation and communication is closely tied to design theory and practice, as the results of shaping procedures often depend on visual modelling methods. In this context, revisiting sketching – a rapid drawing technique that establishes a constructive and plastic basis for design solutions – becomes particularly relevant. The study focused on its digital counterpart, which has gained popularity among designers due to the development of technical devices such as graphic tablets for data input and processing.

Research by D.R. Novica *et al*. (2023) provided a systematic literature review investigating drawing as a method for idea generation in design education. The authors emphasised the rationality of using sketches, highlighting their importance in ideation processes regardless of whether they are created on paper or digitally. The relevance of drawing is associated with its potential to foster learning processes as well as creativity in various fields, as confirmed by Ch. Masi (2021). The theoretical principles of this study provide a basis for understanding the effectiveness of intellectual activity associated with the main stages of the drawing process. In the study by M. Abdullah *et al.* (2024), the necessity of integrating drawing practices into higher education was substantiated. The authors argued that drawing can enhance students' ability to think creatively and visually in both academic and professional contexts. Overall, this research emphasised the significant potential of drawing in professional training. Austrian professor G. Hasenhütl (2020) found that in the development of design visualisation, the perception of the role of hand drawing has changed, while visualisation is acquiring new forms of diagramming, coding, and modelling within the paradigm of systems design. Considering the advantages and disadvantages of hand drawing in engineering design, graphic design, and art education, the author outlined future prospects for the application of manual drawing.

L. Tan *et al.* (2025) found that architectural drawing is not only a means of conveying information but also a unique visual language capable of expressing architectural concepts, cultural memory, and social reality, thereby forming a visual archive with historical depth. M. Fakhry *et al.* (2021) identified the advantages of hand-drawn graphics as enhancing both the level and scope of innovation and creativity, ensuring the originality of physical prototypes and the constructive accuracy of details. However, the disadvantages included increased time costs for creation, especially for modification. It complicates the removal of elements, and there is no "undo" function. O. Paans (2024) examined practical techniques for stimulating creative thinking through linear drawing in the context of architectural design, emphasising that hand-drawn lines play an irreplaceable role in the creative process.

In the article by architect and educator M. Charitonidou (2022), Frank Gehry's creative sketches were analysed at different stages of his projects, during the sequential transformation and concretisation of architectural concepts. Gehry's sketching process was compared with that of renowned architects E. Miralles, A. Aalto, B. Tschumi, and Le Corbusier. The impact of sketching on final design decisions and the evolution of form-making was examined. The link between Gehry's use of continuous line and the function of sketches was analysed, as well as the role of sketches in reinforcing the kinaesthetic connection between action and thought. An analysis of various methods, approaches, techniques, and strategies in the arsenal of artists, designers, and other professionals in visual creativity was conducted by S.G. Pashukova *et al*. (2023). The authors noted that applying different sketching methods allows the identification of the most effective approaches to working with ideas and concepts. The results showed that sketching fosters the development of creative thinking, improves communication in creative teams, and contributes to success in creative professions. The study also explored unconventional applications of sketching, such as B. Kim & E.-C. Jung's (2023) approach to using sketches for conceptual combination and innovation.

The review conducted underscored the relevance of issues associated with the use of sketching and its digital counterpart in artistic and design activities. Comprehensive research is required to investigate sketching tools integrated with digital technologies in order to expand their functional capabilities. The research aimed to identify the priorities for the application of digital sketching tools in contemporary design practice, to assess their rationality and effectiveness in presentation, communication, and design search tasks for artistic form creation, and to define the boundaries of sketching in relation to its digital transformation.

MATERIALS AND METHODS

The basic method chosen was system analysis, which allowed the examination of individual elements within the complex set of means for visualising design decisions, their interrelations, interaction, and functioning as a whole. Theoretical methods of analysis and synthesis, formalisation by analogy, observation, comparison, and comparative-typological analysis were applied. The method of analysing the structural features of

design tools, both traditional and modern, for the creation of form in architectural objects, industrial design, and environmental design, as well as the latest digital formats for image visualisation, was also used. To identify key factors in the formation of project visualisation during the stages of societal evolution and to systematise the process of sketching development, a historical approach was employed. The methodological orientation of the research is based on classification and typological approaches, which reveal the forms and range of visualisation tools, highlight contradictions, and identify problem areas at the present stage of development of project visual means. The research focused on theoretical studies that directly address the identification of specific aspects of the creative process in engineering and design, as well as on studies aimed at systematising innovative approaches to solving tasks characterised by a certain level of uncertainty. The focus of the article lied on studies directed at developing tools that allow the more effective generation of innovative ideas based on scientific knowledge and technologies. The material for the research consisted of competition projects and portfolios of architects and designers. The examples of objects selected for analysis were taken from scientific literature, the official websites of design studios, and software developers. Specialised databases (Scopus, Web of Science, Google Scholar) were used to search for information sources on this topic, to conduct citation analysis, to access openaccess archives, to apply keywords and search operators, and to use machine-learning algorithms for searching and recommending articles that match the researchers' interests.

RESULTS AND DISCUSSION

Sketching was previously considered one of the main tools for creative exploration in the modelling stage of the compositional-plastic and colour properties of an object. Researchers agree that through sketching, the first methodological ideas about the object and the sequence of the design process are predominantly formed (Barreca, 2023; Giesecke *et al.*, 2023). The earliest known uses of graphic sketches in land management, construction, and the creation of sacred and public objects date back to ancient Egypt, Mesopotamia, and Greece. The complex image technologies of antiquity (clay and wax tablets, valuable papyrus manuscripts) have been preserved in historical tradition. Only with the advent of paper did graphic representation become the primary means of preserving and transmitting information about existing buildings, and later, of creating designs for future structures and descriptions of engineering mechanisms. Technical illustrations from the Gothic era that have survived provide insight into the role of drawings in the medieval construction industry. They appear schematic, with predominantly axonometric views, and are characterised by a lack of precise rules of measurement, scale, and proportion. Some sketches were likely used to depict construction joints and decorative details or to illustrate building techniques. It is believed that builders of the Gothic period used these images to construct supporting columns, Gothic windows, and stones with the necessary profiles (Smith, 2005). One of the first examples of using drawings as a tool for design activity is considered to be the work of Leonardo da Vinci – graphic models representing images of future mechanisms, buildings, and works of art (Fig. 1). During the Renaissance, the sketch became a means of conceptualising ideas that preceded the realisation of projects, thereby changing the paradigm of construction. At that time, architects gained the right to authorial control over the realisation process, thus requiring visual means to record the fundamental ideas about a structure.

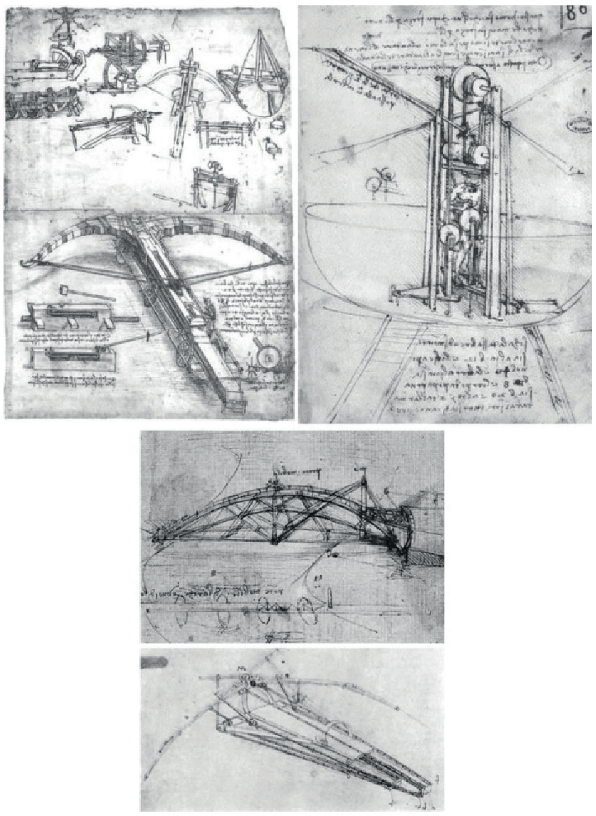


Figure 1. Drawings by Leonardo da Vinci – some of the first examples of project representation
Source: F. Zoellner (2014)

In the 20th century, sketching became a component of the professional language of designers, allowing them to capture the idealised image of a future creation in their imagination. The combination of drawing and drafting methods, together with the use of various means of representation, formed the traditional culture of design at that time. Production graphics became a progressive driving force of design, and sketching turned into a strategy for project exploration. The sketches of 20th-century architects demonstrated the

depth and conciseness of graphic expression in design ideas, generalised through a minimal number of lines (Fig. 2). Traditional artistic and design graphics, before the advent of digital tools, were at the core of design processes, using various means to model spatial-scale relationships between objects and to interpret and transform environmental forms

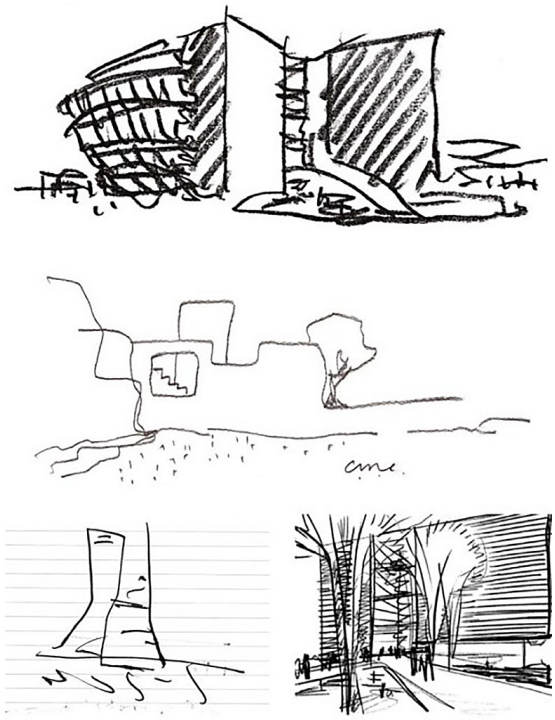


Figure 2. Sketch as a means of conceptualising design ideas
Note: works by outstanding 20th-century architects
Source: K.S. Smith (2005)

The digitisation of project culture has led to a re-assessment of the established methods of design that prevailed throughout the 20th century. Strategies for the graphical exploration of design forms have changed with the active development of 3D modelling and rendering tools, as well as with the automation of design and drafting work. The abandonment of sketching in project practice began to be observed among designers of the digital generation during the rise of computer-aided form-making methods at the beginning of the 21st century. In scientific discourse, questions regarding the appropriateness and effectiveness of hand-drawn image techniques in architectural and design formmaking processes are increasingly being explored (Gomez-Tone & Raposo Grau, 2024). For example, the book by D.R. Scheer (2014) can be considered an analysis of the causes and consequences of the displacement of drawings by computational tools in architecture. According to the author, the use of drawing and drafting graphics long defined the architect as central to the design and construction process. The replacement of drawing with Building Information Modelling (BIM) and computational design has led to a transformation of architectural thinking, as well as to a reduction in the architect's role in construction. Among the main consequences of the digitisation of design processes, D.R. Scheer identified the dominance of efficiency criteria in evaluating design decisions, the reduced influence of architects on design, the loss of the human body as the universal foundation of design practice, the rethinking of geometry's semantic field, and changes in the nature of design.

However, the current state of project culture demonstrates a trend towards an increasing demand for sketching in design fields, particularly in architecture, environmental design, graphic design, and industrial design. There are several main factors contributing to the popularity of sketches in the digital age. These include the illustrative aspect, which involves presenting a design idea through graphic techniques based on a "live" hand-drawn line with characteristic elements and accessories (hatching, stamping, etc.). In contrast to technical drawing, with standardised line thicknesses and types, minimalistic projections, uniform elements, and conventional symbols, sketching is significantly different. It includes random, chaotic artefacts inherent in a handmade style, thus making the image more playful and emphasising the connection with the author and the process of their thinking. The expressiveness of modern digital design graphics is achieved by combining sketching techniques with vector drawings and images formed through 3D modelling. The graphical toolkit of sketching allows a work to be expressive, making it more noticeable and unique. The expressive techniques of hand-drawn graphics can evoke a broader palette of emotions and associations. In an era saturated with monotonous "artificial" content, a sketch truly stands out through its personal, authorial touch. Monotonous graphic representations of design objects, such as renders created using physically accurate image calculation algorithms, create a feeling of "visual fatigue", which, in turn, leads to a demand for unique graphics. The pursuit of photorealism in the presentation of design objects has reached its peak, as the effects of artistic photography no longer always create a strong emotional impact on the client. Thus, among designers, there has been a noticeable search for new techniques of graphic expression. Furthermore, the non-photorealistic approach to image creation is oriented not only towards conveying information about the object as it is perceived visually, but also as it is understood cognitively (Szot, 2020). Therefore, such a presentation method can enhance the effectiveness of perceiving the general aspects and assumptions of a project.

In the evolution of computer technologies, stylisation as sketching has developed as one of the methods for presenting architectural and design objects. Non-photorealistic rendering (NPR) techniques have

been embedded in many computer-aided design (CAD) and 3D modelling software programs (Szot, 2020). In the professional community, experiments with visualisation techniques include creating graphic representations of architectural objects using the traditional language of design drawing. Specifically, among the graphic works of the well-known professional architectural visualiser and head of the "Design Distill" studio, A. Hogefe, there is a piece titled "Mountain Lodge Intro" (Fig. 3). In this work, the author used the geometric outline of the model and falling shadows created in the 3D program SketchUp, combining them with textures applied in the raster editor Photoshop. This example demonstrates the practice of creating a sketch through the digital processing of ready-made images, although visually meaningful forms can also be created from scratch using similar methods.

Figure 3. Digital imitation of sketching techniques in modern architectural visualisation
Source: A. Hogefe (n.d.)

The growing popularity of sketching is also tied to the promising development of its formgenerating resources. An effective sensorimotor connection is a distinctive feature of graphic form-making that renders the creative process tactile and expressive. The freedom of expression inherent in drawn sketches provides significant advantages over other modelling tools. Renowned educator J. Itten (2023) emphasised the importance of exercises for the coordination of body movements in the educational process. According to him, the realisation of the sensory content of a single form through bodily movement makes it possible to repeatedly return to the perception of all forms. In this context, contemporary scientific studies deserve attention. For instance, G. Leandri (2022), in their doctoral dissertation, demonstrated that motor activity associated with hand drawing leads to an increase in the amplitude of electroencephalographic responses compared to CAD drawing. According to the author, this evidence strongly supports the hypothesis that creativity can be enhanced through movement during manual image creation. In the process of graphic modelling, operations such as exploring design ideas through variations of prototypes, their analysis, and comparison are performed. A sketch allows for the rapid recording of visual images during brainstorming, their alteration and editing, the transformation of a form's outline at the early stages of visualisation, the investigation of component relationships, and a focus on nodes and details. Essentially, a sketch serves as a visual support for the conceptual reflection on a design idea (GomezTone & Raposo Grau, 2024; Valença, 2024). It is believed that the deliberate incompleteness of a sketch stimulates the imagination, encouraging the creator to transform the designed form in pursuit of its maximum expressiveness (Barreca, 2023).

Despite advancements in computer tools for 3D modelling and vector constructions, their limitations can negatively impact creativity by narrowing the range of possible solutions. Editing vector or 3D graphic objects can also be challenging due to their complex parametric interconnections. Furthermore, the lack of a sensitive sensorimotor link and material contact during the creation of digital objects reduces the controllability of the process. It is generally considered that important barriers in the development of computer graphics were overcome with the introduction of the electronic pen, which mimics the natural movements of the hand in creating lines and shapes. Unlike a mouse, a pen responds not only to relative movements but also to absolute ones (if the pen is placed in another area of the tablet, the cursor moves accordingly). One of the first graphic tablets appeared in 1984, namely the BitPad from Summagraphics. As it lacked an integrated screen, it required an external monitor to display images. The next significant milestone in computer graphics, which improved visual-motor coordination, was the advent of screen-integrated tablets. These devices merged the tablet and monitor into a single unit, revolutionising digital drawing. Screen-integrated tablets began to appear in the 1990s, with a notable breakthrough made by Wacom in 2001 with the introduction of the Cintiq. This was the first commercially available product with a touch screen that allowed artists to draw directly on the display using a stylus. Such devices have since become the cornerstone of modern digital drawing tablets and are widely used by designers, artists, and illustrators. In 2025, the majority of smartphones and tablets support on-screen drawing, thereby stimulating the development of digital sketching.

The development of digital tablets and pens necessitated the creation of software for sketching. Modern graphic applications extend the possibilities of

traditional drawing by providing tools that significantly enhance the formative and functional potential of this technology. The integration of tools for geometric constructions, templates, stamps, layer manipulation, perspective grids, and zooming optimises the creation of both planar and spatial images. While preserving the natural plasticity of hand-drawn art, digital sketching simultaneously introduces new tools and features that combine the conceptual freedom of sketching with the precision of digital space (Makarouni, n.d.). Sketching applications can be divided into those designed for a wide range of artistic tasks and those tailored to the creation of images for 3D architectural environments or industrial design. The primary distinction lies in the available toolsets. For example, Sketchbook (n.d.) is a well-known and user-friendly application offering approximately 100 customisable digital brushes that simulate pencils, markers, airbrushes, paints, and other media. It also includes features such as dynamic symmetry for mirrored pen strokes and geometric tools such as traditional rulers, templates, ellipse guides, and French curves. In terms of supporting designers and illustrators, Procreate (n.d.) embodies the idea of a mobile art studio. Beyond technical sketches, Procreate offers tools for expressive sketching, illustration, and animation. It provides a vast array of brushes that imitate handcrafted techniques, colour palettes, and visual effect settings. It also supports 3D model drawing with a built-in lighting studio, 3D animation export, and AR capabilities. Features such as QuickShape, StreamLine, DrawingAssist, and ColourDrop, together with image-editing tools such as Transform, Warp, and Blend, simplify sketching tasks (Procreate, n.d.).

Morpholio Trace exemplifies the diversity of tools available for spatial design sketching. According to its developers (Morpholio, n.d.), it combines the elegance and efficiency of sketch production with the intelligence and precision of CAD. The application offers sketching tools, including pens, specialised rulers, layer management features, and a stencil library, enabling designers to develop a personal graphic presentation style. Its advanced 2D drawing capabilities include intelligent colouring for regions, instant scaling for setting precise drawing parameters, and automated guide grids for constructing spatial images in central projection systems. Additionally, the application integrates 3D models into the sketching environment, an essential feature for modern design processes that rely on 3D modelling. Its AR technology allows drawing over photographs and creating 3D models from video scans of spaces. Figure 4 illustrated the range of graphic language and project tasks achievable with digital sketching.

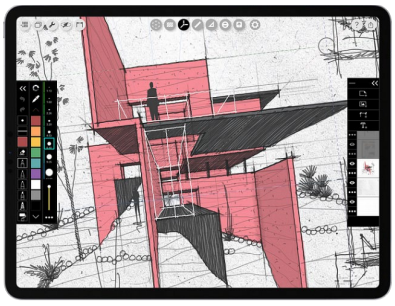
a  b  c 

Figure 4. Sketch created with Morpholio Trace
Note: a – architect J. Gregg; b – student T. Kok; c – landscape designer C. Roy
Source: Medium (n.d.)

In addition to applications designed for creating sketches and demonstration drawings, the field of digital sketching includes tools that integrate drawing techniques and stylise CAD drawings. One such program is Rayon (n.d.), which features an internal library of objects and strokes, thereby simplifying processes such as composition and the creation of mood boards for idea presentation. One of the newest and most promising areas in the development of sketching software is the creation of 3D sketches in a virtual environment, where lines are defined by hand movements within a threedimensional coordinate system. Gravity Sketch is regarded as one of the most interactive tools available. Every stroke is transformed into a SubD surface, NURBS geometry, or a polygonal mesh, which can be freely edited in any modelling software. Gravity Sketch, accessible through virtual reality or a computer, stores all projects in a shared virtual studio, which, according to the developers, is ideal for brainstorming sessions and design reviews. However, the effectiveness of such tools requires further empirical investigation. For example, data presented in a study by M. Lorusso *et al.* (2020) showed that VR systems do not offer significant improvements compared with traditional sketching tools used in graphic and screen-based interactions. Additionally, VR systems can cause physical fatigue during user interaction. A detailed comparative analysis of digital sketching applications, their advantages, and their limitations is presented in Table 1.

Table 1. Comparative analysis of digital sketching applications

Application name	Key features	Advantages	Limitations
Sketchbook	A fully functional brush system (extensive customisation options), works with layers and blending modes, drawing tools (guides, rulers, symmetry), transformation and perspective tools.	User-friendly interface for rapid sketching; historically a free or affordable alternative with a strong brush library.	Does not support 3D; inefficient for precise work with scale and dimensions.
Procreate	Advanced brush system with extensive parameter control, fast performance on iPad (optimised for Apple Pencil), layers with blending modes, transformation tools, effects, and advanced rendering capabilities; 3D model drawing function.	Implements the concept of a mobile art studio; support for working with 3D files; augmented reality support.	IPad-centric (officially iPad/iPhone only); less focused on architectural and precision CAD operations (lacks tools for scaled drawings and specifications).
Morpholio Trace	Advanced 2D drawing features: intelligent colouring of areas; automated grid guides and drawing assistance; integration of 3D models into the sketching space; tools for markup, scaling, measuring, and collaborative layers.	Sketch modelling of spatial design objects; strong focus on architectural workflow (site sketching, construction administration, mark-ups); repeatedly recognised by specialised publications; augmented reality support.	Paid (subscription or premium features); although it includes CADoriented tools, it is not a full-scale 3D CAD package (primarily a tool for sketching, annotation, and light drawings).
Rayon	The ability to create mood boards; focus on architectural drawing and presentations: rapid creation of drawings, editing of plans, conversion of PDFs into editable formats, tools for specifications and visualisation.	Positioned as a "one-stop" solution for floor plans and architectural documentation; emphasises speed and simplicity compared with complex CAD packages.	Limited artistic environment (not intended for detailed brush drawing or illustration); limited 3D modelling functionality (focus on 2D planning and documentation).
SketchUp	3D modelling with a simple interface: model creation, components, plug-ins for rendering and analytics, integration with BIM and SketchUp Pro for professional workflows; web version available.	Easy to learn for basic 3D modelling; large ecosystem of plug-ins and libraries (3D Warehouse); suitable for both conceptual modelling and the preparation of working models.	Limited to 3D modelling; does not support 2D freehand drawing; commercial features (Pro/Studio) are paid.

Source: official product pages

Thus, the priority direction in sketching development may be considered the synthesis of handdrawn image creation on planar media (screen or paper) with digital processing technologies, accompanied by the further expansion of the functional capabilities of design graphics. Existing effective 3D sketch-modelling tools (such as SketchUp) are limited in terms of control methods, primarily relying on the positioning of control points in orthographic projections. The results indicated that, despite the digitisation of design culture and the implementation of new information-based processes in form-making, the hand-drawn sketch remains the most effective form of visual communication, as well as a primary tool for creative exploration and conceptualisation in the early stages of design. This finding is consistent with G. Barreca (2023), who found that drawing continues to be one of the most immediate and effective tools for formal exploration and conceptual synthesis, as it is the only medium that enables thinking, designing, and communicating purely visually. The author emphasised the efficiency and expressiveness of sketching, noting that its unfinished nature leaves space for collective imagination. Regarding digital sketches, the findings suggest that the effectiveness of digital sketching applications may be subjective, depending on the designer's creative style, cognitive approach, and the nature of the task. This corresponds with the conclusions of C. Ranscombe & W. Zhang (2021), who examined motivational factors associated with the balance between visualisation quality and the time and effort invested. Among the advantages of digital sketching, the authors highlight the possibility of detailed elaboration and further iteration in concept development. Problematic aspects include logistical issues related to access to digital tools, as well as designers' views on trade-offs between cost, accuracy, detail, and aesthetics.

N. Yıldızoğlu (2024), in comparing traditional sketching with digital design tools, argued that traditional sketching is fundamental and vital at the conceptual stage, while computer-based methods are more suitable for the design development stage, as they provide greater precision and efficiency. The author concluded that integrating digital tools with traditional sketching enhances creative exploration and

problem-solving. The rationale for digitising sketches is highlighted in D. Dzurilla & H. Achten (2021), who noted that, while the pencil-and-paper paradigm is powerful, it has inherent limitations that restrict its innovative potential. Advantages of tablet sketching include portability, information preservation, and device longevity. Its limitations include difficulties of use in certain conditions, such as construction sites.

M. Das *et al.* (2024) found that control, proportions, and accuracy are superior in traditional sketching when compared with tablet sketching. Disadvantages of digital sketching include a weaker tactile "feel" of the tablet compared with traditional techniques, which complicates effective use. However, the authors suggested that, with training, designers could eventually draw better on tablets than on paper. Differences between paper and tablet sketches appear to be more pronounced at later stages of concept refinement rather than in the early stages.

A higher level of efficiency in traditional sketching, compared with digital sketching, was reported by M. Tufail *et al.* (2024). Paper sketches were found to activate tactile and intuitive sensations, support spatial understanding, improve problem conceptualisation, and encourage diversity of thought and innovative idea generation in the early stages of design. Conversely, digital media often encourage a stronger focus on technical drawing aspects and externally defined ideas, but enable more structured outcomes and a more targeted approach to problem-solving. Digital sketching tools can improve clarity, speed, and ease of modification, thereby facilitating effective communication and allowing designers to focus on specific aspects of their work.

Overall, research has confirmed the effectiveness of hand sketches in the early stages of the design process and digital sketches in the later stages of refinement. There is consistent evidence that hand sketching promotes intuitive thinking, rapid idea generation, and visual communication during conceptualisation, while digital sketching promotes precision, clarity, and iterative development. At the same time, the perceived effectiveness of digital tools remains largely dependent on individual creative styles, levels of experience, and the specifics of the design task.

CONCLUSIONS

It has been found that the foundation of effective sketching lies in mastering academic drawing, which is recognised as a generator of professional skills and of design and architectural culture. Sketching is a priority tool for exploring design imagery at the early stages of the project process, for conceptualising ideas, presenting key concepts, and transmitting information in professional communication. Its simplicity and cost-effectiveness enable its application in a wide variety of artistic and production fields. Priorities for using hand-drawn and digital sketches in visualisation tasks have been defined as achieving conciseness in visual expression and focusing on the main design intentions and assumptions. The value of sketching lies in presenting the designer's way of thinking, showing the development of design ideas, and enhancing the emotional, expressive, and cultural-reflective components of drawing.

The arsenal of form-shaping resources and potential productivity at the stage of modelling morphological, colour-textural, structural, and functional properties of designed objects has been outlined. The key advantages of traditional sketching include the speed of image capture, freedom of expression, and the naturalness of image creation. Despite technological advances enabling precise modelling and comprehensive 3D representations, incorporating sketching into design strategies remains relevant, as the sketching process enables qualitative changes in both visual interpretation and form morphology itself. The features and key functions of popular digital sketching applications (Sketchbook, Procreate, Morpholio Trace, Rayon, SketchUp) have been identified: the optimisation of operational tools, the expansion of transformation and automation functions, the ability to work with scalable models, the extension of colour-texture palettes, and the integration of 3D modelling and CAD drawings into the sketching environment. Supporting the naturalness of drawing in digital applications while expanding their functionality is a promising direction in the development of digital technologies. The rationality of synthesising digital modelling tools – including sketching, 3D modelling, and CAD systems – with the aim of enriching design processes with new formats of visual thinking has been confirmed.

It is established that although the shift from traditional to digital sketching occurs across all areas of design activity, there is no unequivocal dominance of digital sketching. One advantage of traditional sketching over digital lies in the qualities of interaction with physical media, tools, and graphic materials. Thus, tool choice has a significant subjective component and requires further research. A promising task is the development of scenarios for graphic modelling that leverage a diverse set of tools to effectively address specific presentation, communication, and creative-exploration challenges.

ACKNOWLEDGEMENTS

None.

FUNDING

The study was funded by the KROK University as part of the scientific work of the Department of Design.

CONFLICT OF INTEREST

None.

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Цифрова трансформація скетчінгу в художньо-проектній діяльності

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Анотація. Незважаючи на появу прогресивних технологій проектного моделювання, графічний ескіз залишається одним із основних інструментів вирішення багатьох професійних завдань дизайнера. Метою роботи було визначити пріоритети та межі поширення застосування скетчінгу, зокрема його цифрового аналогу, в сучасній дизайн-практиці, виявити ефективність та раціональність в комунікативних, творчо-пошукових та презентаційних задачах. У дослідженні використано методи аналізу інформаційних джерел у галузі теорії проектування, аналізу властивостей інструментів формоутворення об'єктів архітектурного, промислового та середовищного дизайну; метод структурно-системного аналізу та узагальнення результатів досліджень. Виявлено, що в дизайн-практиці скетчінг є інструментом ефективної візуалізації, який здатен передавати інформацію про основні проектні позиції та припущення, через використання системи графічних символів, яка характеризує особистісний стиль автора. Притаманна скетчінгу швидкістю фіксації образу, свобода моделювання та природність створення зображень обумовлює раціональність його використання в творчо-пошукових процесах та у структурі моделювання властивостей проектованих форм. Виявлено, що цифровий скетчінг має розширений функціонал: він спрощує геометричну побудову, підтримує інтеграцію 3D і CAD моделей, надає широкі можливості колірно-фактурної варіативності та трансформації графічних елементів. На основі аналізу програмного забезпечення для створення ескізів визначено пріоритети використання цифрових скетчів у репрезентативних завданнях візуалізації, окреслено їхній арсенал формотворчих ресурсів та потенційної продуктивності на етапі творчої генерації ідей, а також на етапі моделювання морфологічних, колірно-фактурних, конструктивних та функціональних властивостей проектованих об'єктів. Розглянуто перспективи синтезу цифрових технологій та рукотворної графіки. Практичне значення отриманих результатів полягає у можливості застосування теоретичних положень в практичну діяльність художнього проектування, впровадження в освітній процес мистецьких спеціальностей, а також у подальших дослідженнях мистецтвознавства, культурології, архітектури та дизайну

Ключові слова: проектна візуалізація; графічне моделювання; візуальні комунікації; художнє формоутворення; дизайн-процес

ISSN 2617-0272, e-ISSN 2617-0280

ART AND DESIGN
Journal homepage: https://art-design.com.ua/en

9(1), 2026

Received 02.12.2025 Revised 09.03.2026 Accepted 09.04.2026 Published: 10.04.2026

UDC 741.5:316.7

DOI: 10.30857/2617-0272.2026.1.4

Representation of territorial-spatial identity in modern graphic design

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Abstract. The research relevance is determined by growing value of territorial and spatial identity in the context of globalisation, as well as the need to identify trends and opportunities for socially influential institution of graphic design regarding the issue issue. The study aimed to substantiate the functionality of graphic design as a representative of territorial and spatial identity and to analyse methodology for implementing identification markers in design projects. The research process involved use of visual description, stylistic analysis, semiotic analysis, content analysis, classification, and comparative analysis methods. An increase in design community's interest in local contexts has been identified, which corresponds to socially balanced position of designers in vectors of development of modern globalised society. As a result of analysis of graphic design projects for 2021-2024, recognised by international professional communities, leading approaches and techniques for reproducing the identity of macro- and micro-spaces were identified. The study established that markers of territorial and spatial identity are evident in three ways: a single sign or a group of signs representing a material object-marker of natural environment; a space created by humans; a combination of markers of both environments with attributes typical of social actions of people in territory. The study underlined that these means reflect the levels of generalisation of territorial identity – from a single iconic sign of natural or anthropogenic origin to a complex system of symbols of tangible and intangible sociocultural connections. Levels differ in intensity of sociocultural influence on addressee, and choice is determined by project goals. The practical value of the study is determined by the use of the results by graphic designers, educators in art and design specialisations, as well as scholars in the fields of design, cultural studies, and sociology

Keywords: sociocultural identity; visual communication; cultural diversity; localisation; sustainability; interdisciplinarity

INTRODUCTION

At the end of the first quarter of the 21st century, graphic design is recognised as a significant sociocultural phenomenon whose development reflects the dynamics of the communities it serves. Institutionalisation is evident through the activities of international professional associations that cooperate with governmental bodies and educational institutions, contribute to policy-making, and organise public initiatives addressing socially relevant issues. Deep integration of graphic design into social life has fostered a growing sense of responsibility within industry, expressed in designers' efforts to identify and respond to urgent societal challenges.

L.O. Vreja & S. Balan (2023) examined crisis processes in socialisation and construction of self-identity, refuting the concept of fluid self-identity and the possibility of almost daily change. L. Kipng'etich (2024) offered a new interpretation of identity outside crisis paradigm – the concept of hybrid identity, which is formed in conditions of cultural hybridisation. According to the scholar, media content practices using inclusive and nuanced images of cultural diversity can promote better awareness and appreciation of diverse forms of cultural expression and identity among audiences around the world. O. Bartos & V. Smaga (2025) proposed a concept of global identity, defining as a form of self-awareness that reflects an individual belonging to and connection with global community. At the same time, the study emphasised that global identity does not negate other

Suggested Citation:
Udris-Borodavko, N. (2026). Representation of territorial-spatial identity in modern graphic design. *Art and Design*, 9(1), 44-54. doi: 10.30857/2617-0272.2026.1.4.

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levels of self-identification, in particular local identity, which can occur in various forms – from ethnic and national to identification with specific social groups or territories. Thus, contemporary identity emerges as a multidimensional structure that combines local and supranational dimensions.

An equally relevant aspect is the conditions for identity formation, which are considered key in both concept of hybrid and global identity. G.P. Concepcions (2025) emphasised that process of identity formation should be based on democratic principles, respect, tolerance, and sociocultural solidarity. According to the researcher, these principles contribute to development of a sense of belonging, strengthening of unity in diversity, and formation of mutual awareness between countries and cultures. J. Gimeno Martinez (2023) explored changes in perceptions of national identity under the influence of migration, also presenting it as hybrid and dynamic. On the example of a design project by D. Bustamante, the study analysed how redefinition of national symbols can spark public debate. The study emphasised the complexity of expansion of binary logic of "glorification or attack" on the nation and need for new theoretical approaches that incorporate mobility of people within national borders. Territorial identity is fundamental to construction of other components of this concept. According to M. de Jong & H. Lu (2022), territorial identity is formed based on a set of phenomena, events, and their heroes, as well as stories about them. All this, according to the authors, alongside stable spatial attributes, forms the basis with which local residents form a new self-identity. This set transforms and develops into a new symbolic form of the region and spreads in a broader extra-regional information field. M. Bartůněk & P. Marek (2025) updated periodic surveys of local communities to study evolution of socio-cultural characteristics of population and document cultural features of regions as perceived by ordinary people.

Ukrainian researcher V.O. Bobyr (2025) refined theoretical and methodological foundations for studying territorial identity by analysing Domain Name System data and search queries. On example of queries on Kyiv, the study compiled identity markers characteristic of the capital, including categories such as networks, enterprises and institutions, sports facilities, political and institutional entities and events, media, historical and cultural heritage sites, toponyms, and products. Graphic design projects challenge dominant narratives and promote social change. Thoughtful design can contribute to formation of a more inclusive society that accommodates different views and situations, and thus contributes to formation of a hybrid identity. In the context of design's influence on sociocultural processes, M. Fonseca Braga (2023) argued that sustainable development goals are becoming more feasible thanks to a comprehensive view of problems from a design perspective. In particular, actualisation of development of communities, cities, and settlements as inclusive, safe, resilient, and sustainable justifies interest and social responsibility of designers in terms of representing markers of territorial identity.

Despite a significant number of studies on identity from perspective of cultural studies, sociology, psychology, and other humanities, there was a gap in research of possibilities of graphic design as a mechanism for constructing and preserving the territorial and spatial identity of people in the globalised society of the first third of the 21st century. This determines the study aim, which was to substantiate the role of graphic design in representing territorial and spatial identity and to explore approaches to integrating identity markers into design projects.

MATERIALS AND METHODS

Achieving the set goal required analysis of empirical material. To this end, a structure of territorial identity markers was developed. It became a criteria-based scheme for selecting projects and organising them following techniques and methods used by designers. Foundation for creation of criteria structure was theory of social action by T. Parsons (1949). It substantiates the model of social reality and markers of human sociocultural identity, including territorial-spatial identity. The research methodology was also based on theory of sign systems by C. Peirce (1991), in particular triad of signs, which are organised by three types of connection between what is signified and what signifies it: iconic sign, sign-icon, sign-symbol. The source base for analysis of graphic designers' approaches to reproducing territorial identity consisted of projects submitted to international visual communication competitions in 2021 and 2024 and recognised as the best by being included in shortlists or awarded winning places (Table 1). These projects were indicative of the development of graphic design, as they have received professional recognition from a jury composed of leading and influential designers of international practice. The projects demonstrated the position of two categories of participants in the systematic development of visual communications: designers who experiment and embody new ideas (visions) and designers who already have authority and influence and set the highest standards.

Table 1. General characteristics of the source base

Project creation/publication period	From 2021 to 2024.
Project availability	Open access on international visual communications festival platforms Epica-awards, DANDAD, A'Design Award, Red Dot Award.
Project authorship	Local and global design studios from all participating countries (except for Russia).

Table 1. Continued

Necessary component	Realisability, presence of a project annotation with a description of the concept from the designers.
Functional purpose of the project, type of design	All types of graphic design submitted to the festival and competitions in which territorial identity is visually manifested, supported by a description of the project concept in the annotation from the designers.

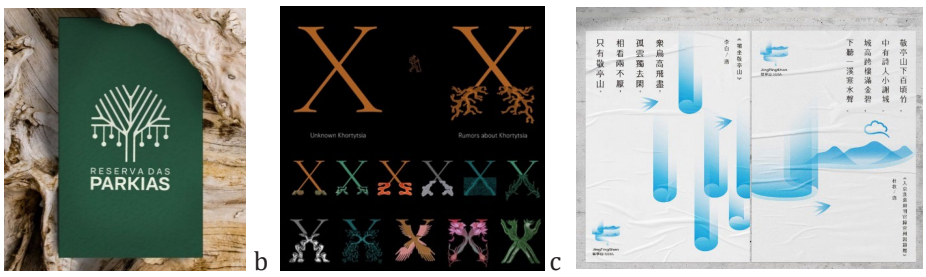
Source: compiled by author

To analyse empirical material, methods of visual description, stylistic analysis, semiotic analysis, comparative analysis and classification were used. A substantial component of the analysis were texts that justify the designers' visual proposals and reveal additional underlying meanings. Projects selected on this basis were grouped into two categories according to type of semantic connection between specific territories and design products representing them using recognisable markers. First group consisted of projects with an iconic type of connection. These projects are directly related to territories, and their graphic elements are iconic symbols of the objects of these centres. They included branding of cities or regions. Second group included projects with indexical and symbolic types of connection. Their themes are indirectly related to territories they represent. Such project concepts were deliberately chosen by designers to achieve additional socially responsible goals.

RESULTS AND DISCUSSION

The systematisation of parameters of a model by T. Parsons (1949) of social reality was used to create a list of criteria for self-identification by a social actor who is the target audience of a graphic design project and reads visual data from it: the macro-space to which it belongs (natural and artificially created by humans) – natural habitat, continent, country; micro-space – place of residence (house, apartment), place of work (office, production facility), leisure area, etc.; social action that the addressee has performed, is performing or plans to perform (goal, conditions, means); social status to which of belonging or which is referential (desirable); social roles and their typical characteristics; social interactions; combination of modes of social time; cultural affiliation. The context of the stated article topic on formation/preservation/consolidation of a person's territorial identity through graphic design addressed the first two components and their representation in graphic design projects – markers of macro- and microspace.

During analysis of first group of projects, a subgroup of projects was highlighted, whose imagery and semantics were based on reproduction of natural objects. Figure 1 showed projects in which visual concepts conveying the uniqueness of specific regions are based on local flora, fauna, and landscape features. Visual identity of the Parkias Reserve (Brazil) is based on an image of the Parkia Pêndula tree, which is iconic for local biome, executed in aesthetics of local body paintings and feather headdresses of indigenous inhabitants of Brazilian forests. In visual identity of Khortytsia Island (Ukraine), the letter X symbolises intertwined roots that transform into images of local flora and fauna, historical artefacts, images from myths and legends, bronze, water, stone and other materials of inner world of the island. Natural components form the basis of visual branding of national forest park in the picturesque Jingting Mountain area (China). Images of mountain ranges, carefree clouds and wild cranes are complemented by attributes of characteristic pavilions and towers. Notably, use of colour gradients and compositional placement of elements create an illusion of mistiness and sublimity characteristic of high-altitude areas, while at the same time easily correlating with aesthetics of digital technologies.



a b c

Figure 1. Representation of territorial identity through single objects of the natural environment

Note: an iconic type of connection between the project and the territory it represents; a – Reserva Das Parkias nature reserve, Brazil (2024); b – Khortytsia Island, Ukraine (2021), Khortytsia "Bickerstaff"; c – area in the Jingting Mountains, China (2023)

Source: Reserva Das Parkias (n.d.), Bickerstaff.658 "Bickerstaff" (n.d.), Jingting Mountain scenic area (n.d.)

The sign systems of the second subgroup of projects contain a combination of natural components and those that are the results of human activity (Fig. 2). In promotional poster for Feixi County (China), calligraphic characters "fei" and "hi" contain images of representative modern structures (industrial parks, bridges, high-speed railways and skyscrapers) and cultural heritage (local recognisable palaces and ancient buildings with historical and cultural imprints). Image style of cultural event celebrating the New Year in historical and cultural gardens of Joyful Garden Tour (China) is based on pictograms of local buildings of traditional architecture and a dragon (the symbol of 2024). Notably, colour scheme of the project (blue and pink) was chosen to reflect new vitality that has emerged from the long history. Elements of territorial-spatial identity are also present in visual accompaniment project for games of Japan's main basketball league, namely buildings and landmarks that identify the host city of Mito. Compositional modules feature random arrangements of photo portraits of sports stars alongside symbolic images of traditional and modern buildings, as well as cherry blossoms and fish. Projects contain symbolic combinations of natural attributes of territory with attributes of historically established social actions in these centres. Such content presents the multi-layered nature of social reality that surrounds a person in their perception, and therefore the complexity of their territorial identity.

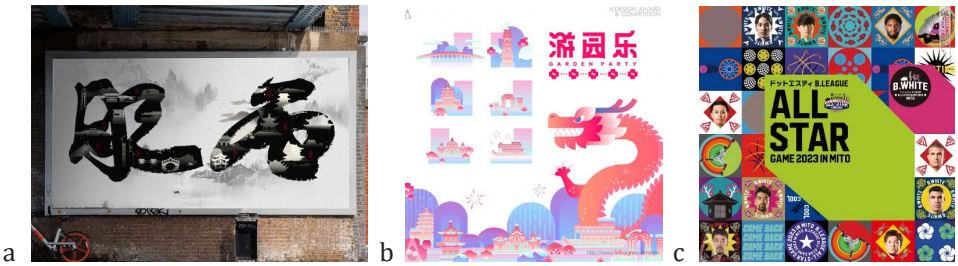


Figure 2. Representation of the macro-space identity through a combination of natural ecosystems and man-made environment objects
Note: an iconic type of connection between the project and the territory it represents; a – Feixi County, China (2023-2024); b – Joyful Garden Tour event, China (2024); c – Mito, Japan (2023)
Source: The impression of Feixi (n.d.), Joyful Garden Tour (n.d.), B. League All-Star Game 2023 (n.d.)

A notable example of redefined elements of microspace, namely local everyday life, is presented in identity of Brazilian Roots Restaurant, located in Amsterdam (Netherlands) (Fig. 3). Brazilian designer reinterpreted such elements of Brazilian everyday culture as checkered tablecloth, which traditionally decorates tables in bars and homes, as well as tambourine, an essential musical instrument for accompanying traditional samba. Thus, square pattern comes from traditional tablecloth, and visual symbols filling these squares are associated with dining (plates and glasses) and entertainment (dancing and music). The colour scheme (pastel variations of green, yellow, and blue) refers to the Brazilian national flag.

Figure 3. Representation of microspace identity through man-made objects
Note: an iconic type of connection between a project and the territory it designates
Source: R. Gomes (n.d.)

Three projects presented in Figure 4 are the result of preliminary research and demonstrate a systematic approach to representation of territorial and spatial identity of the region. Efficiency of territorial and spatial identity of a particular region is related to a systematic approach to representation and preliminary research. A series of stamps, printed materials, and an interactive web application interface created for Japanese railways as part of My Japan Railway brand communication campaign feature identifying images of over 900 stations across the country. They present what is most characteristic of region and include, in addition to natural objects (Mount Fuji, bridges over gorges and reservoirs, unique structures), dishes, drinks, and people engaged in traditional local activities and sports. All components of the project reveal not only travel between regions, but also value of diversity of everyday life in Japan, as well as possibility of diversifying lifestyle simply by moving to another station. The project as a whole reveals social reality not only of a specific station area, but also of a macro-space of Japan in historical socio-cultural development. A similar approach was used for cultural rebranding of tourist region of Kukup (Malaysia). Project logo features an image of a fish and the colour blue, associated with sky and ocean as main natural features that define way of life in the region and symbolise peace and freedom.

While the fish is a dominant conceptual character, territorial and spatial identity is revealed through a wide range of images of local architectural forms, from palaces to fishermen huts on stilts, religious buildings, boats, tableware and household items. Identity of Schweizer Berghilfe, an organisation dedicated to economic development of disadvantaged mountain regions in Switzerland, reveals the appeal of places and character of local people not only through photographs, but also through language of concise pictograms that have been used to mark roads and farms in Alpine regions for centuries. The project's logo and pictograms depict mountains, forests, water bodies, and typical occupations of the inhabitants (agriculture, cattle breeding, carpentry, construction). Minimalist images reflect an in-depth study of the region with established systemic links between the various components of socio-cultural development. They represent elements of macro- and micro-space. This significantly increases variability of identity representations and interpretations of images in projects by target audience, ensuring that a larger number of people are reached.

a  b  c 

Figure 4. Representation of macro-space identity through complex sign systems of natural objects, man-made objects, and attributes of traditional social actions
Note: an iconic type of connection between the project and the territory it represents; a – My Japan Railway, Japan (2024); b – Kukup, Malaysia (2024); c – Schweizer Berghilfe, Switzerland (2022)
Source: My Japan Railway (n.d.), Be a fish in Kukup (n.d.), Schweizer Berghilfe (n.d.)

In projects under consideration, semantic connection between implied by project and image that signifies is direct, thematically determined and visible. Manifestation territorial identity through depiction of iconic and indexical signs of macro-space objects in projects representing a specific territorial centre is logical and predictable. Second group of empirical basis of the study included projects with indexical and symbolic types of connection between a product or service and a sign system representing a specific territory. As in the first group, there are projects in which imagery is based on images of nature and projects in which the sign system is synthetic in nature. Figure 5 showed projects in which visual communication is achieved by highlighting a single object. In addition to unique regional significance, this object is imbued with semantics formed within local culture. For example, packaging of Green Field Watchmen rice, grown in highly ecological environment of Hangzhou (China), features images of wild animals and birds from product's place of origin. Images of roe deer, red cranes, Manchurian tigers, scaly cormorants and sables have miniscule connection with rice as such, but their indirect connection is the demonstration of territorial spatial identity, thus carrying deep meaning. Use of peony flower on the label of the Shun Pin Lang alcoholic beverage bottle is justified not only by physical prevalence in China, but also by symbolic meaning of prosperity, good luck, favour and abundance, reinforced by symbolism of the colour blue, such as wisdom and broad horizons, which, according to the designers, brings a sense of joy and harmony to users. Use of panda image in two variations for identity of a creative company producing various fashion accessories, based in Chengdu (China), is expected given the uniqueness of this representative of fauna, which lives exclusively in China and, accordingly, is a substantial component of national territorial and spatial identity. Symbol of Tahitian airline Air Tahiti Nui is a tiare flower, which is a key element of the island's identity, embodying exceptional and sincere impressions and hospitality. Asymmetrical image of a white flower with seven petals, whose shape emphasises authenticity and organicity in reproduction, is used on various media with compositional transformations. Image of a flower is also key in the set of image materials for the Slovak national folk ballet "Luchnica". Stylised form of a wildflower, as a generalised image of wild vegetation of those lands, symbolises beauty, fragility and, at the same time, vitality and endurance. These are traits that designers have endowed the figure of the dancer with, whose silhouette resembles a stage costume and a flowering plant. The examples discussed demonstrate that emphasis on visual communication on a single image provides a profound and convincing conveyance of territorial and spatial identity. Such an object acts as a carrier of multi-layered cultural, symbolic, and value-based meanings rooted in local context. As a result, design not only identifies place of origin, but also forms an emotional connection between the product, culture, and consumer.

Figure 5. The representation of macro-space identity through individual objects in the natural environment
Note: the indexical and symbolic type of connection between the project and the territory it represents; a – Green Field Watchmen rice, China (2022); b – Shun Pin Lang 480 Blue, China (2023); c – Six Pandas company, China (2023); d – Air Tahiti Nui, Tahiti (2020s); e – Lúčnica, Slovakia (2024)
Source: Green field watchmen (n.d.), Shun Pin Lang 480 blue (n.d.), Six pandas (n.d.), FutureBrand (n.d.b), Lúčnica (n.d.)

A more comprehensive representation of natural locations is presented in Figure 6. These projects reveal contextual connections and demonstrate a macro-space in all complexity and evolution. The labels on Love Hanshui water bottles feature images of protected wetlands and tourist attractions in Wuhan (China), combined with four local animals (finless porpoise, blue duck, black stork and elk), representing four seasons in this location. Design of the gift set for guests of the Oasyhotel cottage resort in the hills of Tuscany (Italy) is based on images of animals and birds, which are presented as icons on a graphic map of local forests and characters on packaging in form of a tangram game.

Figure 6. Representation of macro-space identity through a group of natural environment objects
Note: indexical and symbolic type of connection between the project and the territory it represents; a – Love Hanshui water labels, China (2023); b – Oasyhotel hotel, Italy (2022)
Source: Love Hanshui (n.d.), The 6th "When in the woods" (n.d.)

Second subgroup in this category of selected projects reproduces, in addition to the specifics of the natural habitat, the results of human communities' activities (Fig. 7). These products of activity remained relevant and have become stable markers of space. Mineral water "Hang Water" producer features iconic landmarks of Hangzhou (China) on labels, covering history, culture, environment, ecology and modernity (the archaeological ruins of Liangzhu, the Grand Canal, West Lake, Sisi National Wetland Park and the venues of the Asian Games). The redesign of Acqua Panna® water labels and advertising materials features images of hills and cypress trees. Designers stated that by demonstrating the Tuscan spirit and way of life, they have created a visual universe that resonates with consumers in their everyday lives (FutureBrand, n.d.a). The source of colour for the advertising campaign for this water is also macro-space objects – tiles on the roofs of iconic

architectural structures and fields of purple irises. The labels of a limited series of bottles for dairy products from Ukrainian manufacturer Halychyna in 2022 presented territorial identity of 14 historical regions of Ukraine. They contained images of landscapes with key objects of these locations. Graphic map of the country is features a linear composition that synthesises individual landmarks and natural features. Design of labels and soft packaging for Green Captain, a producer of traditional products from Šipan Island (Croatia), is based on recreation of authentic atmosphere of the area, maritime, natural island and architectural heritage. Wine labels feature patterns with pictographic and concise images of sea waves, seafaring attributes, olives, carob fruits, bridges, buildings and architectural details in four colours with several shades. Images of tangible and intangible heritage formed by long-term human activity in a particular territory ensure the recognisability and historical continuity of territorial identity. This approach combines local context with modern forms of communication to create a coherent and emotionally rich image of a place.

Figure 7. Representation of the macro-space identity through a combination of natural ecosystems and man-made environments

Note: an indexical and symbolic type of connection between the project and the territory it represents; a – labels for Hang Water mineral water, China (2023); b – Green Captain brand, Croatia (2024); c – Galychyna milk products, Ukraine (2022); Acqua Panna Italy (2022)

Source: Images of Hangzhou scenery (n.d.), Bickerstaff.658 "We instead of me" (n.d.), Green captain (n.d.), FutureBrand (n.d.a)

Use of all three types of signs reproduces territorial identity, albeit at different levels of semantic connections. When used in design, symbols reveal a deeper connection, which, on the one hand, requires additional descriptions in brand stories, and on the other hand, provides broader connotations, imagery, communicative effect, and cultural influence on recipient. Demonstration of markers of territorial spatial identity in graphic design projects is implemented by various compositional and semantic means. Examples generalised that territorial-spatial identity in graphic design projects can be manifested in three ways (Table 2).

Table 2. Structure of project approaches to representing territorial-spatial identity in graphic design

Approach	Natural space	Space created by humans
A single material object characteristic of a specific territory	An object of living or non-living nature	A building, a household object, or any other marker of physical space
A group of material objects characteristic of a specific territory	Exclusively natural components that comprehensively represent the natural ecosystem	A complex of buildings of ancient or modern architecture, monuments, bridges, unique small architectural forms
A mixed combination of natural and man-made elements		
A group of objects and related social actions and interactions of people that are typical for a specific territory	Objects of flora and fauna around which traditional crafts and ritual events were formed	Man-made attributes of traditional customs and modern types of production, sports, entertainment, culture

Source: compiled by the author

Main condition for graphic reproduction of identity markers is a combination of conventional schematisation and maximum recognisability through characteristic details and proportions. Recognisability in specific terms ensures representation of space through a painted object outside of general context and, accordingly, reproduces territorial and spatial identity. A design that uses only one sign of territorial and spatial identity focuses the viewer's attention on that object, therefore selection is based on complex reasoning. In such cases, image-identifier combines the of an index sign and a symbol sign, since the appropriateness of choosing this particular identifier is justified by symbolic links with theme of the project. The second and third approaches are used for serial projects or those with variable content branching. In cases where graphic design represents a specific centre, territorial and spatial identity is usually manifested in project in a complex and synthetic way. It is based on a systematic method that reproduces social and cultural components in an inseparable integrity.

Graphic design projects, whose role in shaping meanings and influencing the consciousness and behaviour of recipients has been repeatedly proven by various publications (Raff, 2012; Norman & Stappers, 2015; O'Shea, 2024), can be an influential factor in reproduction, transmission and preservation of people's socio-cultural identity in changing social reality. Despite graphic designers' attraction to the visual language of universal supranational design, whose principles were stipulated in late modernist period, there is now a growing interest in and awareness of value of local component. This applies to both semantic content and graphic representation. An increase in number of projects presenting markers of territorial and spatial identity will contribute to greater respect for diversity of local identities in the context of hybridisation and globalisation. The acceptance of projects with local representations and the recognition of their significance at international competitions confirm the implementation of a course of democracy and inclusiveness.

Analysis of projects revealed that designers often refer to symbolic systems representing a particular region, its history, and cultural heritage when developing project concepts. In addition, this approach, combined with thoughtful stylistics, creates project images that are recognised by professional international community as most memorable international experience. This suggests that despite minimisation of significance of territory factor in context of globalisation, it remains integral to human social activity, issues of identity, and construction of visual communication process. According to L. Kipng'etich (2024), in situations of layering and ambiguous combinations of various sociocultural aspects in a subjective model of human self-determination, markers of objective surrounding space of a person's stay, which they perceive and fix in their memory, organise and stabilise identification responses.

A study of project annotations showed that designers' approach to theme of territorial identity requires preliminary collection of materials and justification of logic for selection of certain markers, as well as their implementation in a specific design. However, as W. Liu (2022) highlighted, not all designers are aware of and master inner meaning of regional cultural markers and highlight only visual effect of f does not exist in projects submitted to international competitions, as they are accompanied by teamwork oorms, which are chosen rather superficially. This problemr personal responsibility of designer as a professional. This experience should be disseminated on a smaller scale.

According to M. de Jong & H. Lu (2022), a wide range of markers of territorial identity includes regional climatic conditions, topography, hydrogeology, animal resources, historical relics, historical remains, cultural resources, as well as signs of various activities and behaviours of people in space. Cultural markers include cuisine, characteristic artistic events, public performance traditions, historically formed public buildings and infrastructure. F. Knaps & S. Herrmann (2018) and M. Buschgens *et al.* (2019) considered elements that are perceptually perceived and create spatial organisation, natural phenomena (trees, mountains, and weather), as well as the role of people in creating the physical environment (architecture, clothing, and art), as substantial. According to results of a survey of Saudi Arabian designers conducted by W.M. Aleshawie (2019), 50.8% of respondents refer to architectural symbols (famous architectural and historical monuments and iconic modern structures) in their practice; 50.8% use images of animals and plants associated with macro and micro-space, and half (55.6%) of respondents use various references to lifestyle, including cuisine, clothing, and behaviour at work and leisure.

Review of projects in the article confirmed diversity of designers' approaches towards creation of a visual concept and using a wide range of territory markers. Result and addition to discourse on the topic is the structuring according to criteria of representation of natural objects, man-made objects, and mixed systems. Such systematisation is relevant for analysis of future projects to determine priorities in selection of markers. In addition, it is beneficial for practicing designers, who can use it as a project matrix. Attributes of social actions and interactions between people, which are recorded by historical objects and what has been created in the present, are also added to markers of territorial identity. The selection between a single object or a group of different markers depends on the complexity of the project task, seriality of developments, and target audience for which project is intended. At the same time, according to results of the review, projects in which the index or symbolic type of connection between the

project and the territory prevails have a deeper and more unexpected impact. Based on analysed projects, sign systems representing artificially created markers of territories mostly contain objects of tangible and intangible heritage. This confirmed the view of S.M. Hassan & T.A. Al-Dajani (2025) that graphic design is substantial for documentation and presentation of socio-cultural heritage, while T.H. Nguyen (2024) insisted that preservation and promotion of traditional values, identity, and tangible and intangible cultural values is one of primary tasks of educating global citizens in modern context of global integration and meets common global criteria. Thus, construction of a design concept based on the idea of representing territorial identity is a method of harmonising social reality, facilitating social orientation, and expanding functionality of graphic design to the level of social design.

Conscious emphasis on preservation and promotion of territorial and spatial identity is a counterbalance to tendency of modern graphic design toward a single global style. Appeal to identity markers is defined by designers and scholars not as an escape from the problem of globalism, but as a consciously chosen mechanism for transmitting cultural diversity to harmonise cultural hybridity. An analysis of concepts and approaches to identity reproduction projects by scientists and designers from different countries shows that the main tool is a system of visual signs, semantics of which reveal the sociocultural uniqueness of communities and modern societies.

CONCLUSIONS

The analysis of theoretical studies and internationally recognised graphic design projects (2021-2024) demonstrated a growing professional interest in local contexts and representation of territorial and spatial identity. Although universal supranational visual language remained widespread, contemporary design practice increasingly emphasised identity-based approaches. The study identified three main ways of implementing territorial identity markers in graphic design projects. First involves use of a single material object typical of a specific area, either natural or man-made. Second method is based on representation of a group of material objects characteristic of a territory, including natural ecosystem elements or architectural and cultural landmarks. Third approach combines material markers with social actions and interactions associated with a locality, such as traditions, customs, production, sports, and leisure. In general, these three methods reflect different levels of generalisation of territorial identity – from a single symbol to a complex system of tangible and intangible connections.

Analysis of projects demonstrated that designers adhere to priorities of sociocultural development of modern globalised society, which are widely declared by social analysts and scientists. This influences concepts of their projects, choice of methods and means of developing project images, and choice of techniques, materials, and technologies. Furthermore, it demonstrates their social inclusion in social processes. A promising direction is further analysis of interdisciplinary cooperation between designers and scientists, particularly in fields of cultural studies, sociology, and anthropology. Another relevant area is development of pedagogical models for professional training of graphic and digital designers, in which preservation of cultural identity is considered a component of social responsibility. This involves integration of research approaches, critical analysis of local context, and ethical principles into educational programs, which will help future designers develop cultural meaning handling skills.

ACKNOWLEDGEMENTS

None.

FUNDING

This work received no external funding.

CONFLICT OF INTEREST

The author declares no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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Репрезентація територіально-просторової ідентичності в сучасному графічному дизайні

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Анотація. Актуальність дослідження зумовлена зростанням значущості територіально-просторової ідентичності в умовах глобалізації, а також потребою у виявленні тенденцій і можливостей соціально впливової інституції графічного дизайну у динаміці цієї проблематики. Метою роботи було обґрунтування функціональності графічного дизайну як репрезентатора територіально-просторової ідентичності та вивчення методики впровадження її ідентифікаційних маркерів у дизайн-проєкти. У процесі дослідження застосовувалися методи візуального опису, стилістичного аналізу, семіотичного аналізу, контент-аналізу, класифікації та порівняльного аналізу. З'ясовано зростання інтересу дизайнерської спільноти до локальних контекстів, що відповідає соціально виваженій позиції дизайнерів у векторах розвитку сучасного глобалізованого суспільства. В результаті аналізу проєктів графічного дизайну 2021-2024 років, відзначеними міжнародними професійними спільнотами, визначено провідні підходи й техніки відтворення ідентичності макро- і мікропросторів. Встановлено, що демонстрація маркерів територіально-просторової ідентичності реалізується трьома способами: одиничним знаком або групою знаків, що репрезентують матеріальний об'єкт-маркер природного середовища; простору, створеного людиною; поєднання маркерів обох середовищ із атрибутами типових для території соціальних дій людей. Узагальнено, що зазначені засоби відображають рівні узагальнення територіальної ідентичності – від окремого іконічного знаку природного чи антропогенного походження до комплексної системи символів матеріальних і нематеріальних соціокультурних зв'язків. Рівні відрізняються інтенсивністю соціокультурного впливу на адресата, їхній вибір визначається проєктними цілями. Практична цінність роботи полягала у використанні результатів графічними дизайнерами, освітянами мистецьких і проєктних спеціалізацій, а також науковцями у галузі дизайну, культурології, соціології

Ключові слова: соціокультурна ідентичність; візуальна комунікація; культурне розмаїття; локалізація; сталий розвиток; міждисциплінарність

ISSN 2617-0272, e-ISSN 2617-0280

ART AND DESIGN
Journal homepage: https://art-design.com.ua/en

9(1), 2026

Received 10.11.2025 Revised 23.02.2026 Accepted 09.04.2026 Published: 10.04.2026

UDC 004.9:159.954-053.9 DOI: 10.30857/2617-0272.2026.1.5

Inclusive design strategies for older users of digital healthcare services

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Abstract. Digital health applications have become routine tools for older adults to register appointments, pay medical fees and purchase medicines, yet many interfaces still impose heavy cognitive and operational demands. This study aimed to identify information-processing barriers faced by older adults when using the Chinese mobile health app Chunyu Doctor and to propose stage-based interface improvement strategies. 16 adults aged 60-70 years with prior experience of health apps completed semi-structured, one-on-one interviews while performing consultation, medication purchase and insurance settlement tasks. Interview transcripts were coded thematically and mapped onto three stages of interaction: perception, cognition and execution. The analysis revealed that perception barriers arise from dense screens, weak text and icon legibility, ambiguous tappable areas and hardly noticeable audio prompts. Cognitive barriers involved technical terminology that exceeds immediate comprehension, icon metaphors that do not reliably signal function, and section structures that conflict with users' task logic. Execution barriers centre on difficulty locating key functions, demanding gesture operations, lengthy branched flows and tight time limits in steps such as verification codes. On this basis, the study proposed stage-specific design strategies that reorganise navigation around medical tasks, rewrite critical text in plain language, adjust icon sets and grouping, and relax temporal and feedback constraints. The results offer a process-based reference for evaluating and improving age-friendly interaction in digital health services

Keywords: information processing model; interaction barriers; aging-friendly design; cognitive load; user interface

INTRODUCTION

Smartphones and various medical apps have penetrated the daily lives of older adults, and tasks such as making medical appointments, paying fees and keeping in touch with family and friends are increasingly carried out via mobile devices. Most existing apps are designed with the operating habits of younger and middle-aged users as the primary reference, which leads to information-dense interfaces and deep navigation hierarchies. His neglect of differences in perceptual abilities, cognitive load and motor performance among older adults results in high cognitive demands during use and undermines their trust in digital services and willingness to use them.

Research on older adults' use of mobile health applications and intelligent interfaces has increased. According to Q. Wang *et al.* (2022), a scoping review of 96 publications showed that usability evaluations of mHealth applications for older adults have focused

Suggested Citation:
Liu, Y., & Rubanka, A. (2026). Inclusive design strategies for older users of digital healthcare services. *Art and Design*, 9(1), 55-64. doi: 10.30857/2617-0272.2026.1.1.5.

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mainly on indicators such as satisfaction and learnability, whereas memorability and error rates have been examined far less systematically. Many studies continue to apply evaluation instruments developed for younger adults, which may conceal age-related operational burdens. Drawing on a systematic review of 65 studies, W. Septiani *et al.* (2024) pointed out that the field relies heavily on the system usability scale, but that studies with older participants often need to be complemented by interviews, think-aloud protocols and behavioural observations in order to identify hidden barriers related to vision, motor actions and comprehension. Drawing on multiple empirical studies, M. Gomez-Hernandez *et al.* (2023) summarised design guidelines for mobile applications targeting older users, providing detailed recommendations on typeface and weight, contrast, icon semantics, information grouping and navigation depth. They emphasised that such guidelines should be grounded in documented usability problems rather than based solely on designers' experience. R. Kirkscey (2020) proposed a combined approach to mHealth application development and user experience evaluation. Using an osteoporosis-prevention app as a case, the study showed how to enumerate different stakeholders during requirements gathering, identify cognitive and operational constraints among older users, and then apply multiple evaluation methods throughout subsequent design iterations. In a field study of older adults' use of health apps, A. Khamaj & M.A. Abdulelah (2024) identified specific difficulties such as small font sizes, densely packed touch targets, multi-level menus and unclear feedback. They argued that interface structure and interaction flows should be adjusted together to reduce these burdens. X. Mattick *et al.* (2025) went further by mapping typical difficulties experienced by older users onto usability and user experience metrics. They proposed a matrix that links operational errors, disorientation and visual fatigue to navigation clarity, touch accuracy and visual hierarchy, thereby providing a testable reference for design evaluation. B. McCarthy *et al.* (2024) incorporated health status and degree of cognitive decline into the analytical framework, and found that older adults with mild cognitive impairment are more likely to become lost in navigation or repeat operations, and that once interface structure becomes complex, these differences are further amplified. Comparing interface designs across different online learning systems, A. Shi *et al.* (2021) found that older users' working-memory load increases markedly under multitasking conditions and deep navigation structures. Their findings suggest that if navigation on smartphones becomes too hierarchical, it directly increases the burden of retaining information and recalling paths. Analysing selective visual attention among older adults on fresh-food e-commerce interfaces, J. Ye *et al.* (2025) showed that complex backgrounds and scattered layouts prolong search time. When the product area and distracting elements were simplified, older users' gaze concentration and operational efficiency both improved.

Based on the above research results and identified gaps, this article aimed to compile a list of barriers to interacting with information that older adults encounter at various stages of using digital health applications, based on their experience in performing real-life medical tasks. Based on this, recommendations were proposed for evaluating and improving user-friendly interfaces for older adults in such applications.

MATERIALS AND METHODS

As the share of mobile health services in scenarios such as appointment registration, fee payment, medication purchase and insurance reimbursement continues to grow, these applications involve more procedural steps and denser information than everyday social and entertainment apps, which makes interface-use problems arising from cognitive aging more pronounced. This study takes digital health applications as its object of analysis and focuses on the information-interaction barriers that older adults encounter at each stage of use, with Chunyu Doctor selected as the specific case for in-depth analysis. On the one hand, this application has a large user base in China's mobile healthcare sector and brings online consultation, appointment registration, medication purchase and health-insurance services together on a single platform, making it a tool that older adults commonly use in real care-seeking situations. On the other hand, each of its screens integrates multiple entry points and information modules, and the task flows are relatively long with high information density, covering key decision points such as costs and medication as well as auxiliary content such as health information.

This study draws on human information processing models and divides older adults' interactions with mobile applications into perception, cognition and execution stages in order to identify weak points in the use process (Card *et al.*, 1983). The perception stage corresponds to information input, during which users obtain stimuli such as text, icons and sounds presented on the interface through various senses. In the cognition stage, users rely on their current state of attention and working memory, together with their prior usage experience, to interpret, filter and associate the input information. The execution stage unfolds after comprehension has been achieved, as users make choices and carry out actions such as clicking, swiping and typing; the smooth progression of this stage depends on timely feedback from the interface, clear task paths and a relatively coherent interaction flow.

According to the official definition in China, people aged 60 years and above are classified as older adults (Law of the People's Republic of China on the Protection of the Rights and Interests of the Elderly, 2018).

Survey data indicate that adults aged 60-70 are more active users of smart devices and, overall, still maintain good autonomous operating and communication abilities (Beijing Municipal Bureau of Statistics, 2022). Accordingly, this study restricted participant ages to 60-70 years and used semi-structured one-on-one interviews to collect their usage experiences with digital health applications. The study was conducted in accordance with the ethical principles for research involving human participants set out in The Declaration of Helsinki (2013). Participants were required to have basic independent mobility and self-care abilities, no obvious cognitive impairment, ongoing experience with smartphone use, and repeated exposure to digital health applications in everyday life. Based on these criteria, a total of 16 older adults who had prior experience using digital healthcare apps were selected for interviews. The average age of the participants was 62.9 years (SD = 3.31), with a gender ratio of 1:1. The interview guide (Table 1) was developed based on the stage-based information processing theory (Card *et al*., 1983), with questions designed to elicit perceived barriers related to interface elements, information comprehension, and task execution.

Table 1. Interviews guide: Questions for evaluating interaction with a digital medical application

Information processing stage	Sample questions
Perception stage	When interacting with the digital healthcare app interface, which visual elements make it difficult for you to recognise or distinguish information? (e.g., small font size, low contrast)
Cognition stage	When reading information on the digital healthcare app, do you find it difficult to understand or interpret certain content? (e.g., medical terminology, test results, colour codes)
Execution stage	When using the digital healthcare app, what operations do you find confusing or difficult to perform?
	In your experience with the app, which tasks make you feel hesitant or uncertain?
	For improving the app's suitability for older users, in which aspects do you think further improvements can be made?

Source: compiled by the authors

The study selects digital healthcare applications as the research subject, focusing on the information interaction barriers encountered during the stages of perception, comprehension, and execution. Another stage of the study was the development of a relational model based on the theory of step-by-step information processing, linking elderly users, stages of information processing, and interface elements. The model was used to analyse the main functional interfaces of the Chunyu Doctor application and identify the problems faced by elderly users at different stages of interaction. Recommendations were then developed to improve the perception of information by elderly people in applications.

RESULTS AND DISCUSSION

The case app selected for this study is Chunyu Doctor, a mobile health platform integrating health consultations, online medication purchases, and medical services. Figure 1 presented four key functional pages of the app's interface. The home page (Fig. 1a) focuses on quick consultations and frequently used services, including features like "Find a Doctor", "Medicine Delivery", and "Video Consultation". The interface is densely populated with icons and contains promotional banners and multiple navigation modules, which may increase the cognitive load for elderly users during information recognition and interaction. The medication purchase page (Fig. 1b) categorises common drug types and includes a search bar, category navigation, recommended products, and a health lifestyle section. While the functions are clearly laid out, the multi-layered interface may pose a learning barrier for users with declining cognitive abilities. The health information article page (Fig. 1c) provides content in categories such as "Trending", "Expert Insights", and "Daily Life", mainly in text-image format. It supports pull-to-refresh and keyword search, offering low reading thresholds that may help stimulate older users' interest in health knowledge. The AI consultation page (Fig. 1d) features the intelligent assistant Huiwen, which enables natural language interactions to support health inquiries, symptom questions, and medical advice, thus streamlining the operation process. While Chunyu Doctor offers comprehensive healthcare services, its interaction complexity remains relatively high. In aspects such as interface density, icon recognisability, font size, and navigation design, the app presents challenges for elderly users experiencing cognitive decline or visual impairment. Therefore, this app is one of the typical representatives of research on human factors barriers to the use of health mobile apps by older adults.

The results of the study showed that the developed relational model effectively links older users, information processing stages, and specific interface elements, as shown in Figure 2. Thanks to the application of the model, the stages at which elderly users encounter difficulties were identified, as well as the corresponding interface elements, which made it possible to determine the distribution of problems between the stages of interaction with the application.

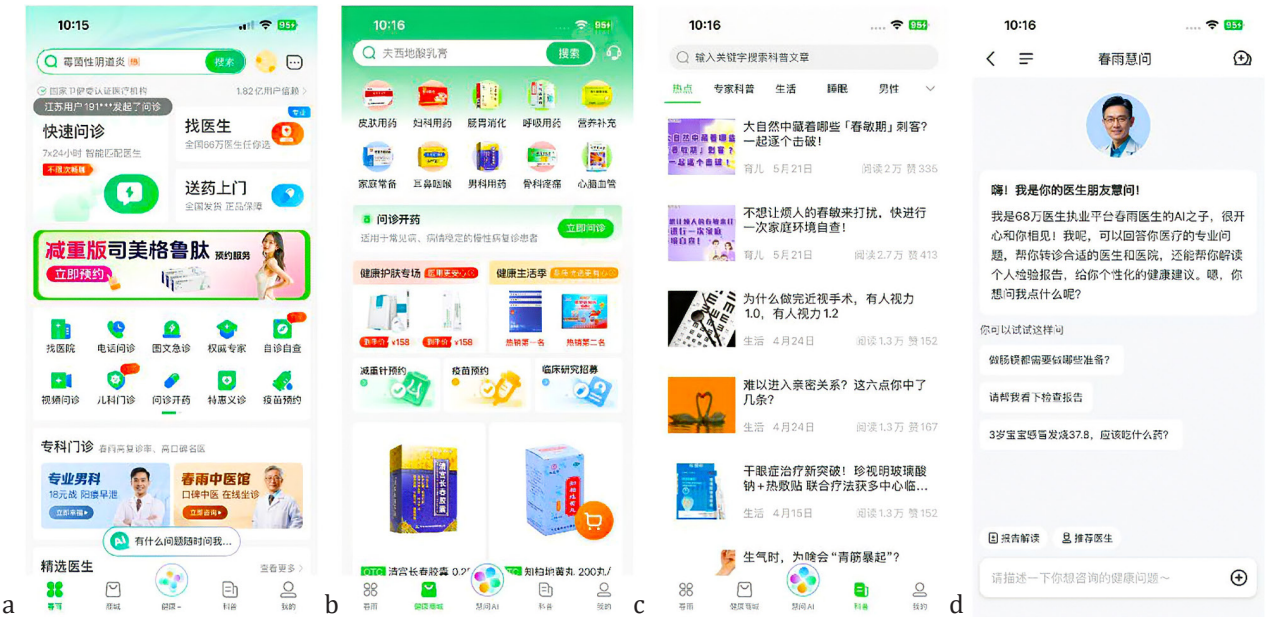

Figure 1. Chunyu Doctor application interface, China (2025)
Source: Chunyu Doctor (2025)

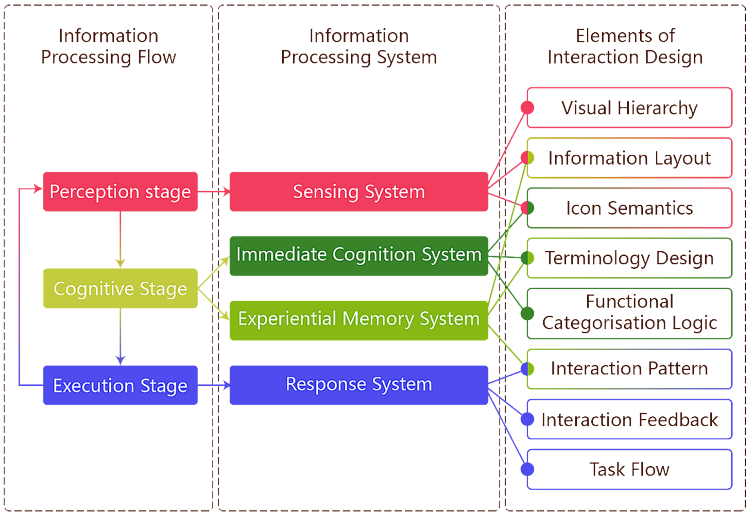

Figure 2. Relationship between the information processing model and interface design elements
Source: drawn by the authors

Through the organisation, refinement, and thematic analysis of interview data from 16 older adults, this study systematically identified typical information processing barriers encountered during the use of digital healthcare apps. The analysis revealed three major categories of problems: information perception barriers, information comprehension barriers, and information execution barriers. Each category is supported by representative quotes from the interview transcripts, reflecting direct feedback from older users regarding interface design, interaction methods, and functional features in real usage contexts. In the perception stage, older users rely on rapid visual scanning and auditory cues to make an initial judgment about "where to look first and where to tap first" on the interface (Table 2). Interviews indicated that the information load and advertising noise were perceived as excessive; typical comments such as "there is too much information on this page" and "there are too many things, it is annoying just to look at it" were used to summarise this problem. Statements like "I cannot read the text clearly" and "I do not understand what the icons mean" reflect problems with the visual legibility of text and icons. Comments such as "the tappable areas and entry cues are not obvious" and "after I tap I still do not know whether anything has happened" indicate missing or unclear entry prompts and action feedback. Reports such as "I cannot clearly hear the sounds played by the app" and "there

is a sound prompt but I can hardly make it out" suggest that auditory feedback is difficult to perceive. Taken together, these expressions point to a situation in which a considerable share of older users' attention has already been consumed by the interface itself before they even start the task.

Table 2. Types of perception stage obstacles and design directions

Obstacle type	Representative quotes	Interpreted meaning	Design direction
Excessive information load and advertising noise	Page information too cluttered	On-screen information stacked with no clear priority	Streamline first-screen information
	Too much content, very annoying	Ads interrupt visual focus	Reduce task-irrelevant ads
	Ads prompting sharing, download and payment		Place main function entries near the visual centre
Poor visual legibility of text and icons	Icons hard to interpret	Icon shapes too abstract	Use more intuitive icons
	Simpler information preferred	Small font and low contrast	Increase foreground-background contrast
	Font too small, tiring to read		Adjust font size and line spacing
Unclear tappable areas and entry cues	Tappable areas and entry cues unclear	No clear response after tapping	Highlight tappable areas with colour blocks
	No clear response after tapping	Feedback after tapping not salient	borders and shadows
	Font too small, tiring to read		Strengthen tap feedback
Poorly perceived auditory feedback	Cannot clearly hear sounds played by the app	Prompt tones difficult to hear clearly	Provide adjustable, easily recognisable sound prompts
	Sound prompts present but barely noticeable		

Source: compiled by the authors

The main interface of Huawei Smart Screen adopts a card-based modular design, and commonly used sections such as video, health and settings are equipped with high-contrast graphics and synchronised voice prompts (Fig. 3). This integrated analysis, moving from "information load and noise" to "visual discrimination", "entry cues" and finally "auditory feedback", shows that the difficulties older adults encounter in the perception stage are not isolated single-point problems but a series of weak links that amplify one another. Corresponding design adjustments therefore need to be considered as coordinated sets rather than only enlarging fonts or simply trimming content.

Figure 3. Huawei's Smart Screen and Honghu operating system

Source: Huawei (2025)

In the cognition stage, older users need to translate the text, icons and sectioned layout on the interface into understandable instructions and steps, and the interview results showed that the obstacles in this process fall mainly into three categories (Table 3). The first category concerns text and terminology that are difficult to understand; participants often remarked "I do not understand what this passage means" and "could it be expressed more clearly?", indicating that technical terms and long sentence structures exceed their immediate comprehension. The second category involves ambiguous icon meanings and weak mapping between icons and text; for example, comments such as "I cannot make sense of the icons" and "I cannot remember what the icons mean, just ignore them" reflect that the correspondence between graphic metaphors and functions is weak and does not support stable memory formation. The third category concerns unclear information structure and navigation logic; many interviewees mentioned that "I often get lost

when using it", "it is hard to find the function I want" and "it is not very convenient to look for functions within a page", suggesting that the way the interface groups functions does not match their task thinking, and that section labels do not clearly indicate the operations they contain.

Table 3. Types of cognition stage obstacles and design directions

Obstacle type	Representative quotes	Interpreted meaning	Design direction
Difficulty understanding text and terminology	Text hard to understand	Wording too abstract	State key information in plain language
	Explanation not clear enough	Weak feedback	Reduce technical terminology
Ambiguous icon meanings and weak icon-text mapping	Icons hard to understand	Weak linkage between icon form and function	Use intuitive icons with short text labels
	Icon meanings not remembered		Apply concrete medicine-related imagery
	Icons simply ignored		
Unclear information structure and navigation logic	Often get lost during use	Information grouping confusing	Simplify section structure
	Hard to find desired functions	Navigation logic unclear	Keep key entry positions stable
	Locating functions within a page not convenient		Downplay distracting content

Source: compiled by the authors

For issues related to text and terminology, research in linguistics and health communication commonly recommends the principles of "easy-to-read language" and "priority for plain-language explanations". T. Okuhara *et al*. (2024) suggested improving comprehensibility by shortening sentences, reducing technical vocabulary and strengthening cues to key information. Regarding the relationship between icons and text, J. Wu *et al*. (2022) found that older adults perform better with icon-label combinations, and that skeuomorphic icons accompanied by text are recognised more quickly and accurately than purely graphical or flat icons. For content such as disease names, medication information and health insurance rules, placing a lay explanation in a prominent position allows older users to first grasp descriptions directly related to symptoms and use, rather than being confronted at the outset with strings of technical terms. In the design of entries for medicines, services and functions, skeuomorphic graphics that resemble real objects, such as medicine boxes, prescription slips and hospital buildings, can be used. Field investigations indicated that older adults have limited ability to interpret charts and are more accustomed to numerical or textual representations. Attaching short labels of two or three characters beneath icons as the main form of explanation enables users to confirm meaning through an "icon plus keyword" combination, rather than relying on memory to guess what the icon stands for. With respect to information structure and navigation logic, Q. Li & Y. Luximon (2019) found that older adults perform better with navigation schemes organised around content areas, whereas interfaces that rely on top or side menus and tab switching make it easier for them to overlook entry points and lose their way in multi-level menus. E. Amouzadeh *et al*. (2025) similarly emphasised that simplified navigation, enlarged text, and error-tolerant interfaces are key design elements that can significantly improve mobile app usability for older adults, highlighting the importance of co-designing applications with older users to address accessibility barriers.

In optimising Chunyu Doctor, online consultation, appointment registration, medication purchase and health insurance reimbursement are treated as four main task lines; it is recommended that the interface structure be reorganised around these lines by reordering sections and entry positions, so that users follow a single path while completing each operation. At the same time, health-information content and promotional campaigns should be placed after the main flows or on secondary pages, in order to avoid inserting excessive detours during task execution. In addition, interface design should further guide users to construct new ways of operating, allowing them to participate to some extent in choosing or defining interaction modes; this supports the smooth transfer of prior experience to new systems and helps foster creative thinking and autonomy. For example, the dial interface of the Xiaomi smart band offers multiple theme styles for users to choose from, which accommodates differences in visual preference, but users cannot customise the specific information shown on the dial, limiting their ability to build personalised cognitive paths based on existing usage habits (Fig. 4).

Figure 4. Xiaomi Smart band and band face configuration interface, China
Source: Xiaomi Smart band watch face settings interface (2024)

When they enter the execution stage, older users are no longer dealing with the problem of "understanding the interface", but with how to turn the instructions they have understood into a sequence of taps, swipes and text entry. Based on the accounts of the 16 participants, difficulties at this stage are mainly concentrated in four areas (Table 4). Interviewees repeatedly commented that "I cannot find the function I want" and "I cannot quickly and accurately locate the operation I need", indicating that key entry points are not salient enough and that the action paths are convoluted and poorly guided. Some also described that "some gesture operations are beyond me", "I cannot accurately hit the icons or buttons" and "pressing for a long time can trigger unintended actions", reflecting a gap between small target areas and complex gestures on the one hand and older users' reduced hand-control abilities on the other. Several participants said that during use they "often cannot get out", that "advertisements interrupt the operation" and that they "forget how to do this", suggesting that the current flows have many branches and deep hierarchies and that cues for going back or exiting are unclear. Verification-code and payment steps introduce an additional layer of tension; some complained that "the verification code expires too quickly", "there is not enough time to enter it" and that "it would be better if there were some feedback telling me whether it has succeeded or not". Taken together, these expressions outline the main pressure points in the execution stage: where to tap, how to tap, within what time frame the operation must be completed, and whether the system gives a clear response afterwards.

Table 4. Types of execution stage obstacles and design directions

Obstacle type	Representative quotes	Interpreted meaning	Design direction
Difficulty locating functions and paths	Cannot find the needed function	Key entry points are hard to locate	Highlight frequent entry points
	Cannot quickly and accurately locate the desired operation		Streamline main paths
Limited touch accuracy and demanding gestures	Some gesture operations impossible	Touch targets small	Enlarge touch targets
	Icons or buttons hard to hit accurately	Gesture set complex	Simplify gestures
	Long press often triggers unintended actions		
Lengthy flows with many branches and difficult exits	Some steps hard to exit	Too many branches	Linearise key flows
	Some steps hard to exit	Easy to get lost	Reduce interruptions
Tight time limits and insufficient feedback	Verification-code time too short	Time pressure	Relax time thresholds
	Code expires before entry is completed	Weak feedback	Strengthen feedback on operations
	Preference for some physical feedback		Relax time thresholds

Source: compiled by the authors

Existing research has proposed a range of optimisation measures from the perspectives of motor control and error-tolerance mechanisms. With regard to touch accuracy and gestures, T. Phiriyapokanon (2011) reported that older adults' tapping accuracy improves markedly when target size is no smaller than approximately 16.5*16.5 mm, but that enlarging buttons alone does not fully resolve the problem and must be combined with appropriate layout and clear feedback. When comparing drag, pinch and double-tap gestures on smartphones of different sizes, T.-H. Tsai *et al.* (2017) likewise found that older adults perform worst under

complex gestures and small-screen conditions, and recommended reducing multi-finger and long-press operations for older users while prioritising single taps and simple swipes. These studies indicated that optimising the execution stage is less about re-emphasising "being able to see" and more about lowering the precision required for each action and reducing dependence on memory and reaction speed. C. Zhou *et al.* (2022) further found that the design of mobile app interfaces, including layout, colour, and icon placement, significantly influences task performance among older adults, with simpler, clearer layouts and appropriate icon sizes improving task completion times and user experience. P.-C. Yeh (2020) demonstrated that increasing font size to 22 pt and positioning buttons at the top of the interface significantly improved task performance for older adults, suggesting that interface design can enhance usability and independence in older populations. Focusing on flow structure and time pressure, G.A. Wildenbos *et al*. (2019) systematically analysed how older patients used two mHealth applications and proposed an "aging barriers model", arguing that excessive steps, frequent context switching and opaque navigation structures cause users to become repeatedly lost and interrupted in the execution stage. C.N. Harrington *et al*. (2017) treated "error tolerance" as a core indicator of age-friendly interfaces and showed that generous time settings, reversible operations and explicit confirmation prompts can ease users' anxiety about making mistakes. In the execution stage, allowing users to proceed more slowly and to recover from occasional errors is more critical than simply pushing for higher accuracy.

To address "difficulty locating functions and operation paths", the interface should no longer rely on a single home-page entry but instead keep the position of the "next step" button stable along each care pathway, so that older users can move in the same direction through consultation, examinations and medication pickup, while non-essential options such as sharing, rating and promotions are postponed to the end of the flow or collapsed. To address "limited touch accuracy and demanding gestures", and drawing on studies of button size and gesture performance, key actions should be standardised as single-tap triggers, with hidden menus avoided for long-press and double-tap gestures, and the apparent tappable area visually expanded so that slight deviations are still treated as valid hits. Online consultation and medication-purchase flows can be divided into several clear stages, with a brief stage label at the top of each screen and prominent "back to previous step" and "save and continue later" buttons below, in order to mitigate the problem of "lengthy flows with many branches that are hard to exit". In relation to "tight time limits and insufficient feedback", the present study advocates extending the valid time for sensitive operations such as verification codes and providing salient remaining-time indicators that offer advance warnings before expiry rather than only error messages afterwards; at key points such as submitting a prescription or completing payment, obvious colour changes and short audio cues should be added, and where necessary a concise text message in the centre of the screen should restate the outcome.

CONCLUSIONS

This study used the Chunyu Doctor app as a case and combines the stage-based information processing theory with interviews with older users to trace information-interaction barriers in digital health apps across the perception, cognition and execution stages, and to anchor these problems in specific interface elements such as visual hierarchy, text and terminology, icon semantics, information grouping, task flows and feedback cues. The findings showed that, even before entering medical tasks, older users have their attention consumed by information load and advertising noise, and that during the comprehension stage they are repeatedly disrupted by technical terminology, icon meanings and navigation logic. At the execution stage they tend to become stuck at points where function locations are unclear, gesture operations are demanding, task flows are lengthy and time limits are tight. These problems are not isolated defects but a chain of vulnerabilities around being able to see the interface, understand it and carry out actions, which has a tangible impact on confidence in seeking care and on willingness to operate independently. In response to these observations, this paper proposed stage-specific strategies for streamlining information, rewriting key text and restructuring navigation around the care-seeking process, together with more relaxed time settings and clearer multimodal feedback at key steps, providing directly applicable guidance for age-friendly evaluation and interface optimisation of future digital health apps. There remains scope for further work in extending the range of application types and in testing the effects of different design solutions.

ACKNOWLEDGEMENTS

In the process of the completion of this paper, the authors received the full support and help of many experts, scholars and relatives, for which sincere thanks are expressed.

FUNDING

The study did not receive funding.

CONFLICT OF INTEREST

There is no conflict of interest in this study. All authors have read and approved this version of the article, and due care has been taken to ensure the integrity of the work. Neither the entire paper nor any part of its content has been published or has been accepted elsewhere. It is not being submitted to any other journal.

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Інклюзивні стратегії дизайну для літніх користувачів цифрових медичних послуг

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Анотація. Цифрові додатки для охорони здоров'я стали звичними інструментами для літніх людей для реєстрації на прийом, оплати медичних послуг та придбання ліків, проте багато інтерфейсів все ще вимагають значних когнітивних та операційних зусиль. Метою цього дослідження було виявити перешкоди в обробці інформації, з якими стикаються літні люди під час використання китайського мобільного додатку для охорони здоров'я «Chunyu Doctor», та запропонувати стратегії для вдосконалення інтерфейсу на основі етапів. 16 дорослих віком 60-70 років, які раніше мали досвід користування додатками для здоров'я, пройшли напівструктуровані індивідуальні інтерв'ю під час виконання завдань з консультації, придбання ліків та розрахунку за страховку. Транскрипти інтерв'ю були тематично закодовані та розподілені на три етапи взаємодії: сприйняття, когнітивні процеси та виконання. Аналіз показав, що бар'єри сприйняття виникають через перевантаженість екранів, погану читабельність тексту та іконок, неоднозначні області, на які можна натиснути, та ледь помітні звукові підказки. Когнітивні бар'єри пов'язані з технічною термінологією, яка перевищує рівень миттєвого розуміння, метафорами піктограм, які не дають надійного сигналу про функцію, та структурою розділів, яка суперечить логіці завдань користувачів. Бар'єри виконання зосереджені на складності пошуку ключових функцій, складних жестових операціях, довгих розгалужених потоках та жорстких часових обмеженнях на таких етапах, як перевірка кодів. На цій основі в дослідженні були запропоновані стратегії дизайну для конкретних етапів, які реорганізують навігацію навколо медичних завдань, переписують критичний текст простою мовою, коригують набори піктограм і групування, а також послаблюють часові обмеження та обмеження щодо зворотного зв'язку. Результати пропонують процесну основу для оцінки та поліпшення взаємодії, зручної для людей похилого віку, в цифрових медичних послугах

Ключові слова: модель обробки інформації; бар'єри взаємодії; зручність для людей похилого віку; когнітивне навантаження; користувальницький інтерфейс

ISSN 2617-0272, e-ISSN 2617-0280

ART AND DESIGN
Journal homepage: https://art-design.com.ua/en

9(1), 2026

Received 07.12.2025 Revised 11.03.2026 Accepted 09.04.2026 Published: 10.04.2026

UDC 73/76:[7.041.5+77.041.5]-055.2]:11/14(045) DOI: 10.30857/2617-0272.2026.1.6

Portrait drama: Lesya Ukrainka in the intertext of visual art

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Abstract. The relevance of the study is conditioned by the growing interest of contemporary art history in the interdisciplinary analysis of visual images as carriers of cultural memory, identity and symbolic meanings, and the need to rethink the Ukrainian artistic experience in a European and global context. The image of Lesya Ukrainka as a key figure in national culture remains insufficiently understood in terms of portrait dramaturgy and intertextual interactions between visual art, literature, and philosophy. The purpose of the study was to interpret the portrait images of Lesya Ukrainka in the context of European visual practices considering their connections with baroque, romantic and neo-romantic traditions, and to understand their artistic and symbolic dimension in the development of cultural identity. A comprehensive methodological approach was applied, including hermeneutics, analytical psychology, iconography, iconology, comparative, historical and cultural, and semiotic methods. The study analysed the evolution of the female portrait image from normative and idealised representations to a psychologically in-depth visual embodiment of the creative personality, within which symbolic structures and dramatic organisation of the composition acquire a defining meaning-creating significance. The study covered portraits created during the life of the poetess and posthumously in various types of art (painting, graphics, sculpture, photography). The comparison of Lesya Ukrainka's portraits with European Works was conditioned by the need to contextualise her image within the broader artistic tradition. This made it possible to identify shared features in the techniques used to convey psychological depth and symbolism that are characteristic of romanticism, neo-romanticism, and modernism. The Ukrainian context, in particular the influence of "The Forest Song" (1911) and other works of the poetess, gave the portraits local specifics, which emphasised their uniqueness. The analysis showed the theatricality and psychologism of Lesya Ukrainka's images, and their connection with the universal motives of love, death, and the spiritual verticality. The symbolic components of the compositions actualised the ritual function of the portrait as a mediator between the past, present, and future

Keywords: artistic representation of poets; iconographic analysis; neo-romanticism; gender; theatricality; photography

INTRODUCTION

The concept of the sublime in art, particularly in the portrait genre of Romantic and Neo-Romantic visual art, is one of the key issues in contemporary art history. Romanticism, with its emphasis on subjective perception, emotional depth, and human interaction with nature and culture, opens up new perspectives for analysing artistic expressiveness. In the Ukrainian artistic context, the image of Lesya Ukrainka, a symbol of national identity and individual creative consciousness, is of particular importance. The analysis of portrait images associated with this figure allows tracing the relationship between the personal and the universal in art, identifying the influence of European romantic and neo-romantic trends on the development of Ukrainian culture. The relevance of the study is conditioned by the need for a deeper understanding of cultural dialogue, symbolism, and subjectivity in art, which contributes to determining the place of Ukrainian Romanticism in the global artistic context.

The concept of the sublime in romantic art, in particular in painting, is central to the research of aesthetics and art history. According to N. Amstutz (2023),

Suggested Citation:
Tarasenko, O. (2026). Portrait drama: Lesya Ukrainka in the intertext of visual art. *Art and Design*, 9(1), 65-77. doi: 10.30857/2617-0272.2026.1.6.

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the sublime, as understood by I. Kant, exists not in the object, but in subjective perception. The researcher emphasised the influence of philosophical ideas of I. Kant on romantic aesthetics, noting that romantic landscapes seek to convey infinity and transcendence through the interaction of nature and human consciousness. This approach allows considering romantic painting as a space for exploring the inner world of the artist and the viewer. In the context of portrait art, romanticism and neo-romanticism reveal unique aspects of subjectivity. The study of photo portraits of the 19th-20th centuries by A. Doussot (2023) revealed the role of background in constructing the literary identity of famous writers.

O. Lihus (2021) examined the historiographical aspect of Ukrainian Romanticism within the broader context of the interdisciplinary field of Romantic historiography. The researcher noted that the term "Neo-Romanticism" appeared in the scientific literature of the last quarter of the 19th century in France and Germany, and later in Eastern Europe, and Lesya Ukrainka introduced it into Ukrainian literature. O. Lihus concluded that the aesthetic "motto" of Ukrainian Romanticism throughout its development was the revelation of a vivid personal individuality through its national identification. Focusing on the literature, Z.O. Yankovska & L.V. Sorochuk (2021) pointed out the connection of European Romanticism with the "cordocentric" type of culture of Ukraine in the 19th century. The researchers established that Ukrainian romantic writers focused on the inner, spiritual world of the hero, who interacts with reality through their own system of values.

The research of Ukrainian art pays attention to the interpretation of the image of Lesya Ukrainka in both literary and visual contexts. Emphasising the importance of Lesya Ukrainka as a cultural symbol, T. Gundorova (2023) studied her biography in the most exhaustive way through archival materials and photographs. O. Lahutenko & A. Alieksiieva (2024) discovered and analysed portrait series dedicated to figures of Ukrainian culture in the late 19th and early 20th centuries. Their research demonstrated how the portraits reflect the socio-cultural and political conditions of the era, forming a unique visual identity. M. Ponomarenko (2023) by applying iconographic and iconological analysis to the self-portrait of the Ukrainian artist M. Glushchenko, revealed the dialogue between the art of the early 20th century and the traditions of the Renaissance. Her exploration of the symbolic space and attributes in the painter's portrait revealed a connection between individual and universal artistic expressiveness. This approach highlighted the importance of intertextuality in the visual arts.

Thus, the analysis of contemporary research has shown that the concept of the sublime in romantic painting and portrait art is implemented through subjective perception, symbolism, and intercultural dialogue. These approaches, supplemented by comparative and intertextual analysis, help to better understand the meaning of Ukrainian art, in particular, the image of Lesya Ukrainka in the world cultural context. The purpose of the study was theoretical and methodological understanding of portrait representations of Lesya Ukrainka in painting, graphics, and sculpture in the European artistic context with the involvement of photographic materials based on the analysis of their stylistic, symbolic, and intertextual parameters.

MATERIALS AND METHODS

Psychological portrait in art history analysis was formed on the material of the image of a creative person. For this purpose, both lifetime and posthumous portraits of Lesya Ukrainka, created in various art forms – painting, graphics, sculpture, and photography – were used (Table 1). Documentary biographical materials were also used, and memoirs were described by T. Skrypka (2015). Personal conversations with the artist Vasyl Chebanyk and Roman Petruk were conducted in compliance with ethical standards (informed consent, confidentiality, transparency, respect for authorship, objectivity) in accordance with the Declaration of Helsinki (2013).

Table 1. Main objects of research

Type	Object	Details	Storage location
Pictorial portraits	Ivan Trush "Portrait Of Lesya Ukrainka" (1900)	Plywood, oil, 30×40 cm	National Art Museum of Ukraine, Kyiv
	Fotiy Krasytsky "Portrait of Lesya Ukrainka" (1904)	Watercolour, 54×48 cm	One Street Museum, Kyiv
	Fotiy Krasytsky "Portrait of Lesya Ukrainka" (1904)	Oil on canvas, 54×48 cm	Lesya Ukrainka literary and Memorial Museum, Kyiv
	Roman Petruk "Ray of Dreams. Lesya Ukrainka" (2020)	Oil on canvas, 80×70 cm	Author's property
Graphic works	Vasyl Chebanyk "Portrait of Lesya Ukrainka" (1966)	Viniplast, 22×7.5 cm and 35.2×30 cm	From the series of postcards "Classics of Ukrainian literature"

Table 1. Continued

Type	Object	Details	Storage location
Sculptural works	Taisiya Sudyina "Memorial plaque of Lesya Ukrainka" (1971)	Bronze, granite, 80×50 cm	65000, 27 Sviatoslav Karavansky Street, Odesa
Photographic materials	Photos of Lesya Ukrainka (1886, 1896, 1901, 1913)	They were used as a basis for creating portraits	

Source: compiled by the author

To study the portrait images of Lesya Ukrainka in visual art, a comprehensive methodological approach was used, combining hermeneutics, iconography, iconology, comparative, and historical and cultural analysis. These methods allowed revealing the multi-layered portraits of the poetess, their connection with European artistic traditions, and their place in the Ukrainian and world cultural context. A hermeneutical approach, based on the works of M. Heidegger (1962) and L.D. Tate (2016), used to interpret the meaning of portrait composition. Hermeneutics as a methodology allowed identifying deep semantic structures, considering the portrait as a dialogue between the visual image and the cultural context. In particular, the theory by L.D. Tate (2016) on the relationship between hermeneutics and poetics formed the basis for analysing the interaction of an artistic image and its symbolic meaning in the intertextual space. In addition to this approach, the ideas of E. Betti (2021) on hermeneutics as a general methodology of the spirit sciences provided a systematic interpretation of compositional elements. Hermeneutical analysis was used to interpret the symbolic content of Lesya Ukrainka's portrait images, in particular, in the context of her literary work and biography. Special attention was paid to the connection between her poetry and visual images reflecting the idea of the victory of love over death (a kind of literary self-portrait in the image of Mavka from the drama-fairy tale "The Forest Song" (1911) (Ukrainka, 2021).

The iconographic approach was used to investigate the compositional elements of portraits, such as angle, colouristics, clothing, and background, which have symbolic meaning. Semiotic method by J. Kristeva (1969) allowed interpreting the portrait as a multi-level sign structure in which visual elements (gaze, darkening of the eyes, compositional static) function as markers of pre-rational and existential states that go beyond iconographic reading. The works of Ivan Trush (1900), Fotiy Krasytsky (1904), Vasily Chebanyk (1966), Taisiya Sudyina (1971), and Roman Petruk (2020) were analysed. The iconological method allowed interpreting portraits in a broader cultural and historical context, revealing connections with European traditions of Renaissance, Baroque, Romanticism, and Neo-Romanticism. A comparative analysis was carried out with portraits of El Greco (1584-1588), Dominique Ingres (1821), Francisco Goya (1811), Ilya Repin (1882), etc., emphasising the universal motives of love, death, and the spiritual verticality.

To identify and demonstrate the features of portrait images of Lesya Ukrainka, a comparative method was used, which allowed comparing portraits of Lesya Ukrainka with images of other creative figures, in particular actresses, and contrasting pictorial, graphic, and sculptural works with photography. Special attention was paid to the influence of photography on the development of the portrait genre, in particular, in posthumous images created based on photographs. The historical and cultural approach involved analysing portraits in the context of the era, in particular, the influence of romanticism, neo-romanticism, and modernism on Ukrainian art of the late 19th-early 21st centuries. Archival materials and historical sources on the activities of the Shevchenko Scientific Society were studied. This integrated approach not only revealed the multi-layered portrait images of Lesya Ukrainka, but also placed them into the global cultural context, emphasising the originality of the study and its importance for art history, cultural studies, and pedagogical practice. Thanks to this approach, the study of Lesya Ukrainka goes beyond traditional literary analysis, demonstrating the significance of her work for the establishment of national identity, the development of cultural self-awareness, and pedagogical ideas.

RESULTS AND DISCUSSION

Lifetime portraits of Lesya Ukrainka. Portrait as a genre of visual art reproduces the individual features of an existing person, performing the function of preserving the image in time and space (Hegel, 1975). In different historical epochs, the portrait had a specific purpose. In Ancient Egypt, portraits provided a connection between the soul and the physical receptacle for eternal existence, in Ancient Rome – served as a ritual connection with the ancestors, emphasising the power of the family, and in Byzantine icons and medieval art, images of Saints reflected the transition from the sensual to the supersensible, where the spiritual plane dominated. Regarding the art of the Renaissance, inspired by ancient traditions, the emphasis shifted to a sensually convincing physical and social image of the individual. In the literature and visual art of romanticism and neo-romanticism, the primary focus became the exploration of the individual's inner state. The fundamental methodological approaches to the study of Ukrainian portrait painting are formulated in the works of P. Biletsky (1981) and V.V. Ruban (1986), in which the portrait is interpreted as a complex artistic structure, focuses

primarily on the individualisation of the portrayed figure, revealing the psychological depth of the image and understanding its place in the cultural and historical context. The study of Lesya Ukrainka's portraits focuses on her image as an outstanding cultural figure, whose work and personality reflect a deep psychologism and existential dimension. Lifetime and posthumous visual representations appear not only as artistic artefacts, but also as carriers of symbolic meanings that reflect the spiritual intensity of the image and its correlation with the concept of "two worlds" outlined by G.W.F. Hegel (1975). This approach allows considering portraits as conduits to another dimension, similar to the role of psychopomps in ancient Dionysian theatre or the mysteries of the Modern Age. Portrait of Lesya Ukrainka, created by Ivan Trush (1869-1941) (1900) (Fig. 1), is a key example of Ukrainian portrait art of the turn of the 19th-20th centuries. Commissioned by the Shevchenko Scientific Society as part of a series of images of prominent figures of Ukrainian culture, this portrait reflects a deep psychologism.

Figure 1. Portrait of Lesya Ukrainka (1900)
Source: Local History (2024)

The portrait of Lesya Ukrainka, made from nature in late March – early April 1900, is an important iconographic document that captures the intersection of her personal biography and the intense creative period of the poetess. The time of its creation coincides with the arrival in Kyiv of Serhii Merzhynskyi (1870-1901), whose figure had a decisive influence on the emotional and spiritual state of Lesya Ukrainka. The subsequent death of S. Merzhynsky from pulmonary tuberculosis on 16 March, 1901, became a turning point in her life and work (Skrypka, 2015; Shpachynska, 2018). In the visual image of the portrait, this biographical context is indirectly reflected through the concentration of the gaze, internal tension, and restrained expression, which correlate with the psychological drama of the poetess. It was during this period that the dramatic poem "Possessed" was created, written in conditions of extreme emotional tension, and later the drama-fairy tale "The Forest Song" was completed, which confirms the transformation of personal experience into an artistic form. The theme of Lesya Ukrainka's tragic love for S. Merzhynsky was immortalised not only in her literary works, but also in cinematic culture. The film "I Am Coming to You…" (1971), produced for the centenary of the poetess' birth at the Oleksandr Dovzhenko Kyiv Film Studio (director: M. Mashchenko; screenplay: I. Drach), represented another attempt to visualise Lesia Ukrainka's profound personal tragedy. Thus, the analysis of Lesya Ukrainka's work against the background of her personal life showed a close relationship between the emotional experiences of the poetess and her creative achievements, which is emphasised not only in her poetic works, but also in cultural interpretations created in subsequent years.

Ivan Trush focused his attention on the poetess's soulful face, using the contrast of light and shadow to convey her inner energy. The burgundy background evokes an allusion to the imprimatura that Titian frequently employed. A dark dress with a stand-up collar and an airy frill create an immaterial effect, emphasising the spiritual dimension of the image. Conditional space removes a person from a specific life situation. The image of Lesya Ukrainka is characterised by reflection. The look, deliberately obscured but clearly eloquent, reflects her emotionally intense state, resonating with the concept of poetic ecstasy. The portrait reflects the connection with eternity, avoiding the everyday context that corresponds to the portrait traditions of romanticism and neo-romanticism, where the psychological state of the individual dominates. The semantics of the visual image of the portrait can thus be interpreted as a visual parallel to the process of internal sublimation characteristic of Lesya Ukrainka's creative method. Thus, the portrait from 1900 appears not only as a realistic image from nature, but as a complex visual text that combines psychological characteristics, biographical memory, and symbolic representation of Lesya Ukrainka's creative identity.

To understand the drama of Lesya Ukrainka's psychological state in the 1904 portrait painted by F. Krasytsky at the poetess's request (Fig. 2), it is essential to note that it was created a year after the sudden death of her brother, the meteorologist and writer Mykhailo Kosach (1869-1903). In the first version, made in watercolour (Fig. 2a), the artist used transparent tonal layers that help to convey delicate mental and physical state of the model. According to memoirs of S. Krasytska, while posing, Lesya Ukrainka looked at the icon of St. Nicholas the Wonderworker, and the lighting was created by church candles (Shlensky, 2008). The history of the portrait's creation has an indirect connection with works characteristic of canonical Catholic iconography: the patrons were depicted in a state of eternal prayer before the image of the Mother of God for intercession before Christ. This portrait was rejected at the exhibition in Lviv (1905), after which F. Krasytsky created a

second version using oil painting techniques with an outdoor background (Fig. 2b).

a b

Figure 2. Portraits of Lesya Ukrainka by F. Krasytsky
Note: a – fragment, watercolour; b – canvas, oil
Source: Museum of One Street (2015), Lesya Ukrainka. Encyclopedia of the life and works (n.d.a)

The circumstances of creating portraits form the existential background of the image of Lesya Ukrainka. The poetess's gaze in portraits translates the image into the plane of sacred dialogue – intimate and reflexive, devoid of external declarative. In this context, the visual image appears as a kind of "silent text", semantically consonant with the linguostylistic analysis of the religious meanings of her writing. The sacredness of portraits functions not as an iconographic gesture, but as a psychological code through which the tension between the experience of earthly suffering and transcendental hope is actualised. Philosophical and pedagogical research by H. Vasianovych *et al.* (2025) allowed understanding the religious dimension of Lesya Ukrainka's work in the categories of universal spirituality and humanistic ethics associated with the ideas of freedom and the "philosophy of the heart" by H. Skoboroda. In the portraits by F. Krasytsky realised this dimension as a visual and psychological form of personal mystical experience. The combination of these approaches allows consider Lesya Ukrainka's portraits as an integral cultural phenomenon, in which the sacred is integrated with personal internal drama and an active cultural creative position. Approach of T. Gundorova (2025) on the topic of illness in the life and work of Lesya Ukrainka allows deepening understanding of the inner drama that is represented in her lifetime portraits. The researcher interpreted this experience as a socio-cultural phenomenon of modernity, which forms a specific optics of self-perception and cultural identity of the poetess, actualising the issues of creative subjectivity, physicality, and spiritual tension.

In this perspective, artistic and literary practice appears as a conscious inclusion of bodily experience in the development of a poetic and aesthetic programme. This theoretical context allows reading the visual image in portraits in a new way: instead of focusing only on "realism" or "psychological portraiture", portraits by I. Trush 1900 and subsequent lifetime images, in particular watercolour and pictorial portraits by F. Krasytsky 1904, appear as visual manifestations of the experienced physical and spiritual state. In these images, illness, reflection, and creativity form an integral artistic identity: posture, gaze, tonality, and compositional detachment determine the way Lesya Ukrainka sees the world, where bodily experience and cultural meaning are closely intertwined.

Comparison with other works of art. The transition from analysing Lesya Ukrainka's portraits to comparing them with the works of European artists is justified by the need to contextualise her image within the broader European tradition of portrait art. Parallels with other works help to better understand their symbolic and psychological content. For example, the portraits of Spanish grandees in the composition by El Greco "The Burial of the Count of Orgaz" (1586-1588) (Fig. 3a) and "Portrait of a Knight with His Hand on His Chest" (1584) (Fig. 3b) visually reflect the idea of duality of worlds, which is shared with the portraits of Lesia Ukrainka. The contrast between dark robes and light collars in El Greco's works enhances the spiritual dimension of the image, similar to the effect in the portrait by I. Trush.

a b

Figure 3. Portrait images in El Greco's compositions
Note: a – The Burial of the Count of Orgaz (1586-1588); b – Portrait of a Knight with His Hand on His Chest (1584)
Source: Toledo Tourist Bracelet (2024), Prado National Museum (n.d.)

Academic basis of the composition of J.A.D. Ingres in "Mademoiselle Jeanne Gonin" (1821) (Fig. 4) also has common features with the portrait by I. Trush. Artists focused their attention on the model's face, highlighting it with light on a dark neutral background. What is common is a black dress with an accent of white lace, which directs the viewer's gaze to the centre. The work by J.A.D. Ingres is characterised by a three-dimensional plastic interpretation of the figure in space. The work by I. Trush is characterised by the dominant pictorial beginning. In the portrait of Lesya Ukrainka, there are

no lines fixing the model. The face and torso are in unity with the background. In contrast to the leader of academicism, the modernist artist does not seek to convey the specific characteristics of the material world (for example, fabric) but focuses on the expression of pictorial texture and tonal contrasts that help to convey the model's inner state.

Figure 4. Mademoiselle Jeanne Gonin (1821)
Source: Artchive (n.d.a)

The image of Lesya Ukrainka as a cultural figure echoes portraits of other artistic natures created in the style of romanticism and neo-romanticism. Portraits of actresses (Fig. 5) emphasised the kinship with the image of Lesya Ukrainka through the emphasis on passionate energy and inner drama conveyed through the eyes of the heroines, contrasts of light and shadow, colour, space. These comparisons were chosen because Lesya Ukrainka's portraits reflect not only her personality, but also a broader cultural context, where artists act as guides to the spiritual dimension.

a  b 

Figure 5. Portraits of actresses
Note: a – Portrait of the Actress Antonia Zárate by F. Goya (1810 or 1811); b – Portrait of the Actress Pelageya Antipjevna Strepetova by I. Repin (1882)
Source: PubHist (n.d.), Artchive (n.d.b)

Thus, the comparison of Lesya Ukrainka's portraits with the works of European artists allowed tracing common artistic principles and conceptual approaches that emphasise the psychological depth and spiritual dimension of the image. Parallels with the compositions of El Greco ("The Burial of the Count of Orgaz", 1586-1588; "Portrait of a Knight with His Hand on His Chest", 1584) demonstrated the idea of two lights and the contrast of dark robes and light collars, which resonates with the portrait by I. Trush in 1900. The academic approach of Jean-Auguste-Dominique Ingres in "Mademoiselle Jeanne Gonin" (1821) coincides with the portrait by I. Trush due to the concentration of attention on the face, chiaroscuro accents, and a black dress with white lace, although I. Trush moved away from academic detail in favour of pictorial expression. The image of Lesya Ukrainka also echoes the portraits of actresses in romanticism and neo-romanticism, in particular F. Goya ("Portrait of the Actress Antonia Sarate", 1810-1811) and I. Repin ("Portrait of the Actress Pelageya Antipjevna Strepetova", 1882), where the emphasis on the look, chiaroscuro and inner drama creates a kinship with the psychological and symbolic dimension of the portraits of the poetess. The portrait by Fotiy Krasytsky in 1904 develops this artistic and psychological line. It reflected the state of loss and inner contemplation, and the use of watercolour techniques emphasised the fragility and spiritual sophistication of the image. Iconographic allusions bring the portrait closer to the sacred tradition, actualising the motif of the marginal state between the earthly and the transcendent.

Together, both works showed the priority of the psychological principle in Lesya Ukrainka's portrait representation, where biographical experience is transformed into an artistic sign, and personal experience acquires universal significance. Portraits function as complex visual texts that require interdisciplinary interpretation, in particular with the involvement of the philosophical concept of duality. The image of the poetess appears as a mediator between different levels of being, which strengthens her symbolic status and forms a stable iconography of Lesya Ukrainka in the national artistic context.

Posthumous portraits of Lesya Ukrainka. In creating posthumous portrait images, photography served as a primary retainer of appearance, similar to a wax mask made using the technology of an ancient Roman portrait. Through individual features of the physical form, the portraitist must convey the inner essence of the model. The convention of the language of black-and-white graphics is similar to photography, but the artist achieves expressiveness by generalising the main tonal relationships and compositional accents. In the graphic works of V. Chebanik (1933-2025), the precision of photography is combined with the conventionality of artistic language: the use of vinyl plastic provides linear expressiveness similar to woodcut printing and allows the creation of portraits that can be reproduced without loss of artistic quality. Full-face image of Lesya Ukrainka in the postcard series "Classics of Ukrainian

literature" (1966) (Fig. 6) demonstrated ritual static, calm frontal composition and psychological concentration on the gaze, which enhances the sense of presence and spiritual weight of the poetess.

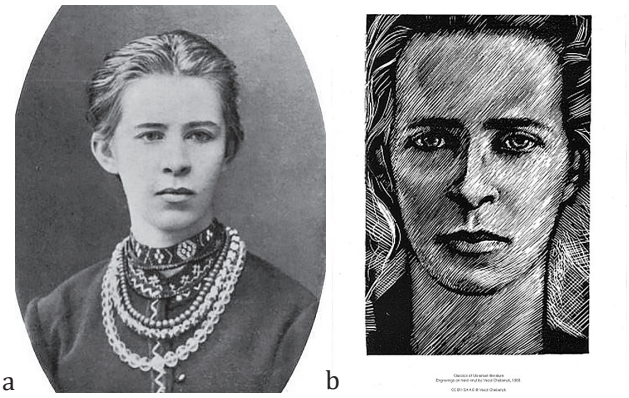

Figure 6. Comparison of a photographic portrait and an engraved image of Lesya Ukrainka

Note: a – photographic portrait of Lesya Ukrainka (1886); b – Lesya Ukrainka, series of postcards "Classics of Ukrainian Literature" (1966)

Source: Poltava Art Museum (2024), Lesya Ukrainka. Encyclopedia of the life and works (n.d.b)

In the versions of the portrait of 1966, the image of a poetess with an open gaze was created (Fig. 7b, 7c). The artist used the technique of cinema: a close-up of a fragmentary image of the face allows focusing attention on the eyes. The light silhouette resembles a fragment of a halo. The basis for the engravings was the last photograph of Lesya Ukrainka (1913) (Fig. 7a), performed by her cousin Yuri Teslenko-Prikhodko, which reproduced the psychological state, angle, and clothing of the poetess, later manifested in portraits by Chebanyk.

I. Babii (2025) emphasised that photography has become an autonomous artistic practice, which is both a document and a source material for further artistic transformation. This approach was completely correlated with portraits by B. Chebanyk, where photographs served as a starting point for creating a generalised artistic composition. Portraits of Lesya Ukrainka, created by V. Chebanyk, demonstrated a connection with the tradition of a female photo portrait analysed by S. Kotliar & I. Zaspa (2021), where the photo performs dual functions: documentary – captures the appearance and psychological state of the model, and artistic – forms the image through composition, chiaroscuro, and emphasis on the gaze. The visual semantics of the poetess's gaze correlate with the poetic faces of the drama-fairy tale "The Forest Song", where L. Ukrainka (2021), metaphorically meant the eyes of people doomed to a short life, as "a look from another world". In the portraits of V. Chebanyk, close-up face and open gaze emphasise psychological individuality, inner strength, and spiritual presence, combining the authenticity of the photo with artistic generalisation and symbolic meaning. Thus, pictorial, graphic, and photographic portraits enter into an inter-media dialogue with the literary text, forming a holistic image of spiritual exclusivity.

Figure 7. Comparison of a photographic portrait and engraved images of Lesya Ukrainka created by V.V. Chebanyk

Note: a – photographic portrait of Lesya Ukrainka (1913); b, c – Lesya Ukrainka by V.Y. Chebanyk (1966)

Source: Lesya Ukrainka. Encyclopedia of the life and works (n.d.c), photo by O. Tarasenko

This approach correlates with the "conversation over time" model proposed by M. Skab & M. Skab (2021) in which the past is understood as a living spiritual presence**.** The portrait becomes not only a reproduction of appearance, but also a tool for an intimate, reflective dialogue between modernity and the historical image. The gaze in the portrait transforms it into a sacral space where the past is experienced as an active spiritual presence rather than a static reconstruction of events or external features. The symbolic and cultural role of portraits was emphasised by S. Dolesko & A. Alieksiieva (2022), who analysed the image of Lesya Ukrainka on the national currency as a symbol of statehood and cultural identity. Like banknotes, portraits by V. Chebanyk was transformed into a symbolic image, which formed a cultural memory, emphasised the historical significance and spiritual role of the poetess in national culture. Thus, posthumous portraits of Lesya Ukrainka,

created by V. Chebanyk, combined documentary accuracy, artistic generalisation and symbolic-ritual load, integrating psychological depth, cultural memory, and the sacred presence of the past into the artistic image.

Memorial plaque to Taisiya Sudyina (1931-2012) (Fig. 8) combined a bronze relief portrait image of Lesya Ukrainka with symbolically rich decorative elements, in particular gilded letters and stylised floral ornaments. The compositional solution has an expressive dynamic character. The flowing scarf organises the vertical axis of the composition and at the same time serves as a semantic link between the portrait image and the text inscription: "The outstanding Ukrainian writer Lesya Ukrainka lived in this house in 1889, 1890, and 1893". The dark silhouette of the bronze relief is clearly outlined on a light grey granite background, which enhances the visual dominant of the portrait image.

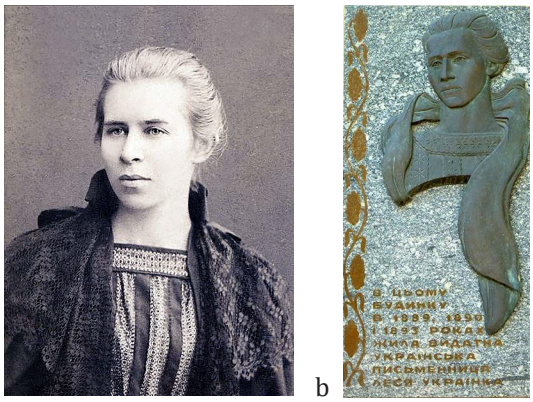

Figure 8. Comparison of a photographic portrait and a sculptural image of Lesya Ukrainka
Note: a – photographic portrait of Lesya Ukrainka, Kyiv (1896); b – memorial plaque to Lesya Ukrainka, bronze, granite (1971)
Source: Embassy of Ukraine in the Republic of Moldova (2021), photo by O. Tarasenko

T. Sudyina integrated the portrait into an expanded ornamental space, within which the psychological individuality of the poetess coexists with generalised symbols of vitality and continuity of cultural tradition. The dynamics of compositional elements – first of all, the movement of the scarf and the rhythm of the floral ornament – violates the static nature of the memorial object, creating the effect of internal movement. The material interaction of bronze, gilding, and stone emphasised the monumentality of the work, and its ritual function – affirming the presence of the image of Lesya Ukrainka in urban space as a sign of cultural memory.

Portrait painting by R. Petruk "Ray of Dream. Lesya Ukrainka" (2020) in Figure 9 presented the image of the poetess through the prism of her drama-fairy tale "The Forest Song", interpreting it in the context of the idea of the spring revival of nature and man as a universal metaphor for spiritual renewal. The development of a recognisable portrait image is based on a thorough study of lifetime photographic materials, which provides biographical authenticity and simultaneously serves as a starting point for artistic generalisation. Overcoming the boundaries of everyday space and historical time, the artist turns to the conventional style of Modernist portraits, in which a realistic interpretation of the face and hands is combined with an ornamentalised solution of the costume.

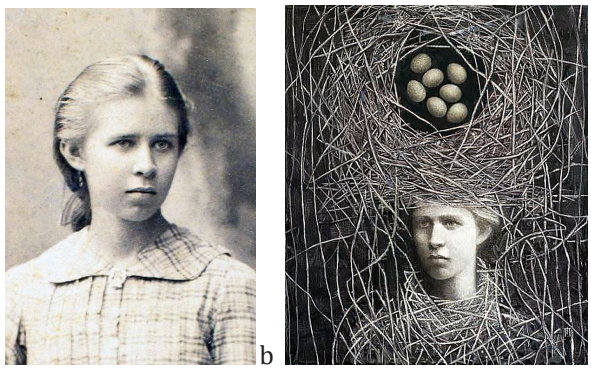

Figure 9. Comparison of a photographic portrait and a painted image of Lesya Ukrainka
Note: a – photographic portrait of Lesya Ukrainka, Odesa (1888); b – Ray of Dream. Lesya Ukrainka by R. Petruk (2020)
Source: Embassy of Ukraine in the Republic of Moldova (2021), Encyclopedia of Modern Ukraine (n.d.)

The symbolic dimension of the image is enhanced by the laconism of the composition and the expressive colouristic opposition of black and white, which functions as the semantic culmination of the visual narrative. In the theoretical concept of W. Kandinsky (2002), these colours are understood as the two limiting possibilities of "silence" – death and birth, which gives the contrast an existential meaning. The inclusion of the egg motif as a universal symbol of the creation of the world and microcosm, and a numerical allusion to Lesya Ukrainka's poem "Seven Strings" (1890) formed a multi-level system of signs (Tresidder, 1997). Above the poetess's head, a bird's nest with eggs is depicted, which simultaneously resembles the shape of a round wreath – a symbol of a closed sacred space, an archetype of integrity, eternal return, and continuity of being. Within this space, the origin of life appears as an act of cosmic and spiritual order. Set among the bare branches of a dormant forest, the nest visualises a potential awakening and inner strength hidden in a state of silent expectation. In compositional and symbolic terms, it served as the semantic centre and visual equivalent of the "Ray of Dream" – the hope of rebirth after a winter sleep and oblivion, which echoes the idea of catharsis and the neo-romantic worldview of Lesya Ukrainka (Chumak, 2021).

The natural motif in the portrait by R. Petruk performs not a decorative, but a conceptual function that

directly correlates with the literary observations of T. Chumak (2021). The researcher emphasised that Lesya Ukrainka's neo-romanticism fundamentally differs from the Western European model by the absence of the motif of spiritual exhaustion; instead, nature in her poetics appears as a space of spiritual strength, self-reflection, and existential choice. The landscape in Lesya Ukrainka's lyrics is not a descriptive element, but acts as a discursive environment where key issues of freedom, will, struggle, and inner harmony unfold. In the pictorial image by R. Petruk, motifs of a sleeping forest, bare branches, and the potency of spring renewal visualise just such a life-affirming neo-romantic ideal, where nature is a source of inner strength, and not a space of melancholic escape.

The image of Lesya Ukrainka in the portrait is formed as a synthetic artistic model, in which biographical recognition is combined with symbolic and mythological generalisation. The appeal to "The Forest Song" allows interpreting the poetess not only as a historical figure, but as an intermediary between the natural and spiritual dimensions of being. This visual concept echoes the conclusions of O. Borzenko (2021) on the early work of Lesya Ukrainka, in which album lyrics and imagery act as a stage in the development of a reflexive artistic consciousness focused on inner experience and symbolic thinking. While in poetry this process takes place in verbal form, in R. Petruk's painting it acquires a visual and philosophical dimension, where Lesya Ukrainka appears as a symbol of rebirth, continuity of life and spiritual stability. The symbolic language of painting by R. Petruk (contrast of black and white, egg motif, numerical allusion to "Seven String") echoes the type of imaginative thinking found by O. Borzenko in Lesya Ukrainka's early poetry: a penchant for picturesqueness, melodramatism, and mythopoetic understanding of reality. If in her album lyrics the poetess explored the realm of intimate feelings and spiritual maturation, then in her paintings this process acquires a visual and philosophical continuation, where Lesya Ukrainka appears as a symbol of rebirth, catharsis, and the continuity of life. Thus, O. Borzenko and Petruk's portrait painting represented different but complementary levels of interpretation of Lesya Ukrainka's image – verbal and visual, united by a common logic of transition from personal experience to cultural and existential universalism.

Thus, the portrait painting by R. Petruka combined elements of realism and symbolism of modernism, creating the image of Lesya Ukrainka as a mythopoetic figure that goes beyond time and space. The artist formed a synthetic portrait in which the recognisable features of the poetess are organically intertwined with mythological and symbolic allusions. The use of natural motifs, contrasting colours, egg and bird's nest symbols forms a multi-level system of signs that reflects the life-affirming neo-romantic worldview of Lesya Ukrainka and her concept of rebirth and catharsis. The painting shows the transition from a personal, biographical experience to a universal cultural and spiritual dimension. In this context, R. Petruk does not serve as an illustrator of poetic texts, but creates a visual reflection on the neo-romantic thinking of the poetess, organically integrating it with the aesthetics of modernism and the dramatic principles of portrait.

In the broader methodological aspect of comparing graphic portraits by B. Chebanyk, memorial relief by T. Sudyina and the portrait paintings by R. Petruk allows highlighting a holistic approach to the visual representation of Lesya Ukrainka in the 20th century. In all cases, the documentary prototype – a photograph or biographical fact – undergoes transformation through artistic generalisation, psychological interpretation, and symbolic coding. This technique creates a multidimensional image of the poetess, in which the authenticity of external features is combined with the depth of the inner world, the ritual significance of the memorial form, and the reflection of national and cultural identity.

Portrait images of Lesya Ukrainka should be considered not only as artistic images, but also as visual representations of a philosophical and cultural personality, in which the individual principle is combined with the socio-historical dimension. According to O. Chaplinska (2022), the poetess appears as a unique phenomenon of the spirit, whose personality is thought in opposition to public and mass perception, which allows interpreting her as a carrier of an autonomous spiritual and cultural position. In this context, a portrait – pictorial, graphic, or photographic – captures not so much external features as manifestations of inner will, spiritual integrity and the desire for freedom, which corresponds to the neo-romantic understanding of the individual as an active subject of cultural and historical processes.

Conceptually similar was the approach proposed by N. Sharma (2022), where female creativity was understood through the prism of the transition from the role of "muse" to the status of an autonomous author of her own narrative. Applying this approach to interpreting Lesya Ukrainka's image is productive, since during her lifetime the poet consistently established herself as an active intellectual and cultural figure, rather than as an object of inspiration. Her texts and public image form a female voice that resists patriarchal models of silence and marginalisation, just as in feminist literature of the 20th and 21st centuries, women's experience becomes central and narratively dominant. In the literary heritage of Lesya Ukrainka, a woman appears as a thinking, reflective, and morally responsible subject of history. Similar shifts can be traced in the visual representations of the poetess – both lifetime and posthumous – where there is a gradual departure from the idealised romanticised image of the "suffering muse" in favour of emphasising intellectual concentration, inner strength, and autonomy.

In comparison with the philosophical views of women of the 19th century, analysed by A. Stone (2024), common conceptual guidelines were identified: the desire for the synthesis of aesthetics and morality, recognition of individual autonomy, interest in the interaction of art and the social role of a person. Like the British philosophers of art, Lesya Ukrainka in her literary and visual images acted as an intermediary between the aesthetic form and the value idea, where beauty, morality, and spiritual mission appear as interrelated components. In the portraits of the poetess, this principle was implemented through the indissoluble connection of the artistic form with the philosophical message, which reveals the inner autonomy, willpower, and cultural responsibility of the individual.

The perspective of philosophical and visual understanding was supplemented by S. Povtoreva (2021), in which Lesya Ukrainka's portraits are viewed through postmodern optics. The researcher noted the restrained expression, internal tension, and lack of everyday markers, which correlates with the non-classical type of thinking of the poetess and her orientation to spiritual, moral, and aesthetic values. In this dimension, the portrait image appeared as an artistic and philosophical model of the individual, which combines intellectual autonomy and symbolic representation of spiritual freedom. Thus, the comparison of Lesya Ukrainka's work with the ideas of N. Sharma (2022) gave grounds to interpret her figure as a symbol of female creative subjectivity in the Ukrainian cultural context. Similar to contemporary feminist art, where the female gaze functions as a form of resistance and self-representation, the image of Lesya Ukrainka in literature and portrait art has established the model of a female creator who forms her own narrative and at the same time reinterprets collective cultural memory.

Thus, the portrait images of Lesya Ukrainka function as a visual projection of the very philosophical ideas that define her literary heritage and echo the aesthetic philosophy of women of the 19th century: the establishment of an active personality capable of influencing public consciousness, forming value orientations and creating a cultural space of autonomous subjects. The internal tension and drama of these images, captured in painting, graphics, and photography, are consistent with the concepts of neo-romantic and postmodern autonomous personality, and with the ideas of leading researchers about the role of aesthetic form as a means of moral, intellectual, and spiritual development of society.

CONCLUSIONS

The analysis of portrait images of Lesya Ukrainka in the context of visual art of the late 19th – early 21st centuries provided conclusions about the evolution of the portrait genre in Ukrainian art and its connection with European artistic traditions. Portraits of Lesya Ukrainka, created by I. Trush, F. Krasytsky, V. Chebanyk, T. Sudyina, and R. Petruk, reflect not only the personality of the poetess, but also broader cultural and historical processes, in particular, the transition from academic tradition to romantic and neo-romantic psychologism. These works demonstrated a paradigm shift in the portrait genre: from representing the social status characteristic of ceremonial portraits of the aristocracy, to emphasising the spiritual depth and emotional state of the individual, which is key for portraits of cultural figures of the 19th-20th centuries.

The study of the poetess's portraits in the context of European visual art revealed their multilayered nature and intertextual interaction with the traditions of Baroque, Romanticism, and Neo-Romanticism. The analysis of lifetime and posthumous portraits of Lesya Ukrainka, created in painting, graphics, sculpture, and photography, showed the evolution of the portrait genre from idealised images of women to psychologically deep images that reflect spiritual energy and existential consciousness. Compositional elements, in particular contrasts of light and shadow, colouristics and ornamentation, emphasised symbolic motifs of love, death, and spiritual verticality, which correlated with European artistic traditions (El Greco, J.A.D. Ingres, F. Goya). Lesya Ukrainka's portraits perform memorial and ritual functions, providing a link between the past and the present and contributing to the establishment of Ukrainian cultural identity. The application of a comprehensive methodological approach helped to establish a link between portraits and the global cultural context. Thus, the lifetime portraits of Lesya Ukrainka appeared not only as iconographic evidence of their era, but also as complex visual texts in which the portrait genre functions as a space of psychological, biographical, and symbolic representation of the individual. In the context of the European portrait tradition – from the ritual and memorial functions of antiquity to the psychological deepening of modernity – the images of Lesya Ukrainka showed a shift from external fixation of individual features to visualisation of internal, existential experience.

Further research may be aimed at studying the influence of Lesya Ukrainka's literary work on visual interpretations of her image, in particular, through the analysis of symbolism in her dramas and poetry. It is also promising to investigate the role of photography as an intermediary between painting and graphics in the portrait genre, which can reveal new aspects of interaction between different media in Ukrainian art. In addition, the analysis of the perception of Lesya Ukrainka's portraits in the modern cultural context, in particular through digital platforms, can shed light on their relevance in the 21st century.

ACKNOWLEDGEMENTS

The author of the study is grateful to the editorial board of the journal for their valuable comments and technical assistance.

FUNDING
None.

CONFLICT OF INTEREST
None.

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Драматургія портрета: Леся Українка в інтертексті візуального мистецтва

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Анотація. Актуальність дослідження зумовлена зростанням інтересу сучасного мистецтвознавства до міждисциплінарного аналізу візуальних образів як носіїв культурної пам'яті, ідентичності та символічних смислів, а також потребою переосмислення українського художнього досвіду в європейському та глобальному контексті. Образ Лесі Українки, як ключової постаті національної культури, залишається недостатньо осмисленим саме в площині драматургії портрета та інтертекстуальних взаємодій між візуальним мистецтвом, літературою і філософією. Метою дослідження було осмислення портретних образів Лесі Українки в контексті європейських візуальних практик з урахуванням їхніх зв'язків із бароковими, романтичними та неоромантичними традиціями, а також осмислення їхнього художнього й символічного виміру у формуванні культурної ідентичності. Застосовано комплексний методологічний підхід, що включає герменевтику, аналітичну психологію, іконографію, іконологію, компаративний, історико-культурологічний та семіотичний методи. Проаналізовано еволюцію жіночого портретного образу від нормативно-ідеалізованих репрезентацій до психологічно поглибленого візуального втілення творчої особистості, у межах якого символічні структури та драматургічна організація композиції набувають визначального смислотворчого значення. Дослідження охопило портрети, створені за життя поетеси та посмертно у різних видах мистецтва (живопис, графіка, скульптура, фотографія). Порівняння портретів Лесі Українки з європейськими творами було зумовлене необхідністю контекстуалізації її образу в межах ширшої художньої традиції. Це дало змогу виявити спільні риси в техніках передачі психологізму та символізму, що є характерними для романтизму, неоромантизму та модерну. Водночас український контекст, зокрема вплив «Лісової пісні» (1911) та інших творів поетеси, надав портретам локальної специфіки, що підкреслило їхню унікальність. Аналіз засвідчив театральність і психологізм образів Лесі Українки, а також їхній зв'язок з універсальними мотивами любові, смерті та духовної вертикалі. Символічні компоненти композицій актуалізували ритуальну функцію портрета як медіатора між минулим, теперішнім і майбутнім

Ключові слова: художнє зображення поетів; іконографічний аналіз; неоромантизм; гендер; театральність; фотографія

ISSN 2617-0272, e-ISSN 2617-0280

ART AND DESIGN
Journal homepage: https://art-design.com.ua/en

9(1), 2026

Received 31.10.2025 Revised 27.02.2026 Accepted 09.04.2026 Published: 10.04.2026

UDC 7.05

DOI: 10.30857/2617-0272.2026.1.7

Innovation design driven by sustainability: A case study based on Samsung electronics

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Abstract. Under the background of sustainable development, the sustainable design and transformation of household appliances are important contents. The aim of this study was to explore the actions and strategies of home appliance companies in sustainable product design. The home appliance products of Samsung Electronics were selected as the main research object, and used case study and strategy research to analyse information and summarised its expressed themes. In the sustainable design of products, a recycling ecosystem centred on home appliances was constructed by Samsung Electronics, and supporting products were developed as key entry point. The exploration of sustainable transformation with corporate characteristics was carried out under the influence of external policy environment, corporate social responsibility, and technological co-innovation. Three major elements of its sustainable design strategy were identified: a design ecology driven by both products and users, the reshaping and optimisation product life cycle management, and user-oriented inclusive design. These elements were shown to provide new insights into the direction of future research and practice. The global transition toward greener home appliance production highlighted the importance of cooperation among enterprises. Based on Samsung's practical experience, it can provide designers and design companies with intuitive and feasible learning standards, and help enterprises explore diversified strategies for sustainable development based on their own situations. The practical significance of this study is that its results can serve as recommendations for designers and companies in the field of home appliances, demonstrating how sustainable design strategies can be effectively integrated into product development and user experience

Keywords: sustainable design; home appliances; product design; user-friendly; case analysis

INTRODUCTION

In the context of global sustainable development, the sustainable transformation of home appliances is not only a modern design trend, but also a strategic decision in the perspective of design studies. At the macro level, sustainable design – as a solution to participate in the construction of ecological civilisation – aims to promote the harmonious development of environment, economy and society. At the micro level, as the undertakers and implementer of sustainable responsibility, enterprises need to consider sustainably-driven innovative design in the whole chain production process, review all aspects of the product life cycle, so as to realise

Suggested Citation:
Jing, Y., & Krotova, T. (2026). Innovation design driven by sustainability: A case study based on Samsung electronics. *Art and Design*, 9(1), 78-87. doi: 10.30857/2617-0272.2026.1.7.

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product upgrading and iteration and lean manufacturing. In this process, product design and innovation are crucial. J. Liu *et al*. (2025) pointed out that the sustainability of a product largely depends on the design stage. H.B. Taramsari *et al*. (2025) believed that the overall sustainable design of a product should revolve around the triple bottom line principles of sustainable design. It is evident that the sustainable design of household appliances is an interdisciplinary and comprehensive study, with in-depth research achievements in environmental, economic and social aspects.

From the perspective of product design, the research hotspots and directions of sustainable design for household appliances are comprehensive. According to X.R. Nie (2024), the development trend of the integration of home environment and household appliances was proposed. It is believed that this method can promote the energy conservation, environmental protection and sustainable healthy development of the industry. The research results of X.Y. Jiang & Q. Wu (2024) indicated that the green transformation of packaging was an important strategic deployment for the sustainable design of home appliances. Z. He *et al*. (2025) also clarified the significance of lightweight design and lean design in their research on the transportation packaging of household appliances. In addition, L. Mei *et al*. (2024), from the perspective of consumers' green purchasing behaviour, pointed out that the energy efficiency information in the design of home appliances has a certain regulatory effect on users' cognition. J.W. Du *et al*. (2019), in response to the green demands of household appliances, have constructed a framework for the green design of household appliances from the aspects of green material development and selection, green design technology, and green evaluation technology. In addition, academic research with the keyword "sustainable design" also focuses on resource utilisation and energy efficiency. W. Liu *et al*. (2025) achieved the management and optimisation of energy systems through multi-agent systems to meet the electricity demands of different household appliances. Meanwhile, the recycling and utilisation of used household appliances have also received certain attention.

Based on the thematic research on Samsung Electronics, in the academic field, Chinese scholars' research on Samsung Electronics mostly focuses on the exploration of the development path of the enterprise. The research of South Korean scholars focuses on the analysis and interpretation of local enterprises (Cha, 2021). Regional differences have led to variations in research levels, resulting in information gaps in this field of study. J. Kim (2022) pointed out in his research on the history and current situation of design in South Korea that the design of Samsung's home appliances has a leading role. Based on the product display of Samsung Home Appliances, L. Su (2024) summarised the core role of intelligent technology in home appliance design, and at the same time pointed out that the integration of home appliances and the home environment is an important trend in product design. In addition, Samsung Electronics is constantly researching and developing materials and processes such as recycled packaging films and surface treatment of aluminium materials, and is continuously making technological innovations in nanotechnology (Mohammed *et al*., 2024), the chip industry, display components, 5G technology and other fields.

From the perspective of the sources of research results, most of the research on sustainable design of household appliances is disseminated within the industry through news and information, etc. There is a lack of theoretical research in this field, opening up opportunities for reflection in professional academic research. At the same time, home appliances themselves should be the focus of research. It is necessary to explore the key role of design thinking and innovative methods in home appliance enterprises. Therefore, the main purpose of this research was exploring typical cases of sustainable development of home appliance enterprises from the perspective of design studies and summarising design direction.

MATERIALS AND METHODS

In order to understand and explore the sustainable design and development strategies of home appliance enterprises, this paper took Samsung Electric as a research sample. Samsung's practice in the field of sustainable design can be considered an industry example, and its product innovation design fully reflected the integration of environmental protection, social responsibility and economic benefits, demonstrating the transformation of ecological brands from traditional home appliance brands to smart home solutions. Through case studies, this paper analysed the product innovation path of Samsung Electronics in the field of sustainable design from 2023 to 2026. The choice of the indicated period was due to the availability and representativeness of empirical data. The scope of this research was defined from the product and user dimensions to specifically explore the sustainable performance of Samsung home appliances in all aspects, including material selection, packaging design, energy-saving technology, user needs, inclusive design, and humanised design. This study adopted a multi-source data collection method. The data sources included the official website of Samsung (Samsung Electronics, n.d.b), product display information, media reports and other channels to collect samples of sustainable design of Samsung home appliances. Using keywords such as "Samsung Home Appliances", "Sustainable design", and "green products" as the core, relevant product models and information were systematically searched and screened. Representative products and strategic actions were selected for further analysis. Their specific performance in sustainable design was interpreted, and sustainable

design strategy with Samsung's characteristics were summarised. Moreover, sustainability-related sections and thematic documents, including corporate social responsibility and sustainability reports, were analysed to assess the accuracy, consistency, and relevance of the collected information.

This study provided insight into its path of sustainable change from three stages. Firstly, starting from the home appliances, Samsung's specific actions were examined and typical cases were selected for analysis. Secondly, from the perspective of user research, the specific manifestations of the sustainable development and transformation of Samsung Home appliances were explored. Finally, Samsung's sustainable development strategy was summarised based on the analysis results and the understanding of sustainable design thinking. The overall research path followed the mapping from product micro-design to development macro-layout, constructing a development theoretical system through product design practice. The limitation of this study lay in its reliance on publicly available product information and relevant materials to summarise the important manifestations of sustainable design in home appliances. It did not include in-depth interviews within enterprises and focused on the analysis of Samsung's home appliance product cases, with the aim of summarising innovative design strategies suitable for the sustainable transformation of enterprises in specific home appliance design cases.

RESULTS AND DISCUSSION

Samsung has built a product ecology around the strategic direction of "sustainability". Samsung Electronics is involved in two major themes in the sustainable design of home appliances. First, focusing on product-centred design optimisation and lean manufacturing of efficient and environmentally friendly home appliances. Secondly, user-centred, accessible and emotional design that pursues social equity.

Product dimensions of sustainable design performance. In the product dimension, building a circular ecology centred on home appliances is an important step for Samsung Electronics on the road to sustainable design. The development and transformation of sustainable design is enhanced and accelerated at a systemic level by utilising the home appliance itself as the core, spanning the entire life cycle and integrating environmental, economic and social aspects. Samsung Electronics follows the concept of product life cycle and adopts corresponding strategies at each stage, which are mainly reflected in the following four aspects.

First, the utilisation and management of materials. The consideration of recycled plastic in the design of Samsung home appliances mainly lies in two aspects. The first one is the reuse of recyclable plastics. An example of this approach is the BESPOKE Grande AI washing machine. This washing machine uses at least 20% recycled plastic for the internal shelves and the outer shell of the detergent box, thereby reducing reliance on limited resources such as raw materials (Fig. 1).

Figure 1. Automatic detergent dispensing compartment
Source: Samsung Electronics (n.d.c)

This approach reflects the transition of materials from a linear to a cyclic model. Transforming waste into usable resources is an important manifestation of the closed-loop utilisation of resource materials within circular design theory. The second is the solution to the problem of microplastics. Samsung Electronics not only optimises the design of its washing machine products but also collaborates with other technology companies to jointly develop a unique "micro-plastic low-reduction filter". This filter is not only suitable for Samsung washing machines but also compatible with washing machine products from other companies, demonstrating strong applicability (Fig. 2).

Figure 2. Less Microfiber Filter first presented at CES 2023
Source: Samsung Electronics (2023)

In addition, Samsung has introduced the Less Microfiber Cycle technology, which reduces the friction between clothes through washing cycles, thereby effectively slowing down the formation of microplastics. Cross-brand adaptability indicates that its design log-

ic has expanded from a single product to a systematic ecological collaboration level. Compared with the discussions on the end-of-life recycling issue of products in previous studies (Carlson *et al*., 2025), this practice systematically considers the dual paths of material recycling and control, and establishes a circular design strategy from the design front end to the post-production stage.

Second, enhance the energy efficiency of household appliances through their appearance design. Improving the energy efficiency of products is the key to the sustainable transformation of most home appliance enterprises. Samsung's contribution in this regard mainly involves achieving the goal of energy conservation by optimising the working mode of the design of home appliances themselves. In the design of the Yinxiangjia series of air conditioners (Fig. 3), the energy-saving and power-saving mode Wind-free can reduce electricity consumption in terms of performance, and the design of the product's appearance further promotes the focus on energy conservation.

Figure 3. Yinxiangjia air conditioners
Source: Samsung Electronics (n.d.d)

The design of the air conditioner's air outlet is rotating, and the micro-hole design on the metal panel can promote the diffusion of cold air. Samsung unifies technical performance with product appearance in its design, not only contributing to energy conservation, but also influencing the visual characteristics of the product design. By optimising the appearance structure, the functional efficiency of household appliances can be enhanced, and differentiated and personalised appearance designs can be formed, demonstrating the harmony and unity of sustainable design in both technology and aesthetics.

Third, the durability of the materials and finishes of household appliances. In terms of the durability design of household appliances, the material and finish of the product's appearance are important entry points. The Samsung sterilising washing machine is designed with tempered glass doors (Fig. 4). The material is sturdy and durable, not easy to break or scratch. Even after repeated touch tests on opening and closing, the appearance still maintains a bright and beautiful texture. In addition, the compact design of the body ensures the optimisation of the usage space while reducing the product size. Moreover, it can achieve intelligent maintenance in the Samsung SmartThings (n.d.) application and is easy to maintain. The design strategies of material strength selection, compact design and intelligent management demonstrate the feasible practices of Samsung home appliances in delaying aesthetic aging, optimising product and spatial layout, and applying digital technology. This observation is consistent with the view of B. He & H. Mao (2023), who noted that the integration of digital technologies such as digital twins and low-carbon design approaches can contribute to improving the sustainability of products. These approaches reflect the evolution of home appliance from physical durability to systematic durability, and reinforce the core goal of sustainable design in extending the product life cycle from multiple dimensions.

Figure 4. Tempered glass door of the washing machine
Source: Samsung Electronics (n.d.e)

Fourth, the recycling of product packaging. Relying on its main products, Samsung is committed to the research and development of additional products for home appliance packaging accessories, which is also an economical and sustainable behaviour. For instance, Samsung has also considered sustainable design in the packaging of its home appliances. The paper box packaging of Samsung vacuum cleaners can be reused to make various household items. Users can cut, fold and assemble stationery, bookshelves, piggy banks, shoe racks and other items according to the dotted lines on the packaging cardboard (Fig. 5).

In this process, not only is the reuse value of cardboard realised, but also users are guided to participate, strengthening their sustainable awareness through participatory experiences. With home appliances as the core, extending to the sustainability of related products such as packaging and remote controls, it means that Samsung's sustainable design for home appliances is different from the single consideration of home appliances themselves (Lima & Kubota, 2022). Instead, it uses the main products to drive the redesign of surrounding products and enhances product interaction and experience through fun design.

Figure 5. Circular packaging
Source: Samsung Electronics (n.d.f)

In addition, the full life cycle design and circular ecosystem are important strategies for the sustainable design of Samsung's home appliances. A comprehensive assessment of the entire product life cycle is conducted to achieve comprehensive and all-round management of resources. Attention is also paid to product recycling and utilisation, and waste electronic products are recycled and reused, fully realising environmental protection benefits. It can be seen that in the process of designing around the products themselves, Samsung Home Appliances have enhanced sustainability in multiple aspects such as material usage, performance optimisation, appearance design, and recyclable packaging. Unlike other home appliance enterprises, Samsung designs its home appliances in a compatible way rather than by completely redesigning them, achieving sustainable product improvement and reflecting an approach to product design optimisation. Furthermore, resource sharing and collaboration among industries also extend the impact of environmental protection innovation to the entire industry, which may contribute to the discussion of sustainable development strategies in enterprises.

User dimensions of sustainable design performance. In the user dimension, Samsung Electronics aims to enhance the user experience by integrating digital technologies and inclusive design approaches. In the era of digitalisation and intelligence, it creates a digital life centred on home appliances, integrating inclusive design and sustainability considerations. First, emphasise user retention through inclusive design, that is, all users can enjoy products and services equally. Samsung interacts with users through various channels to obtain user needs, considering user feedback and needs in product design, so that user needs can be equally met. And conduct in-depth interviews and online surveys for special groups, subdivides user groups, and evaluates product experience and design through user testing (Fig. 6).

Figure 6. In-depth interviews of the professional team
Source: Samsung Electronics (n.d.a)

Furthermore, in product design, it should be more user-friendly in aspects such as the operation interface, appearance form, and material selection. Through these design practices, Samsung not only meets the functional requirements but also integrates the concept of sustainable development into users' daily experiences through form, aesthetics and interaction methods. Second, Samsung considers accessibility for special user groups in the design of home appliances, which is reflected in four aspects: vision, hearing, movement and recognition (Fig. 7).

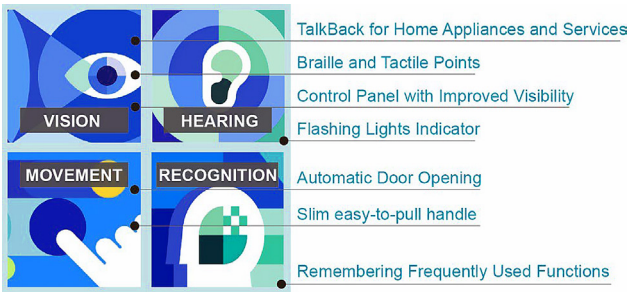

Figure 7. Humanised design in Samsung home appliances
Source: developed by authors

Samsung integrated visual aids, such as braille and tactile dots applied to product buttons, and an LCD panel with enlarged text, complemented by sound effects to distinguish between washing machines and dryers. For hearing, the refrigerator features flashing lights and audible alarms, while the display provides subtitles and videos to provide comprehensive information to hearing-impaired users. On the behavioural side, the refrigerator features a handy slim pull handle for comfort and ease of use. In terms of recognition, washing machine and clothes dryer products intelligently remember common procedures, eliminating setting steps and improving operation efficiency. In the icon design of household appliances, digital displays have replaced physical buttons, marking different usage states of the appliances through the use of simplified and standardised symbol forms. For example, a circle represents "push" and a triangle represents "pull" (Fig. 8).

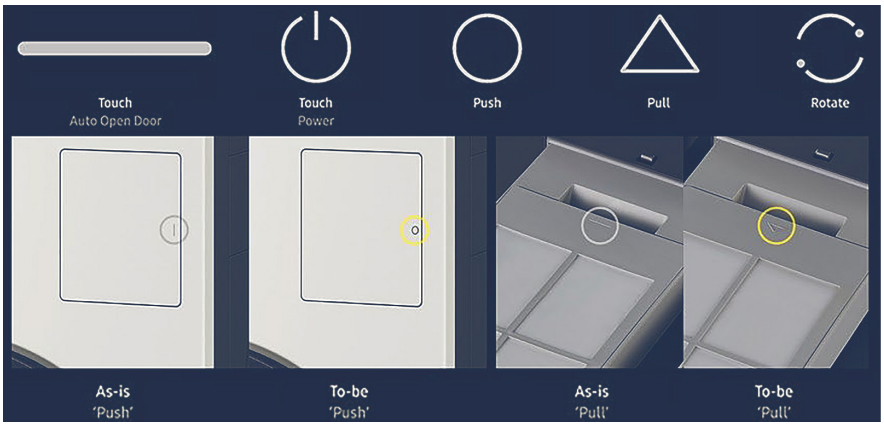

Figure 8. Indicative product icons
Source: Samsung Newsroom Global (2025)

Humanised design of household appliances enhances the satisfaction and usage experience of different user groups, thereby making household appliances a medium for communication between products and users, and achieving the sustainability of green consumption and brand trust. Third, personalised design of the appearance of home appliances based on user demands. In the BESPOKE refrigerator design of Samsung (Fig. 9), clean, minimalist lines of the shape give the overall form stability and a sense of order, designed to align visually with typical household environments.

In terms of form expression, this product uses low-saturation natural tones and soft neutral colours, extending the visual aesthetic life of the product. Materials like glass and metal are treated with matte finishes, delicate texture and soft reflection to unify the visual texture and touch, which may contribute to extending the perceived aesthetic longevity of the product. Designers, based on user preferences, view the product as a system that can continuously evolve in response to changes in user needs. Through unified and standardised structural design, different functional modules are freely combined to meet users' personalised demands.

Figure 9. BESPOKE refrigerator
Source: Samsung Design (2026)

Samsung's focus on users goes beyond the meeting of basic product functions, incorporating user input and accessibility considerations in the design of home appliances. By emphasising inclusive design, considering the needs of different user groups, and focusing on user participation and barrier-free design. This

user-centred sustainable product design illustrates how integrating sustainable design into product development may influence consumer choices and corporate practices. By analysing and interpreting the content of a specific case study on the sustainable design of Samsung's home appliances, the key factors that influence and promote the sustainable design of Samsung home appliances can be explored. As a global environmental awareness that drives the sustainable innovation and transformation of enterprises both externally and internally, Samsung, as a representative home appliance company, can practice the diversity of sustainable development from multiple dimensions such as products, users, and society.

Sustainable design of household appliances is often understood as a matter of technological optimisation, performance improvement or life cycle management. However, the product design itself plays a significant role in the expression of sustainability. S. Ji & P.S. Lin (2022) pointed out that the concept of sustainability can be perceived by users through product forms, materials and aesthetic experiences. This perspective provides an important reference for the sustainable design of Samsung's home appliances. The design of Samsung's home appliances does not take environmental protection as an independent pursuit, but through systematic design, it jointly applies the product itself and user experience to the sustainable expression of home appliances.

Samsung Home Appliances takes products and users as the dual core to build a sustainable design ecosystem. This dual-core strategy makes product design not only focus on technology and environmental protection, but also emphasise user experience and social responsibility, forming an organic whole. Unlike the technology-driven path, emphasised by B.K. Sovacool *et al*. (2022), Samsung's home appliance design, in terms of appearance form, colour and material treatment, weakens the technical attributes of the products visually and enhances the user affinity. This aligns with the view, proposed by E.M. da Silva *et al*. (2025), which suggests that sustainable behaviour can be promoted through design experience. The synergistically driven ecosystem integrates advanced technologies, collaborative innovation, and user feedback to facilitate product iteration and user needs and technological innovation.

The management of the product life cycle has become an indispensable strategy in the development of most enterprises. It is not only a direct initiative to comply with environmental protection, but also an in-depth consideration of the entire product process, and a process of seeking a balance between sustainability and commercial reality (Sun *et al*., 2023). Research shows that Samsung Home Appliances has reshaped the product life cycle with the goal of sustainable development. In the design stage, household appliances have reduced the decorative and trendy elements in terms of colour and shape, maintaining visual aesthetic stability and meeting users' diverse aesthetic needs. This behaviour supplements the research that mainly discusses the life cycle from the perspective of engineering management, indicating that design form and aesthetic stability are both important factors influencing product sustainability.

User-oriented inclusive design is the most prominent feature of Samsung home appliances. J.H. Lee *et al*. (2025) pointed out that inclusive design is not only reflected in the usability of the functional, but should be integrated into the overall design experience. Samsung Home Appliances, through in-depth research on the needs of user groups, ensures that the design of its products takes into account the expectations of both mainstream users and special groups. This makes Samsung's appliances are not just a collection of functions, but a full understanding and respect for the diversity of users. In the era of new products, users play an important role in providing feedback for product design and development. Only by grasping the key information on the demand side of the product can innovation and upgrading on the supply side be achieved with the support of technology. The whole process is dynamic and circular, and the user-oriented inclusive design not only wins social recognition for the enterprise, but also expands the market audience of the product which may influence the public perception of the brand.

Overall, in its research on sustainable design for home appliances, Samsung has comprehensively considered the products and users as well as the systems they form. It has enriched the context of sustainable expression for home appliances from dimensions such as material usage, modular design, energy efficiency improvement, and product packaging. At the same time, it has supplemented a user-centred perspective on sustainability through inclusive design, barrier-free design, and humanised design. Samsung's experience may serve as a reference case for other enterprises.

CONCLUSIONS

Thr ough the case analysis and strategy discussion of Samsung home appliances sustainable design, it can be seen that the expression of sustainability in home appliances is diverse, especially by combining user needs with the products themselves and presenting them visually from multiple aspects such as materials, colours, and shapes. The analysis showed that the product-user dual-core design ecosystem constructed by Samsung Home Appliances was conducive to comprehensively enhancing user perception and usage experience. It was found that the impact of design on the product life cycle could be optimised through aesthetic durability constituted by external manifestations such as materials and colours. The research results on inclusive design indicated that the sustainable design of household appliances was not only achieved through the optimisation of interfaces or operation methods,

but was also realised by simplifying forms and optimising the combined effects of multiple sensory channels. The analysis further demonstrated that Samsung Home Appliances may inform approaches to brand positioning and sustainable design implementation in the home appliance sector. The continuous progress of technology will provide more possibilities for product design, and user interest in social responsibility and sustainability may influence enterprise strategies. Home appliances play a central role in daily household operations, and the attention and satisfaction of users' needs are not blind, but based on sustainable values guidance, and effectively promote fairness through product design. In the future, the home appliance industry will pay more attention to innovation and practice of sustainable design. Further in-depth research will be conducted around product form innovation, the application of ecological materials, and the guidance of users' sustainable behaviours, promoting the development of home appliance design towards a more ecological, humanistic and fair direction.

ACKNOWLEDGEMENTS

None.

FUNDING

None.

CONFLICT OF INTEREST

None.

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Інноваційний дизайн за принципами сталого розвитку: тематичне дослідження на основі електроніки Samsung

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Анотація. В умовах сталого розвитку важливим напрямом є сталий дизайн і трансформація побутової техніки. Метою цього дослідження було вивчення дій і стратегій компаній-виробників побутової техніки у сфері сталого проєктування продукції. Як основний об'єкт дослідження було обрано продукцію компанії Samsung Electronics. У роботі було застосовано метод кейс-стаді та стратегічного аналізу для опрацювання інформації й узагальнення виявлених тематичних аспектів. У межах сталого проєктування продукції компанією було сформовано екосистему перероблення, центром якої виступає побутова техніка, а допоміжні продукти розглядаються як ключова точка входу. Під впливом зовнішнього політичного середовища, корпоративної соціальної відповідальності та технологічної коінновації здійснюється пошук шляхів сталої трансформації з урахуванням корпоративної специфіки. Було виокремлено три основні елементи стратегії сталого дизайну: формування дизайн-екології, що ґрунтується на взаємодії продуктів і користувачів; переосмислення та оптимізацію управління життєвим циклом продукту; а також користувацько-орієнтований інклюзивний дизайн. Показано, що ці елементи відкривають нові перспективи для подальших досліджень і практики. Глобальний перехід до більш екологічного виробництва побутової техніки підкреслив важливість співпраці між підприємствами. Практичний досвід Samsung Electronics може слугувати для дизайнерів і дизайн-компаній наочним і практично застосовним орієнтиром, а також допомогти підприємствам розробляти різноманітні стратегії сталого розвитку з урахуванням власних умов. Практичне значення цього дослідження полягає в тому, що його результати можуть слугувати в якості рекомендацій для дизайнерів та компаній у сфері побутової техніки, демонструючи, як стратегії сталого дизайну можна ефективно інтегрувати у розробку продуктів та користувацький досвід

Ключові слова: сталий дизайн; побутова техніка; дизайн продукту; зручність використання; кейс-аналіз

ISSN 2617-0272, e-ISSN 2617-0280

ART AND DESIGN
Journal homepage: https://art-design.com.ua/en

9(1), 2026

Received 09.12.2025 Revised 05.03.2026 Accepted 09.04.2026 Published: 10.04.2026

UDC 004.42

DOI: 10.30857/2617-0272.2026.1.8

Application of contemporary cloud-based design tools in web interface

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Abstract. The relevance of this study is determined by the rapid development of the digital environment and the increasing demands placed on the quality of user interfaces, which require the effective use of contemporary graphic design tools in web design practices. The purpose of the study was to provide a comprehensive analysis of the role of the platforms Figma, Adobe XD, and Sketch in web interface development processes and their impact on task efficiency, design speed, the level of collaboration, and the development of design systems. This purpose was achieved through an integrated approach combining theoretical analysis, case studies, and an empirical experiment with a student learning group. Key characteristics of the tools were analysed, their effectiveness in performing typical project tasks was evaluated, and their impact on productivity and interface quality was assessed. The study established that contemporary graphic editors substantially transform professional User Interface design practice by ensuring scalability, consistency, and efficiency of digital products. Successful examples of tool application in e-commerce, healthcare services, educational platforms, and SaaS solutions were analysed. The advantages of cloud-based collaboration, integration with other software ecosystems, and support for accessibility standards were identified. Based on empirical data, recommendations were formulated regarding the selection of tools depending on project requirements, and potential risks of excessive design standardisation were outlined. The findings may be used by designers, front-end developers, managers, and educators to optimise User Interface processes, enhance team productivity, and improve the quality of web interfaces

Keywords: UI design; Figma; Adobe XD; Sketch; digital interfaces; design systems; graphic editor

INTRODUCTION

In the digital era, graphic design has undergone a substantial transformation: from a tool of visual representation, it has evolved into a means of designing user experience. At the centre of this transformation lies the development of interface practices that require designers to possess not only aesthetic sensitivity but also a deep understanding of behavioural psychology, usability principles, adaptability, and multichannel communication. Contemporary graphic design tools do not merely simplify layout processes, but establish a new model of interaction within team-based, iterative, and agile design. Their application is a key factor in shaping effective UI/UX design (User Interface / User Experience Design) that meets user expectations and adapts to different platforms and contexts of use. The interaction between design tools and the quality of user experience occupies a central place in many studies. The impact of specific graphic platforms (Figma, Adobe XD, Sketch) on UI design practices, however, requires deeper conceptual consideration.

S. Zhang *et al.* (2025) indicated a shift in the very approach to interface design. The researchers emphasised that the transition from desktop tools (Photoshop, Illustrator) to cloud-based collaborative platforms (Figma) altered the logic of designers' work: designers became part of the software development cycle rather than external consultants. X. Ye *et al.* (2024) focused on analysing the effectiveness of different stages of the UI

Suggested Citation:
Azzaari, A. (2026). Application of contemporary cloud-based design tools in web interface. *Art and Design*, 9(1), 88-99. doi: 10.30857/2617-0272.2026.1.8.

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process involving designers, developers, and product managers. The researchers demonstrated that platforms supporting real-time collaboration reduced the number of revisions at the final stage by nearly 40%. This confirms that contemporary graphic tools are not only convenient but also reduce resource expenditure. Component-oriented design systems, such as those implemented in Figma, demonstrate high flexibility and enable the creation of reusable elements, which ensures design consistency in large-scale projects. S.S. Goraya (2024), however, noted that excessive standardisation may limit individuality and creative expression, as pre-built templates and reusable components may impose structures that are not always suitable for specific cases or innovative solutions.

O. Rajala (2024) addressed an important issue: how UI design tools support the scalability of digital products. The researcher established that the use of components and libraries substantially improves the updatability of design, since replacing a single element in a library automatically updates it across all related layouts. The academic field gradually forms an understanding of UI design as an interdisciplinary practice in which tools function not only as technical means, but also as instruments for organising work, thinking, and creativity. Ukrainian researchers pay particular attention to the organisation of design systems as a foundation for creating sustainable and scalable interfaces. S. Samulinas & N. Zhytienova (2025) analysed in detail the role of Figma as a cloud-based environment that supports a component-based approach, auto layout, adaptive typography, and collaborative work on UI cases. The researchers noted that the implementation of a design system increases consistency between developers and designers, reduces the time required for updating visual elements, and decreases the number of coding errors. They also emphasised the role of Figma as an educational platform: due to its accessibility, intuitive interface, and the possibility of creating templates, the tool forms new standards of visual thinking in student projects.

Other researchers, P.V. Krokhmal *et al.* (2024), in an interdisciplinary study, demonstrated how Adobe XD transforms the creation of media-oriented interfaces. The focus lay on the integration of animation, voice triggers, logical transition sequences, and the construction of narrative in digital educational environments. The researchers indicated that multimodality ensures deeper user engagement, particularly in projects related to education, museum environments, or cultural communication. R.S. Uhlyk (2025), by contrast, drew attention to critical aspects of template-based design. In the study, the researcher examined the consequences of excessive use of ready-made UI components in Figma, which leads to aesthetic standardisation, loss of context, and depersonalisation of brands. The researcher called for a balance between functional standardisation and creative experimentation, arguing that successful interfaces result from a contextual approach that considers the target audience, cultural code, social habits, and the environment of use.

In the context of practical development of digital services, the position of T. Huang (2024) was of particular interest, as the researcher developed integrative approaches to the use of Figma in design. The method Figma-Enhanced App Design Framework for Improving UI/UX in Educational App Development demonstrated how variable components, prototyping, and interactive links in Figma enable the modelling of user behaviour logic and its testing in the form of a visual script. This approach contributes to the democratisation of design, since even small teams without advanced front-end knowledge can effectively create competitive web products while adhering to user-centred design principles and improving user interaction with interfaces. A distinct dimension of the issue concerns the cognitive aspect of interaction. In their study, M. Zhang *et al.* (2022) analysed the role of microinteractions and colour coding in reducing cognitive load. Drawing on UX testing of mobile applications, the researchers demonstrated that a well-structured visual hierarchy, spatial rhythm, typographic organisation, and colour accents significantly enhance user orientation. They also examined the role of emotional triggers, such as transition animations, changes in button states, and tactile effects, as factors contributing to trust in the interface.

The academic discourse is therefore increasingly enriched by interdisciplinary approaches to the analysis of UI/UX design. Most studies, however, remain narrowly specialised or focused on the review of individual tools without a comprehensive analysis of their impact on design thinking, user interaction, and interdisciplinary connections between technology, psychology of perception, and visual communication. In this context, the purpose of the study was to examine the role of contemporary graphic tools as a foundation for shaping an effective, inclusive, and emotionally meaningful user experience in the digital environment, with reference to the context of Ukraine, educational and cultural practices, and the experience of Ukrainian design communities.

MATERIALS AND METHODS

The study was conducted using an integrated approach that combines theoretical analysis, case study, and empirical evaluation. This combination ensured a comprehensive examination of the effectiveness of contemporary UI/UX design tools and strengthened the robustness of the results obtained. At the first stage, an analysis of academic sources and current practices of using UI/UX design tools was carried out. This enabled the identification of key evaluation criteria, including ease of use, task completion speed, level of collaboration, prototyping capabilities, support for design systems, integration features, and overall effectiveness

of the application. At the second stage, a case analysis was conducted, covering five practical scenarios of using UI/UX design tools in different sectors, including e-commerce, healthcare, education, analytical services, and media. Each case involved the performance of typical interface design tasks using a specific tool, namely Figma, Adobe XD, and Sketch. Within this stage, key performance indicators were recorded, including changes in design time, errors in the interface design process, level of collaboration, development of design systems, and accessibility provision.

Task completion time and the number of errors under control and experimental conditions were examined to determine changes in the duration of key development stages within controlled and experimental task environments. Under control conditions, basic tool functionalities were used without collaboration or component libraries, whereas experimental conditions involved full use of functionality, including component libraries, auto layout, and real-time collaboration. For Case 1, a detailed table with absolute values for each stage of development is provided as an illustration of the general measurement procedure. Percentage indicators of changes in design time and error rates during interface development were determined through comparison of the results of identical project tasks performed under control and experimental conditions.

Task completion time was recorded through continuous time tracking during the execution of cases. The starting point was defined as the moment when participants received instructions for task completion, and the endpoint as the presentation of the final version of the layout or prototype. Data on the duration of each stage were recorded in an observation protocol. The number of errors was determined through expert analysis of the created layouts and included cases of inconsistency of interface elements with the technical specification, violations of navigation structure, and incorrect use of design system components or visual styles. Errors included inconsistency of interface elements with the technical specification, violations of navigation structure, and incorrect use of design system components or visual styles. The recording of task duration and the registration of errors were carried out by the researcher based on observation of the participants' workflow and analysis of the obtained results. Percentage changes in time and error rates were calculated as the ratio of the difference between control and experimental values to the control values, multiplied by 100%. The obtained data were systematised and generalised, which enables transparent comparison and verification of the results.

The third stage of the study involved a training experiment in the form of a controlled empirical investigation. The target group of the empirical study consisted of third- and fourth-year students of technical and information-related specialisations at the Libyan College of Electronic Technology, including programmes in information technology, computer science, and digital design. All participants provided consent to take part in the survey, and the entire process complied with the Declaration of Helsinki (World Medical Association, 2013). The selected group possessed a sufficient level of theoretical training and basic practical experience in the field of digital product development, which ensured the possibility of informed analysis of the presented cases and a grounded comparative evaluation of the tools used. The experiment involved 13 participants who had prior experience with UI/UX design tools. The participants were divided into three groups of 4, 4, and 5 individuals, respectively. Each group worked under identical conditions and received a unified instruction for task completion. The experiment lasted three days, during which each group performed designated cases using a specific tool: the first group worked with Figma (Cases 1 and 4), the second with Adobe XD (Cases 2 and 5), and the third with Sketch (Case 3). External experts were not involved in the evaluation, and the recording of results was carried out by the researcher.

A standardised questionnaire consisting of seven questions was used for data collection, each corresponding to a specific evaluation criterion. Respondents evaluated the tools on a five-point scale, where values from 1 to 5 reflected the degree to which a given characteristic was expressed, from lowest to highest. Data were processed through the calculation of an integral efficiency index for each tool. The index was defined as the arithmetic mean of the scores across all criteria, which enabled the aggregation of individual indicators into a single quantitative metric. Formally, this can be expressed as:

$$I = \frac{1}{n}\sum_{i=1}^{n} S_i, \quad (1)$$

where – the integral efficiency index, – the score for an individual criterion, – the number of criteria.

To enhance interpretability, the index was also normalised into percentage form relative to the maximum scale value:

$$I_{\%} = \frac{I}{5} \times 100\%. \quad (2)$$

The proposed methodology ensures a systematic, transparent, and reproducible approach to evaluating the effectiveness of UI/UX tools. The use of a combination of theoretical analysis, case study, and empirical experiment enables precise measurement of changes in key indicators, including design time, error rate, level of collaboration, and development of design systems, and allows their presentation in percentage form for ease of comparison. This approach ensures objectivity and reliability of the results and establishes a basis for their substantiated analysis in the subsequent section of the study.

RESULTS AND DISCUSSION

In the rapidly evolving landscape of web design, UI development has become a key element in ensuring a seamless digital experience. As users interact with websites across multiple devices and platforms, the visual and interactive quality of interfaces directly influences levels of engagement, satisfaction, and retention. Graphic design, previously treated as a distinct artistic discipline, now constitutes an integral component of UI design and shapes the logic of presenting and interacting with digital content. Within the context of this study, particular attention is given to analysing how the use of contemporary graphic design tools transforms web interface development processes, affects the efficiency of team collaboration, and influences the quality of final UI solutions. The emergence of cloud-based and collaborative design platforms transformed conventional workflows into dynamic, iterative models that involve continuous interaction between designers, developers, and stakeholders.

The results of the study indicated that the use of contemporary graphic design tools in the development of web interfaces exerts a systemic influence not only on the technical aspects of UI/UX design, but also on the organisation of development processes, the efficiency of collaboration among participants, and the quality of the final digital product. The analysis of five practical cases, combined with a comparison of the results with data from recent studies, enabled the identification of consistent patterns in the transformation of interface development processes under the influence of cloud-based and desktop platforms. A considerable shift in the structure of the design process was identified in the first instance.

The first case concerns the redesign of the web interface of an e-commerce platform. The primary objective was to improve navigation usability, optimise the catalogue structure, and enhance the visual hierarchy of interface elements. Component libraries and responsive layouts were used to implement these tasks, which enabled rapid testing of alternative interface variants. During the process, a design system with reusable UI components was developed, which ensured consistency of visual style and simplified subsequent product scaling. As illustrated in Figure 1, the interface of the platform in Figma includes component libraries and responsive layouts, which clearly demonstrate the organisation of elements and the structure of the design.

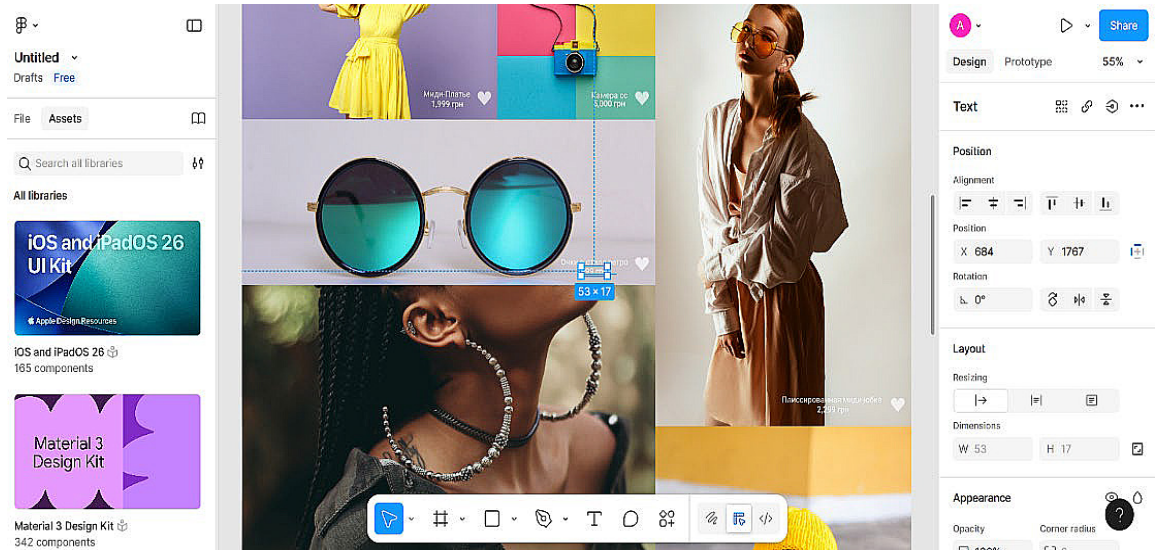

Figure 1. Development of an e-commerce platform using Figma – time optimisation and reduction of errors through collaboration and component libraries

Source: compiled by the author

The second case concerns the development of the interface of an online medical service in the Adobe XD environment. The main objective of the project was to create a clear structure of user scenarios, including registration, login, and service selection. The use of a contemporary design tool enabled iterative testing of prototypes and rapid modification based on feedback from potential users and stakeholders. During the design process, a series of screens was developed that represent the sequence of user interaction with the system, including data input forms, selection of activities, medical specialists, and appointment time. As illustrated in Figure 2, the interface is presented as a set of interconnected screens that demonstrate the main stages of the user journey and the logic of transitions between them in the Adobe XD environment. All screens were designed in accordance with accessibility standards WCAG 2.1 level AA (World Wide Web Consortium, 2018), which ensures their usability for individuals with disabilities.

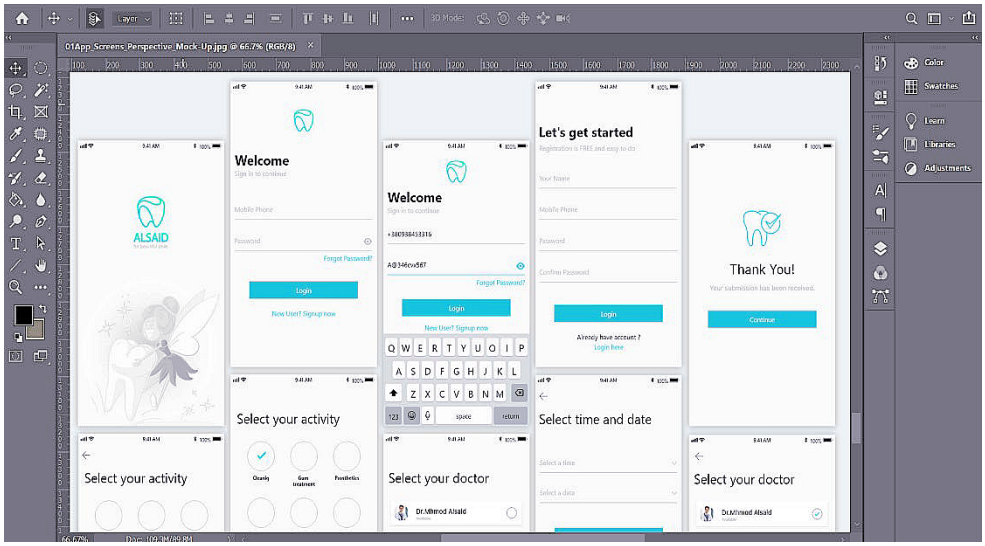

Figure 2. Development of a medical application using Adobe XD
Source: compiled by the author

The third case covered the development of an interface for an educational web platform intended for distance learning. The primary task was to establish a clear information architecture and ensure convenient navigation between learning modules, courses, and interactive materials. Prototypes of varying levels of fidelity were used during the design process, which enabled gradual refinement of the interface structure and alignment of design decisions. Figure 3 presented a set of design system elements, including typography, UI components, and interface solution variants developed in the Sketch environment.

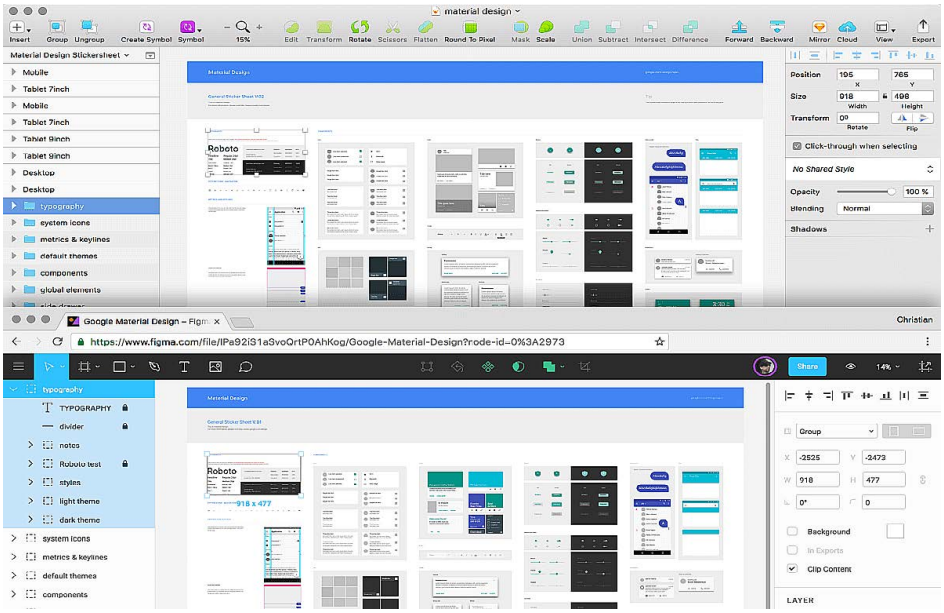

Figure 3. Example of an interface implementation for an educational web platform in Sketch: screen structure, typography, and design system components
Source: compiled by the author

The next case is devoted to the development of an interface for a SaaS platform for financial analytics. The main objective was to reduce visual overload and improve the perception of complex analytical data. Modular grids, iconography, and elements of visual hierarchy were applied to achieve this objective, which enabled the structuring of information and improved readability. During the design process, design system components and standardised interface solutions were used, which ensured consistency of elements and simplified

work with layouts within a unified environment. The interface of the SaaS platform for financial analytics, including a dashboard with data visualisation, charts, and design system elements developed in Figma, illustrates structured data presentation and the use of unified components (Fig. 4).

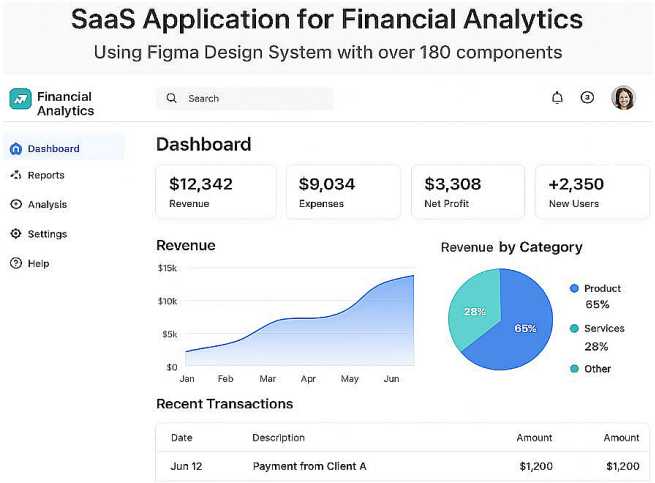

Figure 4. Example of a SaaS application interface for financial analytics created using a design system in Figma
Source: compiled by the author

The further development of these approaches is considered in the following case, which concerns the design of the interface of a news web portal. In this case, the main focus was placed on ensuring responsiveness, optimising page structure, and improving content readability. A component-based approach was applied, which enabled the standardisation of content presentation and ensured interface coherence. An example of implementation is presented in Figure 5.

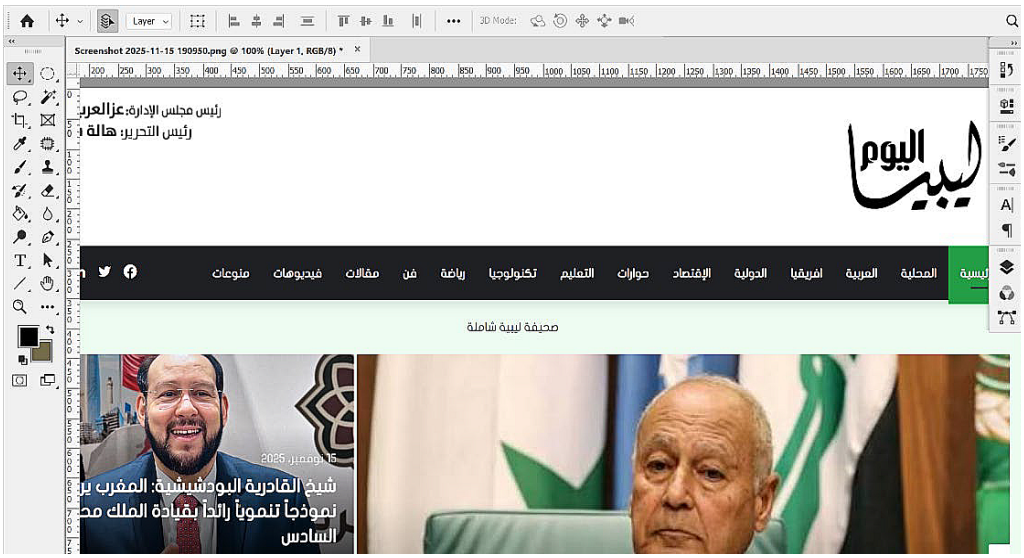

Figure 5. News portal – integration of Adobe XD with Creative Cloud for efficient graphics processing and interface adaptation across devices
Source: compiled by the author

A comparative analysis was conducted to quantify the actual impact of these platforms on workflows and team productivity, as well as to systematise their advantages and limitations, based on the results of an empirical survey of students of the Libyan College of Electronic Technology. The aggregation of respondents' answers, combined with the analysis of case studies, enabled the formation of a structured evaluation of three leading platforms – Figma, Adobe XD, and Sketch. The results of the analysis, presented in Table 1, were systematised across seven key criteria.

Table 1. Comparative assessment of tool effectiveness (scale 1-5)

Indicator	Figma	Adobe XD	Sketch
Interface usability	4.8	4.3	4.2
Collaboration (teamwork)	5.0	3.8	3.2
Adaptability / responsive design	4.7	4.4	4.1
Integration with other systems	4.5	4.9	3.7
Prototyping speed	4.9	4.6	4.0
Accessibility (WCAG, plugins)	4.4	4.8	3.9
Design system support	5.0	4.2	4.1
Average score	4.76	4.43	3.89

Source: compiled by the author

Lower collaboration indicators point to the limitations of the offline work model and reduced flexibility in collaborative editing. Sketch demonstrated the lowest average result, although it retains stability in core interface design functions. Its strengths remain rapid prototyping and interface simplicity. Limited collaboration and weaker integration with cloud services, however, constrained its use in large or distributed teams. The effectiveness of UI/UX design tools is therefore determined not only by the number of features but also by the level of integration, adaptability, and support for collaborative interaction. Cloud-based environments, particularly Figma, shape a new paradigm of digital design in which collaboration, scalability, and process standardisation become priorities. The selection of a specific tool depends on the type of project, available infrastructure, and requirements for design customisation. Within the experimental stage described in the methodology, Case 1 was analysed to provide a quantitative assessment of the impact of Figma on the efficiency of the interface development process. Table 2 presented the average indicators of task completion time and number of errors under control and experimental conditions.

Table 2. Comparison of task completion time and number of errors when using Figma (Case 1)

Stage	Time (hours)		Time reduction (%)	Number of errors		Error reduction (%)
	Control conditions	Experimental conditions		Control conditions	Experimental conditions	
Layout creation	40	25	38	12	6	50
Prototyping	30	20	33	5	2	60
Client approval	25	15	40	3	1	67
Total	95	60	37	20	9	55

Source: compiled by the author

As shown in the table, the transition to experimental conditions enabled a substantial reduction in task completion time and a decrease in the number of errors across all key stages of interface development. Following the transition to Figma, a significant reduction in overall design time was observed. The largest decrease occurred at the layout development stage (38%), which indicates the effectiveness of component libraries and collaborative editing. The reduction in prototyping time (33%) is explained by the ability to create interactive scenarios rapidly without exporting to external tools. The client approval stage also became shorter, since Figma provides simultaneous access for clients and developers to the current version of the layout, eliminating the need for multiple review cycles and file transfers. As a result, the implementation of Figma contributed not only to reduced design time but also to increased process transparency, fewer errors, and improved version control. This confirms the relevance of cloud-based environments in contemporary design teams, particularly in large or distributed projects.

The cases examined demonstrated the specific features of applying different UI/UX design tools depending on the type of project, defined tasks, and organisation of the development process. The presented examples reflect the variability of approaches to interface design, including the use of component libraries, prototyping, collaboration tools, and integration capabilities. The results of case execution were summarised in tabular form to systematise the data obtained and enable further comparison. Table 3 presented the main characteristics of each case, the tools used, the design objectives, and the recorded performance indicators.

Among the tools examined, Figma demonstrated the highest integral efficiency, Adobe XD showed a moderate level, and Sketch – the lowest. The aggregation of survey results indicates that the key determinant of the effectiveness of contemporary UI/UX design tools is the integration of collaboration, prototyping, and asset transfer functions within a unified environment. This reflects a broader trend in the development of digital design platforms towards

cloud-oriented collaboration and the reduction of barriers between the stages of design, testing, and implementation of interfaces. The results of the analysis allow the identification of several key trends in the use of contemporary graphic design tools in web interface development. First, a flexible and adaptive approach to design is becoming increasingly widespread, enabling efficient work across multiple platforms, from desktop to mobile devices. Tools that support responsive design significantly facilitate this process. Second, the component-based approach has become a standard in professional practice. Third, the importance of collaboration is increasing. Tools that support real-time collaboration, such as Figma, demonstrated higher effectiveness, particularly in distributed teams or projects with tight deadlines.

Table 3. Comparison of case study results

Case No.	Industry / product	Tool used	Main objective	Key results
1	E-commerce platform	Figma	Redesign of a mobile application	Design time ↓ 35%, task-related errors ↓ 50%, collaboration – high (real time), design system – centralised components, accessibility – partial.
2	Medical system	Adobe XD	Accessibility and WCAG compliance	Design time ↓ 20%, task-related errors ↓ 30%, collaboration – medium, design system – medium, accessibility – full WCAG 2.1 AA compliance.
3	Educational portal	Sketch + Abstract	Version control management	Design time ↓ 15%, task-related errors ↓ 20%, collaboration – limited, design system – medium, accessibility – limited.
4	SaaS analytics	Figma	Design system development	Design time ↓ 30%, task-related errors ↓ 45%, collaboration – high, design system – 180+ components, scalability – high, accessibility – partial.
5	News portal	Adobe XD	Integration with Adobe Cloud	Design time ↓ 25%, task-related errors ↓ 35%, collaboration – medium, design system – medium, accessibility – partial.

Source: compiled by the author

The comparative analysis of the effectiveness of contemporary UI/UX design tools confirmed that both cloud-based and desktop solutions significantly influence the organisation of user workflows. In the study by J. Wang *et al.* (2022), testing of Figma, Adobe XD, and Sketch indicated that, although statistically significant differences were not identified overall, 58% of respondents noted that the "overall usability" of Figma was noticeably higher. Similar conclusions are presented in the report of The Competition and Markets Authority (2023), where Figma received a score of 31 in workflow evaluation, Adobe XD 23, and Sketch 21; the assessed criteria included learning, collaboration, version control, and other functional aspects. The technical analysis of C. Krammer (2017) emphasised that Figma provided more advanced "layout grid" and "vector networks" functionalities compared with Sketch and Adobe XD, which positively affects design adaptability and prototyping efficiency.

The use of tools that support real-time collaboration facilitates a transition from a linear design model to an iterative one, within which design, testing, and modification occur in parallel. Similar conclusions were presented by H. Maxwell & R. Brisco (2025), who stated that the integration of designers and developers within a shared digital environment reduced the number of repeated iterations and shortened the decision-making cycle. The results of this study confirmed this tendency: in cases where cloud platforms were used, the time required for layout approval and revisions decreased compared with conventional offline approaches. A second important outcome of the use of contemporary tools is the increase in respondent efficiency and the reduction in errors during task execution. In the study by Y. Lamine & J. Cheng (2022), the implementation of component-oriented design systems increased the consistency of visual solutions and organisational efficiency of teams. Similar results were observed in the case studies, where the use of component libraries ensured centralised updates of layouts, reduced the number of inconsistent elements, and improved the stability of UI solutions in large-scale projects.

Particular attention should be given to the impact of tools on team interaction, since the use of digital technologies in collaborative project environments can significantly alter team behaviour and improve the efficiency of group processes, as demonstrated in research on collaborative digital technologies in design (Yu *et al.*, 2024). Platforms that support simultaneous editing and real-time commenting enhance process transparency and reduce communication gaps between designers, developers, and other stakeholders. This corresponds with the results of K.J.K. Feng *et al.* (2023), who demonstrated that the integration of UI tools into a shared workspace increases team productivity and reduces the risk of discrepancies between design decisions and their technical implementation.

An important aspect of the results concerns the impact of contemporary tools on compliance with accessibility standards. The study by H. Shah (2024) emphasised that the presence of built-in mechanisms for verifying compliance with WCAG 2.1 AA at the design

stage significantly increases the level of inclusivity of digital products. Alongside these positive outcomes, certain limitations were identified. Excessive standardisation of design systems may reduce creative flexibility and lead to a loss of brand distinctiveness, which corresponds with the conclusions of A. Tevi *et al.* (2025) and A. Shokrizadeh (2025). The use of local tools without a fully developed cloud infrastructure also complicated the synchronisation of changes in large or distributed teams, which is supported by the findings of R. Jolak *et al.* (2023). The study demonstrated that contemporary graphic design tools transform not only the technological dimension of UI/UX processes, but also the organisation of teamwork, the scalability of projects, and compliance with accessibility standards. The key determinants of the effectiveness of UI/UX tools include real-time collaboration, a component-oriented approach, support for WCAG (World Wide Web Consortium, 2018), and integration with other tools. These factors ensure effective teamwork, interface consistency, inclusivity of digital products, and continuity of workflows. Among the tools examined, Figma demonstrated advantages across all these dimensions.

Thus, the findings of the study and the analysis of user experience also enable the identification of certain limitations of contemporary UI/UX design tools. Excessive unification of design systems may lead to reduced individuality and a loss of brand distinctiveness in interfaces. The use of cloud platforms is associated with technological dependence and high requirements for internet connectivity. In summary, the case results confirm that flexibility, component-based architecture, accessibility, and integration constitute key determinants of the effectiveness of contemporary cloud-based design environments, which is also supported by D. Masveta & M.E. Manyangara (2025), who emphasised the importance of adaptability and personalisation in contemporary digital interfaces for ensuring a positive user experience. The effectiveness of any tool remains contingent on the conditions of its use, the level of the team, and the context of the task.

Figma has a range of functional advantages that position it as one of the leading tools for UI/UX design. The platform supports real-time collaboration, enabling multiple designers to work simultaneously on a layout, which increases process transparency and reduces the likelihood of version conflicts. An important feature is the support of component libraries and design systems, which enable automatic updating of elements across all layouts, facilitate design standardisation, and reduce the time required for repeated modifications. Auto layout and responsiveness simplify the creation of responsive interfaces for different platforms and devices, while the cross-platform nature of Figma, with access via browser or desktop environments (Windows, macOS, Linux), renders the tool suitable for distributed teams. The availability of plugins and integrations extends functionality, enabling accessibility checks, the creation of interactive prototypes, and UX testing.

Among the limitations of Figma is the requirement for a stable internet connection for full functionality. In large projects, the organisation of components and libraries may require the use of additional plugins. The study by T. Huang (2024) emphasised that Figma substantially altered the conventional model of interface development by integrating users into the full cycle, from layout creation to user experience testing. The usability of the platform enables even users with limited experience to create interactive prototypes rapidly and test UX hypotheses, while the browser-based version and cross-platform accessibility ensure availability across devices. Within the experimental study involving students of the Libyan College of Electronic Technology, the use of Figma in the e-commerce platform case enabled participants to redesign a mobile application simultaneously, reducing design time by 35% and decreasing the number of errors by 50%. This supports the conclusions of T. Huang regarding increased efficiency and quality of work when using a cloud-based platform.

Adobe XD offers its own set of functional advantages. The platform integrates with Adobe Creative Cloud, which ensures seamless asset exchange between Photoshop, Illustrator, and XD, which is particularly relevant for multimedia projects (Krokhmal *et al.*, 2024). The tool supports prototyping and animation, enabling the creation of interactive scenarios without reliance on third-party applications. Adobe XD also supports plugins for UI/UX design and accessibility verification, which facilitates compliance with WCAG 2.1 AA standards (World Wide Web Consortium, 2018) and enables control of colour contrast and typography. The platform also presents certain limitations. In large teams, its real-time collaboration capabilities are less effective compared with Figma, and flexibility in constructing component systems is more limited, which may complicate work on large-scale design systems. The study by X. Ye *et al.* (2024) demonstrated that Adobe XD is an effective tool for creating inclusive interfaces, particularly in medical and educational services. The platform supports WCAG 2.1 AA standards, enabling verification of colour contrast, font size, and compliance of interface elements with accessibility requirements. It also provides prototyping capabilities with animation and interactive scenarios, which enable modelling of user behaviour with diverse sensory and cognitive needs. Integration with the ecosystem of Adobe Creative Cloud facilitates the processing of graphic assets in Photoshop and Illustrator and their rapid incorporation into layouts. A practical example supports this: in the case of a medical information system, the use of Adobe XD ensured full compliance of the interface with WCAG 2.1 AA standards (World Wide Web Consortium, 2018), which enabled the creation of a usable and accessible digital service.

In turn, X. Ye *et al.* (2024) indicated that Adobe XD has limitations in the context of team collaboration, particularly in projects with tight deadlines. The platform does not provide fully synchronous real-time collaboration for multiple users, which may lead to delays and an increased number of revisions at the final stage. Large or distributed teams often require additional tools for version control and file management. For example, in the case of the news portal, integration with Adobe Creative Cloud accelerated graphic processing, yet the approval of layouts between participants in the experiment and developers required more time than in Figma. Adobe XD thus combines strengths in inclusivity, integration, and multimedia prototyping with certain collaboration constraints. The platform is an optimal choice for projects in which compliance with accessibility standards and integration with graphic assets are critical; however, for rapid team cycles and work on large distributed projects, it is advisable to consider additional tools or alternatives that support real-time collaboration (Kowalczyk *et al.*, 2022). This approach preserves the advantages of Adobe XD in creating inclusive interfaces while reducing the risks of delays and decreased team productivity.

Sketch demonstrated a number of functional advantages that make it attractive for specific categories of users. First, the platform is characterised by stability and fast rendering of layouts, which makes it suitable for work on macOS and in offline mode, particularly for small and medium-sized teams. Second, Sketch supports an extensive plugin ecosystem, which enables the extension of functionality and integration with Abstract for version control in team projects. Third, the availability of flexible component libraries supports the reuse of interface elements and enhances design consistency within large projects. Sketch also presents certain limitations. The absence of a Windows version and limited online collaboration capabilities create difficulties for teams working across different operating systems or remotely. The platform depends to a considerable extent on local infrastructure and third-party services for synchronising work in large teams, which may complicate the scaling of development processes.

The study by P. Krokhmal *et al.* (2024) emphasised that Sketch remains an effective tool for creating stable layouts and managing local design processes, particularly in small teams and projects with a limited number of participants. The main advantages of the platform include fast rendering, stability on macOS, and a wide range of plugins that enable flexible extension of functionality and the creation of local component li braries through Abstract. These features make Sketch suitable for the development of design systems and for maintaining a high level of interface quality under controlled conditions. Nevertheless, as noted by R.S. Uhlyk (2025), the absence of a cloud environment and limited support for real-time collaboration create substantial constraints in large-scale and distributed projects. Participants working on complex products with numerous layouts encounter difficulties in synchronising changes, risks of duplicated work, and challenges in version control. In the case of the educational portal (Case 3), respondents indicated that, although Sketch enabled the creation of flexible design systems, limited collaboration and the absence of an integrated cloud environment slowed work on large interface sections and increased the coordination burden on project managers, who were required to manage changes manually. Sketch is therefore suitable for locally managed projects due to its stability and fast rendering, while limited support for online collaboration and cloud integration reduces its effectiveness in large or distributed teams.

Thus, graphic design tools such as Figma, Adobe XD, and Sketch considerably transform web interface development processes. They support integration between designers, developers, and product teams, and improve the efficiency of UI/UX processes through a component-oriented approach, adaptive design, and integration with other systems. The use of contemporary platforms enables the optimisation of workflows, improves interface quality, and ensures scalability and design consistency.

CONCLUSIONS

The analysis of the case studies and the comparative evaluation of Figma, Adobe XD, and Sketch indicated that the key determinants of UI/UX process efficiency include collaboration, a component-oriented approach, design adaptability, integration with other systems, and compliance with accessibility standards. The study demonstrated that the use of Figma in team-based workflows reduced design time by 35% and decreased the number of errors by 50% (Case 1). The analysis showed that the possibility of simultaneous layout editing and the use of shared component libraries ensured interface consistency and supported the efficiency of scalable projects.

The study indicated that Adobe XD is an optimal tool for projects with high requirements for accessibility and integration with the Adobe Creative Cloud ecosystem. In Case 2 of the medical information system, the platform ensured full compliance with standards, which confirmed its effectiveness in the development of inclusive interfaces. At the same time, the analysis demonstrated limitations of Adobe XD in synchronous collaboration for large or distributed teams. Sketch demonstrated high stability and fast rendering of layouts, which makes it effective for locally managed projects. The study confirmed that limited support for online collaboration and the absence of cloud integration reduce the effectiveness of Sketch in large-scale or distributed teams (Case 3).

Overall, the analysis indicated that Figma achieved the highest integral efficiency indicators among the

platforms under consideration (average score of 4.76), due to high team productivity, support for design systems, and integrated collaborative editing functions. Adobe XD and Sketch demonstrated strengths in specialised aspects, yet showed limitations in collaboration and scalability. Prospects for further studies include the quantitative evaluation of the impact of integrated cloud platforms on the productivity of teams of different sizes and project types, along with the examination of optimal strategies for combining tools to balance creativity, adaptability, and design standardisation. Particular attention should be given to the impact of the component-oriented approach on the innovativeness and uniqueness of interfaces across different sectors.

ACKNOWLEDGEMENTS

None.

FUNDING

None.

CONFLICT OF INTEREST

None.

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Застосування сучасних хмарних інструментів дизайну у практиках розробки веб-інтерфейсів

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Анотація. Актуальність цього дослідження зумовлена стрімким розвитком цифрового середовища та зростанням вимог до якості користувацьких інтерфейсів, що потребує ефективного використання сучасних інструментів графічного дизайну у практиках веб-дизайну. Мета статті полягала у комплексному аналізі ролі платформ Figma, Adobe XD та Sketch у процесах розробки веб-інтерфейсів та їхнього впливу на ефективність виконання завдань, швидкість проєктування, рівень колаборації та розвиток дизайн-систем. Для досягнення цієї мети застосовано комплексний підхід, що поєднав теоретичний аналіз, кейс-стаді та емпіричний експеримент із навчальною групою студентів. Проаналізовано ключові характеристики інструментів, оцінено їхню ефективність у виконанні типових проєктних завдань та виявлено вплив на продуктивність і якість інтерфейсів. Визначено, що сучасні графічні редактори значною мірою трансформують професійну практику User Interface дизайну, забезпечуючи масштабованість, послідовність та ефективність цифрового продукту. Проаналізовано успішні приклади використання інструментів у сферах e-commerce, медичних сервісів, освітніх платформ та SaaS-рішень. Виявлено переваги хмарної співпраці, інтеграції з іншими програмними екосистемами та підтримки стандартів доступності. На підставі емпіричних даних сформульовано рекомендації щодо вибору інструментів залежно від потреб проєкту, а також окреслено потенційні ризики надмірної шаблонізації дизайну. Дослідження може бути використане дизайнерами, фронтенд-розробниками, менеджерами та викладачами для оптимізації процесів User Interface, підвищення продуктивності команд та покращення якості веб-інтерфейсів

Ключові слова: UI-дизайн; Figma; Adobe XD; Sketch; цифрові інтерфейси; дизайн-система; графічний редактор

ISSN 2617-0272, e-ISSN 2617-0280

ART AND DESIGN
Journal homepage: https://art-design.com.ua/en

9(1), 2026

Received 25.11.2025 Revised 24.02.2026 Accepted 09.04.2026 Published: 10.04.2026

UDC 712.3:502.5:111.852:911.375.5 DOI: 10.30857/2617-0272.2026.1.9

Designing for ecological aesthetics in urban agriculture: Operationalising ecodesign principles across multilayer city landscapes

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Abstract. Ecologically designed urban agricultural landscapes present a critical, yet underutilised, strategy for mitigating biodiversity loss, enhancing climate resilience, and addressing social inequities within contemporary urban environments. The primary purpose of this study was to develop and operationalise a theoretical and practical framework that integrates ecological aesthetics into the design of urban agriculture, positioning aesthetic experience as a core component of multifunctional ecological performance. A mixed-methods approach was employed, combining a comprehensive literature review on ecological aesthetics with a detailed analysis of design examples from existing urban agricultural spaces. The investigation established a structured ecodesign framework with explicit criteria that synthesise aesthetics, ecological function, and resilience across diverse urban layers, including green roofs, greenways, and building facades. It was found that sensory qualities such as colour, texture, and rhythm, along with cultural meaning, can be deliberately orchestrated to amplify biodiversity support, enhance food production, and improve climate regulation without compromising ecological integrity. The framework further demonstrated how these aesthetic strategies can be systematically applied across vertical, horizontal, and transitional urban spaces to create coherent and engaging landscapes. The practical value of this research resides in its actionable design guidance and evaluation criteria, which can be utilised by urban planners, landscape architects, and policymakers to create adaptive, context-aware urban agricultural environments that harmonise beauty with robust ecological function and social relevance

Keywords: green infrastructure; ecological performance; landscape typology; microclimate mitigation; biodiversity strategies; vertical urbanism; ecosystem services

INTRODUCTION

Urban agricultural landscapes are rapidly emerging as a critical spatial typology within contemporary cities, offering a multifunctional approach to addressing interconnected challenges of food security, environmental degradation, and social well-being. E. Mino *et al*. (2021) noted that as urban populations continue to expand, the integration of food production into the urban fabric presents a strategic opportunity to transform underutilised spaces into productive and ecologically beneficial environments. These landscapes hold the potential to reconnect urban dwellers with food systems, mitigate the urban heat island effect, manage stormwater, and support biodiversity, thereby contributing to the overall resilience and sustainability of cities. Consequently, understanding how to effectively design and implement urban agricultural landscapes

Suggested Citation:
Ren, X., & Bulhakova, T. (2026). Designing for ecological aesthetics in urban agriculture: Operationalising ecodesign principles across multilayer city landscapes. *Art and Design*, 9(1), 100-115. doi: 10.30857/2617-0272.2026.1.9.

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has become a pressing concern for researchers, planners, and policymakers seeking to create more liveable and sustainable urban futures.

The scholarship has made significant strides in advancing the ecological and functional dimensions of urban agricultural design. R. Hansen *et al*. (2023) explored the potential of urban agricultural landscapes to address food insecurity and environmental degradation, establishing a foundational understanding of their multifunctional role in urban settings. Expanding on this, K. Bohn & D. Chu (2021) developed the "food-productive greenway" concept, proposing an integrated approach that combines food production with urban food system activities to enhance both ecological capacity and socio-economic resilience. This work provided a significant framework for thinking about how productive landscapes could be woven into urban infrastructure. In a related vein, I. Quintero *et al*. (2022) introduced the Main Agro-ecological Structure (MAS) index, a comprehensive assessment tool comprising ten criteria and twenty-nine indicators designed to evaluate agro-biodiversity. Their research emphasised that the structural and spatial configuration of agricultural landscapes, particularly the extension and diversity of ecological connectors, can be strategically designed to enhance biodiversity connectivity. Furthermore, they argued that effective design must integrate physical landscape elements with cultural context, accounting for management practices and farmer perceptions to create resilient agro-ecosystems. However, their work, like much of the current research, focuses primarily on ecological function and connectivity without delving into the aesthetic dimensions of these designed landscapes.

Parallel developments in urban park design have yielded principles applicable to urban agriculture. F. Bolat & V. Deneri (2022) identified key agroecology principles such as habitat preservation and stormwater management that have been successfully implemented in urban agricultural projects, emphasising the importance of community involvement and resilience in creating successful public spaces. Similarly, J. Yuan & C.S. Kim (2024) advanced context-sensitive design approaches for coastal urban areas, focusing on the integration of salt-tolerant plant species and specialised soil and water management techniques. While these studies provide valuable insights into the ecological and functional aspects of designed landscapes, they similarly overlook the role of aesthetic experience in shaping user engagement and long-term stewardship.

The question of aesthetic experience in landscape architecture has itself undergone significant re-examination. K. Melcher (2022) traced the historical evolution of aesthetic preferences, noting that while aesthetic experience has varied across different periods and cultures, it has predominantly been centred on visual appeal, with people historically drawn to landscapes characterised by symmetry, colour, and formal beauty. However, R. Mundher *et al*. (2022) documented a growing recognition that contemporary design aesthetics must transcend mere visual attraction to incorporate principles of ecological sustainability. This shift has given rise to what S. Fu & F. Lv (2023) characterised as "ecological aesthetics", an emerging paradigm that integrates ecological principles directly into aesthetic theory and practice. Their work established that ecological aesthetics represents not merely an application of ecological knowledge to design, but a fundamental reconceptualisation of beauty itself as inherently connected to ecological health and function.

Urban agricultural landscapes present a uniquely promising opportunity for the application of ecological aesthetics. J. Zhang (2025) argued that by integrating ecological aesthetics into the design of these productive spaces, designers can create multifunctional environments that are simultaneously engaging, environmentally beneficial, and rich with social educational potential. Their research suggested that such integration could transform urban agriculture from primarily a food production strategy into a comprehensive approach to urban placemaking. Yet despite this potential, the systematic application of ecological aesthetics within urban agricultural contexts remains largely underexplored, representing a significant gap in current scholarship. Given these insights, this study was conducted to investigate the concept of ecological aesthetics and to develop a categorised typology of urban agriculture applications across multiple city layers. By incorporating ecological aesthetics into the design of these typologies, the research sought to establish a framework for enhancing the multifunctionality and resilience of urban agricultural landscapes, ensuring they not only contribute to food security and environmental sustainability but also meaningfully enrich the urban aesthetic experience.

This study employed a qualitative mixed-strategy design that integrated theoretical synthesis with comparative case study analysis. The methodology was constructed through an iterative process in which a literature review informed the selection and analysis of design exemplars, and insights from the cases subsequently refined the theoretical framework. The literature review established a robust theoretical scaffold for ecological aesthetics, drawing on interdisciplinary scholarship across landscape ecology, urban design, and sustainability studies. This review generated an analytical framework comprising three core categories – aesthetics, ecological function, and resilience – which structured the subsequent case analysis.

Case selection was guided by this theoretical foundation, with projects chosen to represent a spectrum of scales, contexts, and operational strategies within contemporary landscape and ecological design. The sample was purposively selected to ensure coverage of diverse urban strata, including the horizontal ground plane, the vertical building envelope, interior spaces, and coastal

edges. The set of exemplars comprised: Hauser & Wirth Somerset (Oudolf, n.d.), the Battersea Power Station Roof Garden (Crook, 2023), the Brick Swale at Balfour Street Pocket Park (MacGowan, 2012), the Oyster-tecture Project (SCAPE, 2025), and the Urban Farming Office in Ho Chi Minh City (Elangical, 2023).

Analysis procedures involved applying the three analytical categories to each case study. Data sources included project documentation, design drawings/models, and published critiques. Cross-case synthesis was employed to identify recurring operational strategies and context-specific adaptations for embedding ecological aesthetics within different urban layers. This integrated approach – moving iteratively between theoretical categories and empirical cases – supported the development of a structured multi-layer ecodesign framework that translates ecological aesthetics into explicit design criteria.

ECOLOGICAL AESTHETICS AND EDIBLE LANDSCAPES IN SUSTAINABLE URBAN DESIGN

Edible landscape has roots that trace back to the earliest practices of gardening. Since the early 2000s, this age-old practice has experienced a resurgence in urban areas, driven by concerns such as environmental degradation and food security issues linked to industrial food production systems. As Z.-W. Zheng & R.-J. Chou (2023) argued in their systematic review, these pressing challenges have positioned edible landscapes as a key strategy for sustainable urban development. Urban agricultural landscape should be understood not as mere spaces to be occupied, but as deliberate design elements that integrate edible functionality into the urban fabric. According to X. Shi (2023), who explored the creation of public edible landscapes, urban food forests and productive plantings can transform public spaces by encouraging community participation and multifunctional use. By incorporating productive plantings – such as fruiting trees, culinary herbs, edible perennials, and nourishing groundcovers – urban environments evolve from static backdrops to dynamic, functional ecosystems. This approach harmonises aesthetics with nourishment, yielding places that are visually compelling and ecologically and socially functional, promoting biodiversity, resilience, and community engagement. As R. Biasi & E. Brunori (2023) further emphasised, such integration of food systems into urban design fosters multifunctional landscapes that address both ecological and social dimensions of sustainability. In embracing edible landscape design, the authors acknowledge that urban spaces can be both aesthetically refined and materially productive, transforming each corner into a locus of nourishment, shelter, and sustainable practice.

In environmental design, designers seek a form of beauty capable of coexisting harmoniously with the natural world. As T. Beck (2013) observed, this pursuit emphasises how aesthetic elements – such as form, material, colour, light, and movement – play a crucial role in shaping landscapes that are both visually appealing and environmentally responsible. Emerging from these ideas, ecological aesthetics offers a perspective that foregrounds the relationship between people and ecosystems. By focusing on how landscapes look, feel, and function, ecological aesthetics fosters public understanding and acceptance of sustainable design, making beauty an accessible and meaningful dimension of everyday environments.

Ecological aesthetics redefine landscape appreciation by foregrounding cognitive processing, environmentalism, and a normative, style-independent approach to beauty. Rooted in the principle of "making nature visible", this conception, according to B.-W. Min (2012), emphasised multi-sensory experience, ecological functions, landscape temporality, and the historical dimension of place, while also addressing concerns of security and accessibility. Building on this foundation, A. Berleant (2025) concept of aesthetic engagement reconceptualises aesthetic experience as an immersive, temporal process rather than a moment of detached contemplation. It foregrounds the viewer's active participation within a holistic context, where meaning emerges through direct sensory interaction with the environment. Aesthetic value, in this view, is not inherent in an object alone but arises from the dynamic relationship between participant and setting, unfolding over time as perception deepens and conditions shift. By decoupling aesthetics from rigid stylistic norms, ecological aesthetics invites a broader, more inclusive understanding of beauty – one that highlights the integrative roles of ecosystems, human perception, and cultural memory. In translating these characteristics into practice, designers are urged to cultivate what J. Mikkonen (2022) described as creativity that effectively communicates ecological functions and the evolving narratives of landscapes to the public. Through such approaches, ostensibly unattractive or hidden ecological spaces can be transformed into legible, engaging, and artistic environments.

Urban agricultural spaces, as integral components of green infrastructure, offer substantial design opportunities to mitigate pollution and regulate urban microclimates. As D.L. Evans *et al*. (2022) demonstrated in their systematic review, thoughtful integration of spatial composition, materiality, and aesthetics can transform these spaces into multifunctional environmental assets. When edible vegetation is integrated into the built fabric through deliberate design, these spaces can simultaneously perform ecological functions – such as providing shade and cooling through evapotranspiration – and make those functions legible as part of the landscape's identity.

Central to this approach is the principle of revealing ecological functions – making the invisible work of

microclimate regulation visible and tangible to users. P. Pradhan *et al*. (2023) emphasised that performance outcomes such as cooling, shading, and airflow must be deliberately considered in design decisions, ensuring that aesthetic quality and ecological function reinforce one another. The resulting microclimatic benefits – captured particulates, CO_2 sequestration, moderated temperatures, directed breezes, and controlled humidity – should therefore inform both form and material choices, transforming abstract environmental services into sensory experiences.

Spatial layout plays a key role in this process. By prioritising the relationship between sun exposure and prevailing winds, designers can guide the orientation of planting beds, access routes, and built elements to maximise cooling, shading, and airflow. More importantly, these spatial decisions become perceptible to users: shaded walkways signal temperature modulation, breezeways channel moving air, and open planting arrangements invite awareness of sun and shade dynamics. The balance between enclosure and openness, achieved through plan geometry, sightlines, and perforated barriers, further communicates ecological function while protecting crops from proximal pollution sources.

Materiality reinforces this legibility. Materials with natural textures and colours can reflect moisture and light, while ventilated facades, green walls, and permeable pavements reveal how water, air, and heat move through the space. As D. Giaquinto *et al*. (2022) observed, green walls, vertical gardens, tree canopies, and green corridors should be integrated not only for their ecological value but also as expressive design elements that visually narrate pollution absorption, cooling, and habitat provision. In this way, material choices do not merely serve function – they articulate it, making the landscape a readable story of environmental performance. In sum, when spatial composition and materiality are intentionally designed to reveal microclimatic processes, urban agriculture transcends its productive role to become a model of ecological aesthetics. It makes visible the ways in which landscapes regulate, cool, and clean, inviting users to experience sustainability not as an abstract concept but as an everyday, embodied reality.

Beyond microclimatic regulation, urban agricultural spaces can function as engines of sustainability when design foregrounds closed-loop resource flows, biodiversity, and resilient water management. As O. Morrow & A. Davies (2022) argued, these productive landscapes offer a unique opportunity to demonstrate how urban systems can operate within ecological limits when their underlying processes are made visible through design – and in becoming visible, they invite users to participate in and care for the systems that sustain them. C.I. Nicholls *et al*. (2016) highlighted how thoughtfully configured productive landscapes can exemplify waste-to-resource cycles, energy synergy, and habitat creation. Drawing from the design strategies synthesised in Table 1, a design-centric perspective emphasises spatial composition, materiality, and aesthetic integration to translate these ecological principles into visible, legible, and usable landscapes. By shaping layouts that reveal these interconnected systems, designers can craft spaces where ecological performance is experienced as everyday beauty and practical function.

Spatial composition plays a foundational role in making closed-loop processes perceptible. H. Rashidi *et al*. (2015) demonstrated that layouts can organise composting zones, rainwater harvesting systems, and renewable-energy installations in deliberate sequence with planting beds, paths, and gathering spaces – allowing users to intuitively grasp the logic of material flows. The differentiation between perimeter and core spaces, achieved through thoughtful enclosure and openness, can communicate concepts of material reuse and energy cycling while maintaining accessibility and crop productivity. The arrangement of beds, terraces, containers, and vertical elements should dramatise the movement of resources: from organic waste transforming into compost, from solar energy captured to energy used on-site, from greywater collected to irrigation delivered. In this way, the landscape itself becomes a living demonstration of circular design, inviting users to witness and learn from its processes.

Materiality is equally central to rendering these ecological functions legible. H.A. Saleh & T.R. Alrobaee (2024) emphasised that durable, repurposed, and modular materials can embody circular economy principles while simultaneously conveying ecological function. Reclaimed timber signals resource efficiency; recycled metal exemplifies material reuse; porous pavers and permeable surfaces reveal the movement of water through the site. Surface textures and colours can further articulate ecological dynamics: rough, heat-absorbing textures in exposed zones contrast with cool, reflective finishes near rainwater catchment or composting areas, making thermal performance tangible. As D. Giaquinto *et al*. (2022) observed, vegetation and architectural elements should be coordinated to reveal closed-loop processes – for example, composting enclosures with vented sides can be designed as visible, accessible features, and rooftop solar arrays integrated with shade-providing canopies can simultaneously harvest energy and moderate microclimates, making energy synergy perceptible in daily experience.

Aesthetic integration, as H.A. Saleh & T.R. Alrobaee (2024) articulated, requires that ecological functions be made legible through a coherent design language. Green infrastructure components – bioswales, green walls, vertical gardens, and tree canopies – should serve as expressive accents that narrate ecological strategies rather than function as hidden

systems. Plant palettes can be selected to demonstrate ecosystem services and support biodiversity, with species chosen for growth patterns that visibly illustrate water filtration, soil stabilisation, habitat provision, and their attractiveness to pollinators and other wildlife. Path networks, seating, and educational signage should reveal cause-and-effect relationships: where rainfall is captured, how shade patterns form, where air quality improvements become perceptible. Lighting, colour, and proportion can be used to highlight functional zones and to unify utility with beauty, as synthesised from the design strategies in Table 1. Through these integrated design moves, the landscape communicates not only what it does, but how and why – inviting users into an ongoing relationship with the ecological systems that sustain them.

Table 1. Design strategies for achieving ecological aesthetics

Category of ecological functions	Ecological design principles	Examples of related design strategies
Microclimate regulation/Climate resiliency	Temperature and humidity moderation to make local temperatures milder	1. Carefully arrange the layout and orientation of planting beds, access routes, and built elements to maximise shading, cooling, and airflow. 2. Use large-canopy deciduous trees on south and west sides to block hot sun in summer while allowing winter solar gain. 3. Layer shrubs and groundcover to maximise interception, evaporation, and cooling.
	Providing shade to lower local temperatures	
	Directing breezes to improve air circulation	
	Cooling the air through evapotranspiration	1. Choose high-transpiration, climate-appropriate species (often natives) with a mix of evergreens and deciduous trees to sustain shade across seasons. 2. Favour light-coloured, porous surfaces and efficient irrigation with mulch to minimise soil heat and evaporation; use reflective ground covers where appropriate.
	Capturing particulates to reduce dust and pollutants in the air	1. Strategic windbreaks with dense evergreens. 2. Multi-layer tree canopies for interception. 3. Native, pollutant-tolerant shrub belts along roads. 4. Green walls and vertical gardens. 5. Pollutant-absorbing species selection. 6. Seasonal adjustments for maximum capture.
	CO_2 sequestration by absorbing carbon dioxide from the air	1. Maximise biomass carbon through shade trees and forest-like structure. 2. Prioritise native and climate-appropriate species. 3. Create multi-layer canopies for accelerated photosynthesis. 4. Lifecycle planning for longevity.
Resource cycling	Converting waste into resources	1. Make explicit turning organic waste into fertiliser. 2. Turning used recyclables and used item into the design of space.
	Energy synergy	1. Make explicit utilising renewable energy and using it on-site.
	Water management	1. Make explicit rainwater harvesting and greywater irrigation.
Biodiversity	Increasing biodiversity	1. Create a mosaic of habitat types. 2. Continuous flowering and nectar sources. 3. Habitat corridors and connected spaces. 4. Native plant species selection. 5. Deadwood and snag habitat.
Ecological education	Displaying ecological processes through landscape design	1. Educational signs and signages. 2. Utilising technologies like AR+VR.

Source: created by authors based on M.A. Altieri & C.I. Nicholls (2018)

In summary, a design strategy for urban agricultural spaces, when grounded in the principles of ecological aesthetics, must transcend the mere provision of functional benefits. Its core mission is to translate abstract ecological processes into tangible, visceral experiences for the user. This means designing spaces where the ecological processes and functions are not hidden utilities but are made legible and sensory. By doing so, the landscape becomes a lived-in narrative of sustainability, fostering a public understanding and emotional connection that transforms functional green infrastructure into a cherished and meaningful place.

Landscapes are inherently dynamic, evolving through seasonal cycles and ecological succession. Ecological aesthetics, as B.-W. Min (2012) articulates, celebrates the beauty of this temporality, positioning

change not as loss but as a generative design material. The central task of design, therefore, is to acknowledge and reveal these temporal processes so that people can directly experience the shifting character of the landscape. By making time an explicit dimension of the landscape's story – illuminating its past, present, and potential futures – sustainable design fosters a long-term emotional connection between people and place.

This temporal orientation operates across multiple scales. Landscapes carry layers of history, and preserving historical elements within landscapes is essential for sustaining both ecological integrity and cultural continuity. Landscape narratives convey historical and cultural meanings by weaving memory into spatial form, plant communities, and built features. M. Agnoletti & A. Santoro (2022) extended this view, emphasising that historical landscapes function as repositories of collective memory – encompassing natural history (ancient trees), cultural history (ruins), and ecological history (former wetlands). Design should integrate these elements so that history remains an active, living dimension rather than a static relic, enhancing people's sense of identity and belonging.

The Hauser & Wirth Somerset project illustrated in Figure 1, designed by P. Oudolf (n.d.), exemplifies landscape temporality as a core dimension of ecological aesthetics through its masterful planting design. Rather than conceiving the garden as a static composition of perpetual bloom, P. Oudolf (n.d.) celebrated the full lifecycle of perennial plants – from fresh spring emergence to summer flowering, autumn seed-head formation, and winter decay. This deliberate embrace of seasonal change reveals the temporal beauty inherent in living systems, where each phase, including dormancy and dieback, contributes to the landscape's evolving narrative. By allowing plants to stand through winter, their skeletal structures catch frost and low sunlight, transforming decay into its own form of visual poetry. In this way, the project makes visible the ecological processes of growth, senescence, and regeneration, inviting visitors to perceive time as an integral and beautiful dimension of the landscape – a central tenet of ecological aesthetics.

Figure 1. Seasonal change through planting design to show the lifecycle of perennial plants
Note: Hauser & Wirth Somerset designed by P. Oudolf
Source: P. Oudolf (n.d.)

Looking forward, design must also incorporate emerging technologies to enhance both the experience and resilience of ecological aesthetics. U.K. Ashinze *et al*. (2024) proposed integrating sensors and data-driven systems to monitor soil moisture, microclimate, biodiversity indicators, and pollution levels, with these metrics translated into real-time or seasonal visual cues within the landscape. Renewable energy installations – such as solar-canopy structures and small-scale microgrids – can power irrigation, lighting, and interactive interpretive displays without compromising aesthetics or habitat value.

Crucially, seasonal change, weather variability, and climate change must be incorporated as explicit temporal dimensions shaping design decisions. Seasonal shifts in plant phenology, colour, texture, and structure can be leveraged to craft evolving visual experiences throughout the year. Weather events – storms, droughts, wind patterns – inform the arrangement of spaces, drainage strategies, and material choices to maintain resilience and comfort. S. Štrbac *et al*. (2023) emphasised that climate change, understood as long-term shifts in temperature, precipitation, and extreme events, should be reflected in adaptive design strategies: modular, heat- and drought-tolerant planting palettes, scalable water harvesting and retention systems, and flexible infrastructure responsive to changing rainfall regimes and storm intensities. These temporal axes – seasonal, weather, and climate – become integral to the landscape's story, enabling visitors to perceive adaptability and foresight as part of ecological aesthetics.

In sum, the temporal beauty of landscapes is amplified by a design approach that fuses historical depth with forward-looking considerations of seasonality, weather, and climate change, while lightly integrating technology. By weaving temporal storytelling, heritage preservation, and adaptive systems into the fabric of ecological aesthetics, future landscapes can integrate historical narratives while demonstrating how people, ecosystems, and innovative design co-create resilient,

meaningful environments over time. Having established ecological aesthetics as a guiding framework, the next section translates these principles into concrete design applications across the urban area's layered landscape.

MULTILAYER IMPLEMENTATION: SPATIAL TYPOLOGIES

Urban agricultural landscapes manifest across multiple urban strata, from aerial habitats to street-scale interventions, with each layer presenting distinct opportunities for integrating productive landscapes into everyday life. Operationalising ecological aesthetics across these multilayer city landscapes requires treating urban agriculture not as a standalone program but as a design medium through which food production, ecological function, and sensory experience converge. As U.K. Ashinze *et al*. (2024) contended, this integrative approach enables landscape designers to fuse food production with ecological aesthetics, social engagement, and climate resilience across diverse urban strata – including Green Roofs, Greenways and Corridors, Community Farms and Parks, Coastal Green Spaces, Street-level Edges and Medians, and Building Facades. The challenge, as T. Thiesen *et al*. (2022) and J. Yuan & C.S. Kim (2024) respectively emphasised, lies in developing design strategies that honour context, function, and beauty within each layer's specific conditions. The following synthesis outlines how agricultural elements can be integrated into each urban layer through landscape design strategies that render ecological processes perceptible, temporally legible, and aesthetically coherent – making the layered city itself a canvas for ecological aesthetics in action.

Green roofs offer an elevated stage for design-led ecological expression and aesthetic enhancement within the urban canopy. As J. Zhang (2025) described, they function as aerial ecologies – vertical landscapes that influence skyline composition while integrating edible production and habitat value into a cohesive visual narrative. The design objective is to cultivate legible, poetically structured experiences that are perceptible from aerial vantage points and from street-level views through surrounding facades. Edible assemblages – comprising salad greens, herbs, compact fruiting species, and rooftop orchard configurations – are conceptualised as design modules selected not solely for productivity but for their contributions to colour, form, and texture across seasonal cycles. A modular, weight-conscious growing-media system is conceptualised as a sculptural substrate that supports diverse plant guilds while enabling precise tactile contrasts among succulent mats, herbaceous perennials, and flowering taxa, thereby generating perceptual depth within the constrained roofscape.

Aesthetics on the roof emerge as a choreography of colour, texture, and topography. Seasonal colour trajectories provide a discernible narrative of phenological change. Texture heterogeneity – dense, low-lying succulent mats juxtaposed with airy, flowering perennials – produces spatial depth and tactile richness that invite close observation from proximate terraces and elevated viewpoints. Micro-topographies – graded mounds, sunken pockets, and stepped beds – generate intimate moments for users, such as kneeling contours aligned with viewer eye-lines to the urban horizon or sheltered herbaceous terraces that function as micro-gardens within a dense city fabric. These design elements render ecological processes – growth, flowering, seasonal adaptation – perceptible and experientially vivid.

From a functional perspective, the roof can be designed as a constellation of productive parterres and pollinator strips that are legible as urban artworks. The spatial arrangement prioritises formal clarity: geometric beds delineate crops as a living mosaic, aisles serve as contemplative circulation routes, and strategically placed focal plantings anchor seasonal composition. Irrigation, drainage, and soil-health systems are integrated into the aesthetic discourse as visible design gestures: colour-coded irrigation conduits become intentional accents, moisture indicators translate into subtle shifts in plant presentation, and rainwater-harvesting features are embedded as sculptural elements that simultaneously educate and engage. T. Beck (2013) observed that this design language renders water stewardship readable and accessible, transforming the roof into a pedagogical and sensorial landscape where ecological function is not merely operative but perceptually present.

To maximise aesthetic resonance, roof landscapes should achieve consonance with prevailing architectural grammars and urban rhythms. Plant palettes may be selected to reflect adjacent materiality and tonalities or to articulate city-wide seasonal palettes, while the arrangement of beds and circulation paths can exhibit formal or contextual looseness yet maintain coherence with broader urban design intentions. The roofscape should be legible across scales: at a macro level, the overall composition should be discernible from higher vantage points; at meso and micro scales, careful attention to plant selections, texture differentials, edging materials, seating, and enclosure devices should reward close inspection. Seating arrangements, shade strategies, and microclimate interventions – such as wind buffering and sun-tracking planters – are embedded as aesthetic decisions that simultaneously enhance user comfort and social interaction, while foregrounding the roof's role as a modulated, responsive habitat.

The rooftop garden at Battersea Power Station, designed by James Corner Field Operations, exemplifies how ecological aesthetics can be rendered perceptible within a landscape of industrial heritage (Fig. 2). The vertical planting, which echoes the power station's iconic columns, creates a dynamic visual rhythm while simultaneously establishing vertical habitat corridors

and microclimatic gradients that support diverse insect communities. The violet blossoms, with their rich, deep hue, contrast beautifully with the white towers and the expansive blue sky – a chromatic dialogue between cultural memory and living systems that makes ecological processes legible through seasonal flowering rhythms. This design not only pays homage to the site's industrial past but also introduces a new layer of ecological and aesthetic richness wherein plant growth, pollination activity, and phenological change become experientially vivid. The garden's layout, with its carefully arranged planters and pathways, invites visitors to observe the interplay of texture, colour, and biotic activity at close range, transforming a once-industrial rooftop into a pedagogical and sensorial landscape of the kind T. Beck (2013) describes – where water stewardship, habitat provision, and living processes are not merely operative but perceptually present. The integration of modern planting techniques with the robust architecture of the power station results in a harmonious composition that renders ecological function visible and engaging, offering a serene retreat where industrial memory and ecological expression coalesce within the urban canopy.

Figure 2. Roof garden at Battersea Power Station
Note: James Corner Field Operations
Source: L. Crook (2023)

Green ways/corridors function as linear spatial structures that can be strategically designed to connect disparate urban areas while serving multiple purposes. As J. Melicher & J. Špulerová (2022) observed, their environmental and social value is substantially enhanced when design solutions and aesthetic approaches consciously integrate the potential of urban agriculture. Within this framework, green routes can be configured as continuous multifunctional spaces that incorporate edible plantings, thereby amplifying both productive capacity and recreational appeal while rendering ecological processes legible to users.

The spatial organisation of the corridor may adopt a gradient structure of plantings – a concept advanced by W.S. Alawsey *et al*. (2025) – that reflects a gradual transition from locally adapted, nature-oriented communities and pollinator-supportive zones toward more cultivated border plantings and public areas situated near sites of social activity. This sequential arrangement contributes to the formation of seasonally expressed landscape narratives, stimulates both passive perception and active participation, and ensures the visual coherence of green infrastructure across multiple scales. More importantly, it makes ecological gradients perceptible: users can literally walk from a wilder, insect-friendly margin into a more cultivated edible zone, experiencing first-hand the relationship between plant community structure and ecological function.

Path edges become sculptural frames for edible hedgerows – currants, raspberries, and edible flowers – that, according to C.I. Nicholls *et al*. (2016), function simultaneously as habitat corridors and deliberate design accents. Here, ecological aesthetics emerge through the dual legibility of these plantings: they are recognisable both as productive elements and as pollinator habitat, their flowering and fruiting cycles marking seasonal time while supporting urban biodiversity. Materials and surface treatments articulate a tactile hierarchy that reinforces this ecological narrative. H. Rashidi *et al*. (2015) demonstrated that permeable pavements, bioswales, and rain gardens are not merely functional components but essential contributors to texture and rhythm within the spatial procession. The sound of water moving through a bioswale, the contrasting textures of gravel and wood, and the aromatic release of crushed herbs underfoot collectively constitute a multisensory palette that heightens spatial identity and renders hydrological and ecological processes experientially accessible across seasons.

Wayfinding and interpretive signage are reframed as integral design devices rather than mere information kiosks. As noted by J. McCarthy & P. Wright (2024), this approach aligns with the principle of emotionally durable visual communication design, which enables these elements to communicate ecological functions effectively, thereby influencing visitors' aesthetic

sensibilities and guiding their behaviour toward greater environmental awareness. Within the greenway context, signage should articulate ecological processes and cultivation cycles through a cohesive visual grammar – colour coding that corresponds to plant guilds, typographic hierarchies that distinguish between immediate sensory observation and deeper ecological explanation, and pictorial language that complements the landscape's material palette. Such signage does not explain ecology from outside but rather makes visible the ecological relationships already present in the planted form.

The greenway, reimagined as a living classroom and market, invites immersive encounters that deepen ecological perception. As Y. Zhou *et al*. (2021) suggested, seed-sharing nodes, demonstration beds, and pop-up harvest areas can be integrated as architectural moments within the corridor, each exhibiting distinct yet harmonious expressions of form, colour, and texture. These elements function as pedagogical interventions that make visible the otherwise abstract cycles of cultivation, harvest, and regeneration. Through such design strategies, the greenway transcends its functional role as a connector to become a legible ecological aesthetic – a linear landscape where productivity, biodiversity, and sensory experience coalesce, and where users encounter not just greenery but the visible evidence of living systems at work (Fig. 3).

Figure 3. Ecological Education signage design of parcours du lac de l'Arret Darre
Source: Pic Bois (2022)

Community farms and parks function as central nodes in democratising urban food systems, yet their design demands a pronounced emphasis on ecological aesthetics – the deliberate making-visible of living processes through form, material, and spatial arrangement. Landscape configurations should foreground legibility, coherence, and plasticity, ensuring that productive functions remain inseparable from perceptual quality and social engagement. Within this framework, productive plots can be conceptualised as spatial modules organised into recognisable zones. These include demonstration gardens that articulate companion planting, soil regeneration, and ecological pedagogy, as O. Morrow & A. Davies (2022) described; community plots that provide affordable, legible access to fresh produce; and edible landscapes that integrate food crops with ornamental elements to cultivate a rich, contextual visual grammar. Visual unity across these zones arises through a deliberate material palette, curated plant guilds, and canopy configurations that harmonise disparate crops into a cohesive narrative – one in which composting cycles, pollinator activity, and soil health become perceptible rather than merely operational.

Ecological aesthetics in the community farm context emerge through the legible expression of systemic relationships. Sculptural plantings, pollinator habitats, and insect hotels are designed to read as architectural details within the landscape – not hidden functional inserts but deliberate compositional elements that reinforce ecological function while generating human-scale moments of discovery. A habitat stack, for instance, might be articulated through carefully arranged materials that reveal their purpose through form: drilled logs, bundled stems, and layered stone become textural accents that simultaneously support solitary bees and invite tactile inquiry. Water features, operating as irrigation reservoirs and microclimate modifiers, contribute to the aesthetic palette through materiality, form, and movement. As H. Yu (2025) observed, they transform waterflow into an educational element wherein children and adults alike can observe the relationship between storage, distribution, and plant health.

Shading structures offer thermal relief while hosting climbing edible species such as beans or grapes, thereby weaving vertical productivity into the human comfort zone. Here, ecological aesthetics operate through double-coding: a pergola is simultaneously a shade device, a support structure for food production, and a frame for viewing the farm's larger composition. M.R. Khalilnezhad *et al*. (2024) noted that the seasonal transformation of these living structures – from bare tendrils in early spring to dense foliar canopy in high summer – renders time perceptible and deepens attachment through repeated observation.

Planting strategies must balance productivity with spectacle, yet as A. Russo & L. McCarthy (2024) argued, spectacle itself is reimagined in ecological terms. The spatial choreography reveals seasonal progressions and maintains visual interest during non-harvest periods through architectural planting schemes, canopy rhythms, and ornamental understory layers. A bed of overwintering kale, its leaves frost-silvered, becomes as compositionally significant as a flowering perennial border; the skeletal structure of fruit trees in winter offers a lesson in branching architecture that is at once aesthetic and ecological. Soil, too, is not hidden but

celebrated: composting areas are sited as prominent landscape moments, their layered materials and thermophilic activity visible through thoughtful enclosure, transforming decomposition into a pedagogical and sensorial experience. Ultimately, the community farm or park achieves ecological aesthetics when its visitors can read the landscape as an integrated system – when the relationship between flower and pollinator, between compost bin and fertile soil, between rainwater catchment and thriving crop becomes intuitively graspable through designed experience. In such spaces, as N. Wijesooriya & A. Brambilla (2021) contended, ecological function is not merely operative but perceptually present, inviting sustained engagement and cultivating the environmental awareness that underlies truly democratic urban food systems.

MULTILAYER IMPLEMENTATION: URBAN INTERFACES AND VERTICAL SYSTEMS

Coastal green spaces must withstand salinity, surge, and sea-level change, yet their value is profoundly amplified when design and aesthetics foreground place-making and experiential richness. From a design perspective, agricultural elements should be integrated as legible, culturally resonant features that articulate both habitat value and edible production within a coherent coastal narrative. Another constituent of coastal urban agriculture extends beyond conventional design mediums. Oyster farming, for example, can be understood as an integral component of coastal food systems – one that blends ecological process with designed form. SCAPE Studio's Oyster-texture project in New York Harbour (SCAPE, 2025) offers a compelling case (Fig. 4). The proposal envisions a living reef constructed from "fuzzy rope" that boosts marine biodiversity and cleans harbour water through natural filtration by oysters and other species. What distinguishes this project as an exercise in ecological aesthetics is its deliberate making-visible of underwater processes: the fuzzy rope substrate is not merely functional but formally expressive, creating a three-dimensional landscape that registers visually at the water's surface while operating invisibly below. The design renders oyster filtration legible as a dynamic system – fluctuations in water clarity, the gradual accretion of reef structure, and the return of marine life become perceptible indicators of ecological function. This aesthetic operates across scales: from the sculptural quality of the rope fields viewed from the shoreline to the intimate encounter with thriving marine communities accessible by kayak. The project thus transforms ecological remediation into an immersive educational experience wherein visitors can observe, touch, and begin to understand the relationship between designed form and living system.

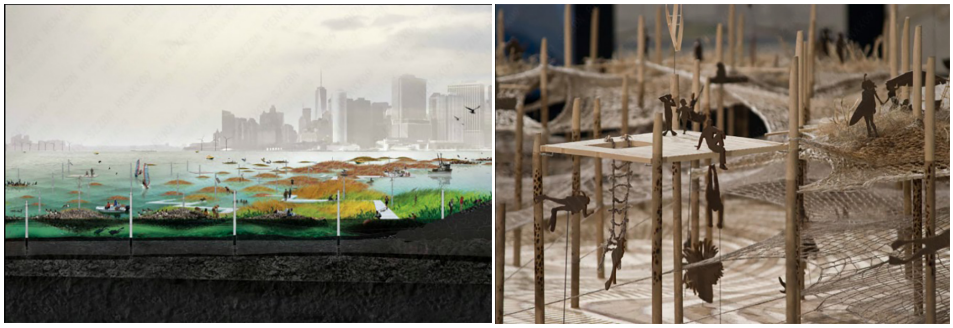

Figure 4. Oyster-tecture, diversifying marine life and recreational potential
Source: SCAPE (2025)

Vegetation communities are curated to balance ornamentality with practical resilience. The plant palette integrates hardy ornamentals alongside salt-tolerant edibles such as Salicornia and coastal herbs, creating a living narrative of place and adaptation. This approach foregrounds seasonal shifts in texture and colour, ensuring visual legibility from both sea-facing and inland viewpoints. Material choices – weathered timbers, salt-resistant concretes, and patinated metalwork – reinforce the coastline's tactile character while serving functional roles in drainage and microclimate modulation. As A. Ghirardelli *et al*. (2025) observed, edible crops arranged within raised beds in legible geometries evoke historic coastal patterns and rhythms of human cultivation, rendering visible the enduring relationship between coastal communities and cultivated margins. J. Yuan & C.S. Kim (2024) further noted that these material and planting expressions simultaneously address practical needs – drainage, microclimate control – while cultivating a distinctive coastal aesthetic. Together, vegetation and materiality cohere into a designed expression where ecological function and cultural resonance become perceptibly intertwined.

Water-management features are conceived as sculptural elements that communicate ecological processes. Dune-like topographies serve as sculptural windbreaks and flood-storage devices; their forms reveal protective function while shaping spatial experience. Tidal indicators and rain-harvesting systems are embedded as formal accents that articulate coastal hydrology. These

components become design protagonists, contributing to an educational narrative about adaptation and food security. A tidal indicator might mark daily fluctuations through changes in water colour or textured surfaces, rendering tidal range perceptible and engaging.

Together, these strategies craft a multi-sensory landscape where form, materiality, and planting express coastal identity and ecological resilience. In such designs, ecological function is not merely operative but perceptually present – visitors encounter not just protection from surge but the sculptural expression of dune morphology, not just water filtration but the visible life of the oyster reef, not just salt-tolerant crops but a living palette that narrates adaptation at the edge of land and sea. Through these integrated strategies, coastal landscapes become pedagogical fields wherein the dynamics of salinity, tide, and resilience are rendered intuitively graspable through designed experience.

Street-level Edges and Medians offer highly accessible opportunities to democratise urban edible landscape, but their value is amplified when design and aesthetics foreground experiential quality and visual legibility. From a design standpoint, these strips should read as cohesive, human-scaled narratives that frame the street, provide shade, and deliver fresh produce in a manner that enhances daily traversals (Ogwu & Kosoe, 2025). Street-level edges and medians represent critical opportunities to democratise the urban edible landscape, yet their full potential emerges only when design and aesthetics foreground experiential quality and visual legibility. As M.C. Ogwu & E.A. Kosoe (2025) argued, from a design standpoint these strips should read as cohesive, human-scaled narratives that frame the street, provide shade, and deliver fresh produce in ways that enrich everyday movement. By embedding ecological aesthetics into these narrow corridors, designers can transform functional infrastructure into legible, living systems where ecological processes become sensory experiences.

Edges and avenues become living corridors whose plant language is carefully choreographed. Edible street trees and low-lying fruiting shrubs are integrated with maintenance-friendly groundcovers to create a continuous, tactile edge encountered during routine passages. J. Peng *et al*. (2021) emphasised that the plant palette must balance fruitfulness with street-scale readability: tree canopies that cast shade without blocking sightlines, mid-layer shrubs offering seasonal fruit, and unifying groundcovers that provide consistent texture. This composition yields a rhythmic, legible edge where ecological function – food production, habitat support, microclimate regulation – is made perceptible through deliberate form and material continuity. The threshold between public realm and private frontage thus becomes a smooth, meaningful transition rather than an abrupt boundary.

Medians, meanwhile, function as micro-landscapes capable of transforming the daily commute into an immersive edible experience. Small-scale vegetable beds, herb cushions, and pollinator-friendly groundcovers are arranged in clear geometries responsive to pedestrian flow and curb contours. Z. Iqbal *et al*. (2025) highlighted the importance of seasonal choreography – edible blooms, shifting foliage colors, and crop succession – which generates a dynamic visual sequence rewarding repeated encounters. Modular planting beds, defined edges, and transparent planting hierarchies ensure that ecological complexity remains visually legible from a distance while inviting close inspection. Here, ecological aesthetics operates through designed readability: biodiversity, pollination cycles, and soil health become tangible, observable phenomena woven into the urban fabric.

Across both edges and medians, the visual language must prioritise legibility and safety without compromising beauty. D. Adams *et al*. (2023) underscored the need for clear sightlines, durable materials, and concise, design-conscious signage communicating crop cycles and harvest timing. Material choices – paving textures, edging, seating, and plant-support structures – should reinforce a coherent street aesthetic that resonates with surrounding built forms while enabling low-maintenance operation. Rain gardens and permeable pavements aligned with curbs contribute to stormwater management while conveying a sense of urban care, textural richness, and place identity. These infrastructural elements, when aesthetically integrated, render invisible ecological services visibly and experientially present.

As shown in Figure 5, designed by J. Irwin Landscape Architecture and completed in Sydney in 2010 (MacGowan, 2012), the Balfour Street Pocket Park transforms stormwater management into a visible and engaging urban feature. Its curved brick swale channels runoff from surrounding streets, with protruding bricks that slow water flow and capture debris, making the process of water filtration perceptible to users. The swale transitions into a mini-wetland where specially designed paving creates ripples, visually narrating water movement through the landscape. This project exemplifies ecological aesthetics by rendering a hidden utility – stormwater drainage – into a tangible sensory experience, allowing visitors to see and hear water being cleansed. It transforms functional infrastructure into what J. Irwin called a "demonstration piece", educating the public about hydrological processes while enriching everyday experience.

From a design-analytic perspective, integrating edible landscapes into street-scale edges and medians demands a cohesive design vocabulary uniting form, function, and experience. This requires specifying planting grammars attuned to local climate and urban character, establishing predictable maintenance regimes, and

articulating seasonal transitions as perceptible design moves. By foregrounding aesthetic coherence – through plant form, colour relationships, materiality, and spatial sequencing – the street becomes a democratic, sensorially rich corridor supporting nourishment, biodiversity, and civic identity. Ecological aesthetics thus operates not as an abstract principle but as a tangible framework through which urban dwellers daily encounter and understand the living systems sustaining their city.

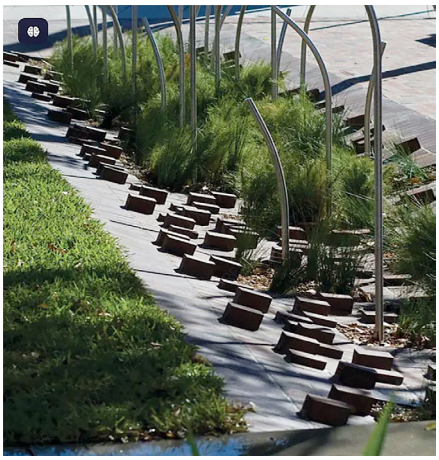

Figure 5. Brick Swale as a drainage system
Note: Balfore Street Pocket Park created by Jane Irwin Landscape Architecture
Source: T. MacGowan (2012)

Building facades present a vertical canvas for edible architecture, where green facades, living walls, and espaliered fruiting trees transform cultivation into overt architectural expression. As K. Al-Kodmany (2018) contended, these surfaces become disciplined interfaces between building program, structural logic, and public perception. From a design standpoint, successful integration demands species selection calibrated to microclimatic conditions and robust structural strategies capable of accommodating loads and ongoing maintenance. T. Thiesen *et al*. (2022) noted that Modular planting devices – conceived to work seamlessly with window boxes, balcony gardens, and railings – enable scalable, legible interventions across the elevation.

Within this framework, ecological aesthetics emerges as the guiding design language. Vertical rhythm is established through repetitive planting modules and trellis patterns, while seasonal legibility is rendered visible through shifting leaf colours and fruiting phenology that animate the facade across the year. J. Brandt & H. Vejre (2004) emphasised that the architectural relationship between occupants and the exterior environment is foregrounded through these choices: planting decisions become experiential cues that modulate light, texture, and silhouette from both interior viewpoints and street-level perspectives. Edible elements – fruit-bearing vines, espaliered trees, integrated herbs – are not merely productive but visually articulate the building's ecological performance over time (Fig. 6).

Figure 6. Urban farming office
by Von Trong Nghia Architects in Ho Chi Minh City
Source: J. Elangical (2023)

Functionally, facade horticulture is designed to deliver shade and microclimate moderation, yet these benefits are made perceptible through deliberate material and form decisions. K. Bohn & D. Chu (2021) noted that green walls with modular trays, climber supports, and refined edge treatments maintain sightlines and accessibility while rendering environmental services visible. The system simultaneously functions as living habitat, inviting insects and birds and contributing to urban biodiversity. H.A. Saleh & T.R. Alrobaee (2024) argued that this ecological function becomes an integral aesthetic element: habitat-friendly plant textures, the motion of pollinators, and seasonal bird activity weave biodiversity directly into the sensory experience of the facade. Through such design, ecological processes are not hidden infrastructure but legible, everyday encounters – making the building envelope a dynamic interface where food production, habitat support, and climatic responsiveness coalesce into coherent, inhabitable form.

Ultimately, the architectural language of edible facades functions as an educational medium, conveying principles of food systems, climate adaptation, and biodiversity through crafted materiality, colour, and spatial sequencing. By making ecological processes visible and accessible, these living vertical landscapes transform abstract concepts into tangible daily experiences. Passersby can observe seasonal growth cycles as edible plants progress from flowering to fruiting, revealing the temporality inherent in productive landscapes. They can witness climate adaptation strategies in action as drought-tolerant species thrive on sun-exposed surfaces while moisture-loving plants cluster near irrigation outlets, demonstrating how vegetation moderates microclimates through shading and evapotranspiration. They encounter biodiversity first-hand as pollinators are drawn to flowering crops, revealing the reciprocal relationships between urban agriculture and local

ecosystems. The deliberate layering of plant species – tall canopy plants providing shade for shade-tolerant vegetables below, trailing vines softening building edges, and brightly coloured fruits signalling harvest readiness – creates a spatial narrative that guides viewers through the logic of productive landscapes. Material choices further reinforce this educational role: trellises and support structures are exposed rather than concealed, revealing how vertical loads are distributed; planter modules are arranged to demonstrate water flow from collection points through irrigation channels; and contrasting textures between rough building surfaces and soft vegetation highlight the integration of natural systems with constructed form. This design synthesis positions building facades not merely as envelopes but as expressive, productive portraits of urban resilience and cultivated beauty – living textbooks that teach ecological principles through materiality, seasonal change, and spatial experience.

CONCLUSIONS

This study advances a mixed-methods analysis of integrating ecological aesthetics into urban agricultural landscapes, yielding a coherent ecodesign framework that operationalises aesthetic principles across multiple urban layers. Through critical examination of real-world exemplars, it identifies actionable strategies that merge visual appeal with ecological function, making ecosystem processes accessible to the public via deliberate design.–The analysis demonstrates that multilayer city landscapes operate most effectively when understood as interconnected ecological systems rather than isolated interventions. Across diverse spatial strata, productive green roofs, multifunctional corridors, community-based agricultural spaces, adaptive coastal landscapes, transitional transport edges, and vertically greened facades collectively enhance biodiversity, microclimate regulation, and resource cycling.

The study confirms that, when coordinated within an integrated framework, these spatial strategies enable green infrastructure to synthesise food production, environmental resilience, and educational value into a coherent urban design system. The findings underscore the centrality of ecological aesthetics for enriching urban agricultural landscapes, demonstrating that beauty, perception, and cultural meaning can coexist with ecosystem services and ecological performance in multi-layer urban contexts. Temporal dynamics, historical narratives, and adaptive design emerge as crucial components for resilience amidst environmental change. Future work should prioritise empirical validation of the ecodesign framework via pilot projects and long-term monitoring to assess effectiveness across diverse urban settings. Expanding inquiry into the social and cultural dimensions of ecological aesthetics – how various communities interact with and perceive these landscapes – will be essential for designing ecologically sustainable yet culturally inclusive and socially equitable spaces. This research lays a foundation for further exploration of ecological aesthetics in urban design, offering a pathway toward more resilient and engaging urban environments that balance aesthetic experience with environmental benefit.

ACKNOWLEDGEMENTS

None.

FUNDING

None.

CONFLICT OF INTEREST

None.

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Проєктування з урахуванням екологічної естетики в міському сільському господарстві: впровадження принципів екодизайну в багатошарових міських ландшафтах

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Анотація. Екологічно спроєктовані міські сільськогосподарські ландшафти є критично важливою, однак недостатньо використаною стратегією зменшення втрат біорізноманіття, підвищення стійкості до зміни клімату та вирішення соціальної нерівності в сучасному міському середовищі. Основною метою цього дослідження було розробити та впровадити теоретичну та практичну основу, яка інтегрує екологічну естетику в дизайн міського сільського господарства, позиціонуючи естетичний досвід як ключовий компонент багатофункціональної екологічної ефективності. Було використано змішаний підхід, що поєднує комплексний огляд літератури з екологічної естетики з детальним аналізом прикладів дизайну з існуючих міських сільськогосподарських просторів. Дослідження створило структуровану основу екодизайну з чіткими критеріями, які синтезують естетику, екологічну функцію та стійкість у різних міських шарах, включаючи зелені дахи, зелені доріжки та фасади будівель. Було виявлено, що сенсорні якості, такі як колір, текстура та ритм, разом з культурним значенням, можуть бути цілеспрямовано узгоджені для посилення підтримки біорізноманіття, збільшення виробництва продуктів харчування та покращення регулювання клімату без шкоди для екологічної цілісності. Структура також продемонструвала, як ці естетичні стратегії можуть систематично застосовуватися у вертикальних, горизонтальних та перехідних міських просторах для створення цілісних та привабливих ландшафтів. Практична цінність цього дослідження полягає в його практичних рекомендаціях щодо дизайну та критеріях оцінки, які можуть бути використані містобудівниками, ландшафтними архітекторами та політиками для створення адаптивного, контекстуально свідомого міського сільськогосподарського середовища, яке гармонізує красу з надійною екологічною функцією та соціальною значущістю

Ключові слова: зелена інфраструктура; екологічна ефективність; типологія ландшафтів; пом'якшення мікрокліматичних змін; стратегії біорізноманіття; вертикальний урбанізм; екосистемні послуги

ISSN 2617-0272, e-ISSN 2617-0280

ART AND DESIGN
Journal homepage: https://art-design.com.ua/en

9(1), 2026

Received 01.12.2025 Revised 10.03.2026 Accepted 09.04.2026 Published: 10.04.2026

UDC 7.071 DOI: 10.30857/2617-0272.2026.1.10

Material aesthetics of stop-motion animation as a factor of trust: Narrative and cinematic analysis of the project

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Abstract. The growing crisis of media trust and fatigue with a standardised digital aesthetic encourage audiences to seek out an authentic visual experience. Stop-motion animation meets this request because of its fundamental materiality – the ability to turn the physical presence of objects into an aesthetic argument for authenticity. In this context, materiality appears not only as a technical characteristic of time-lapse animation, but also as an independent aesthetic category that affects the development of trust and the reduction of social distance between the message and the viewer. The purpose of the study was to theoretically substantiate stop-motion animation as a factor in the development of audience trust and identify artistic mechanisms of its implementation, in particular, through narrative and cinematic means of organising the audio-visual series. The research material was an author's social and educational project implemented within the framework of interdisciplinary cooperation between the Department of Visual Design and Art of the National University "Lviv Polytechnic" and the public sector. The methodology combined contextual, structural and system, and comparative analysis with practice-based research, which allowed integrating artistic design into the scientific plane and tracing the relationship between the material organisation of the image, the type of narrative, and the mechanisms of trust development. The results of the study showed that materiality in stop-motion animation functions as an aesthetic mechanism for reducing social distance and increasing the acceptance of media messages. The correlation between the textured organisation of the image, compositional chamber, and causally constructed narrative, implemented through cinematic techniques (editing, framing, rhythmic organisation), which form the effect of authenticity on the visual-plastic and emotional levels, was revealed. It was proved that the material aesthetics of stop-motion appears as an independent artistic factor of trust, expanding the idea of the functioning of this technique beyond its technological definition and actualising its potential in hyper-digital culture. The results obtained can be used by designers, teachers, and developers of social and communication media projects to create visual content aimed at increasing audience confidence in a hyper-digital environment

Keywords: audio-visual communication; multimedia; media content; animated video; animation project; animation technique; improvement of media literacy

Suggested Citation:
Habrel, E., Shtets, V., & Leniv, Yu. (2026). Material aesthetics of stop-motion animation as a factor of trust: Narrative and cinematic analysis of the project. *Art and Design*, 9(1), 116-126 doi: 10.30857/2617-0272.2026.1.10.

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INTRODUCTION

In the context of the rapid spread of algorithmically generated content and the growing lack of trust in digital media, the issue of aesthetic mechanisms for generating reliability is gaining a new research weight. The hyper-digital environment, characterised by an excess of standardised images and the rapid circulation of media content, highlights the need to seek alternative visual strategies capable of restoring a sense of physical presence and authenticity. It is in this context that stop-motion animation (SMA) appears as a demonstrative aesthetic phenomenon, whose material nature acquires a communicative and trusting function.

Research in the field of educational technologies confirms the broader aesthetic potential of SMA. According to M. Farrokhnia *et al*. (2020), the creation of videos by students and pupils in the SMA technique positively affects the measurement indicators of students' knowledge in subject-specific areas, and personal characteristics and behavioural attitudes. This effect was achieved if the process was organised with appropriate scaffolding – a system of temporary training support, which provides for a gradual reduction in assistance as the student's autonomy increases, and in the context of the SMA includes appropriate technical instructions, relevant examples, and leading questions. As noted by Y. Gong (2023), the appeal of SMA lies in its ability to "break the line between virtual and real" through the use of material objects, so that even the illusory screen world is perceived by the viewer as authentic and correlated with its own reality.

The mechanisms of building trust in animation (and in any media product in general) are the subject of interest of many researchers. Both in the local and global media space, there is a lack of audience trust, and, according to observations by I. Pohrebniak *et al.* (2024), this problem is only getting worse. In the context of contemporary digitalisation, building trust in a media product, brand, or any narrative is becoming an increasingly lengthy process, which is becoming increasingly complex due to the regular increase in the amount of information and the increase in cognitive load (Arnold *et al.*, 2023), which once again emphasises the importance of creating and testing a trust-building model, which is presented in the paper.

The relevance of the analysis of the development of trust in animation was confirmed by surveys conducted by a number of non-governmental public organisations and the Ministry of Culture and Strategic Communications in 2022-2025 (ZMINA, 2022; PO "Detector media", 2025). The potential of the selected technique was confirmed by V. Shtets & O. Melnyk (2024), who argued that the potential of SMA is provided by visual clarity, emotional expressiveness, ease of perception by a wide audience, the ability to create a special viewing atmosphere, and high artistic characteristics. The unique aesthetic and communicative properties of SMA, the ability to convey metaphors of movement and influence the viewer's perception through the development of a complete visual series were considered by L. Yilmaz (2019), analysing the application of SMA in project tasks. International discourse close to Ukrainian realities: as noted by M. Kops *et al*. (2025) in a review study synthesised based on 151 scientific publications, the effects of exposure to false information on young people are multidimensional. These effects cover emotional dimensions such as fear, confusion, uncertainty, stress, and frustration, and social consequences such as the development of distrust of institutions and feelings of information overload. This highlights the critical need for visual media literacy as a countermeasure against disinformation.

The purpose of the study was the theoretical substantiation of the materiality of SMA as an aesthetic factor of trust development and the analysis of artistic mechanisms of its implementation through narrative and cinematic means in the conditions of hyper-digital culture and the identification of artistic mechanisms for reducing the social distance between media content and the viewer. Thus, the purpose of the study was to confirm the phenomenon of SMA reliability in times of military threats and at its theoretical reinterpretation in the plane of trust aesthetics.

MATERIALS AND METHODS

The research was conducted as a case study of a specific design product, involving an analytical examination of an individual project as a representative example. To achieve this objective, a creative team comprising students under the guidance of their lecturers developed an animated short film entitled "Easy money" (Veterans' Support NGO "Palms for a Hero", 2025) at the Department of Visual Design and Art at Lviv Polytechnic National University. The video was developed as part of the project "Eco. Info. Children" commissioned by the public organisation "Palms for a Hero" for demonstration at educational and preventative lessons conducted to warn teenagers about the threat of propaganda of the Russian special services, including, in particular, the recruitment of Ukrainian teenagers via the Internet to carry out acts of sabotage and terrorism (Chop, 2025). The methodological basis of the research was the practice-based approach, in which the creation of an animation product was considered not as an educational process, but as a research tool that allows identifying artistic, expressive, and communication properties of the material aesthetics of SMA and their impact on the development of trust in media content. The video was developed in three stages: research, script development, and implementation.

In order to make the video correspond to the complex image of the target audience, students of the working group conducted a survey among children aged

8-15 in the form of an open interview. The questions were general in nature and concerned the interests and preferences of the participants. The criteria for selecting respondents were school age; the survey was conducted anonymously. The study followed the ethical standards of the Declaration of Helsinki (World Medical Association, 1964). The results of the responses were used to develop exposure, symbolic details, and "desire objects" in the video, so it is not necessary to present detailed quantitative data in this case.

The script was developed using a combination of classical drama principles and LLM tools "Chat GPT" and "Gemini", which were used to form plot hypotheses, variants of the conflict structure, and clarify the motivation of characters. LLM tools were not used for other purposes. The generated materials were selected by experts according to the criteria of narrative integrity, ethical compliance, and production feasibility using the SMA technique. The final version of the script was created by iterative editing and author's revision. The Universal SMA shooting algorithm shown in Figure 1 was close to the typical video production process, and its fixation in this paper was aimed at summarising the stages of creating an animation product in time-lapse technology. In the process of implementing the project, managers avoided excessive moderation and strict restrictions on creative thinking, since a significant difference in age and life experience could reduce the effectiveness of students' independent work and limit their experimental thinking.

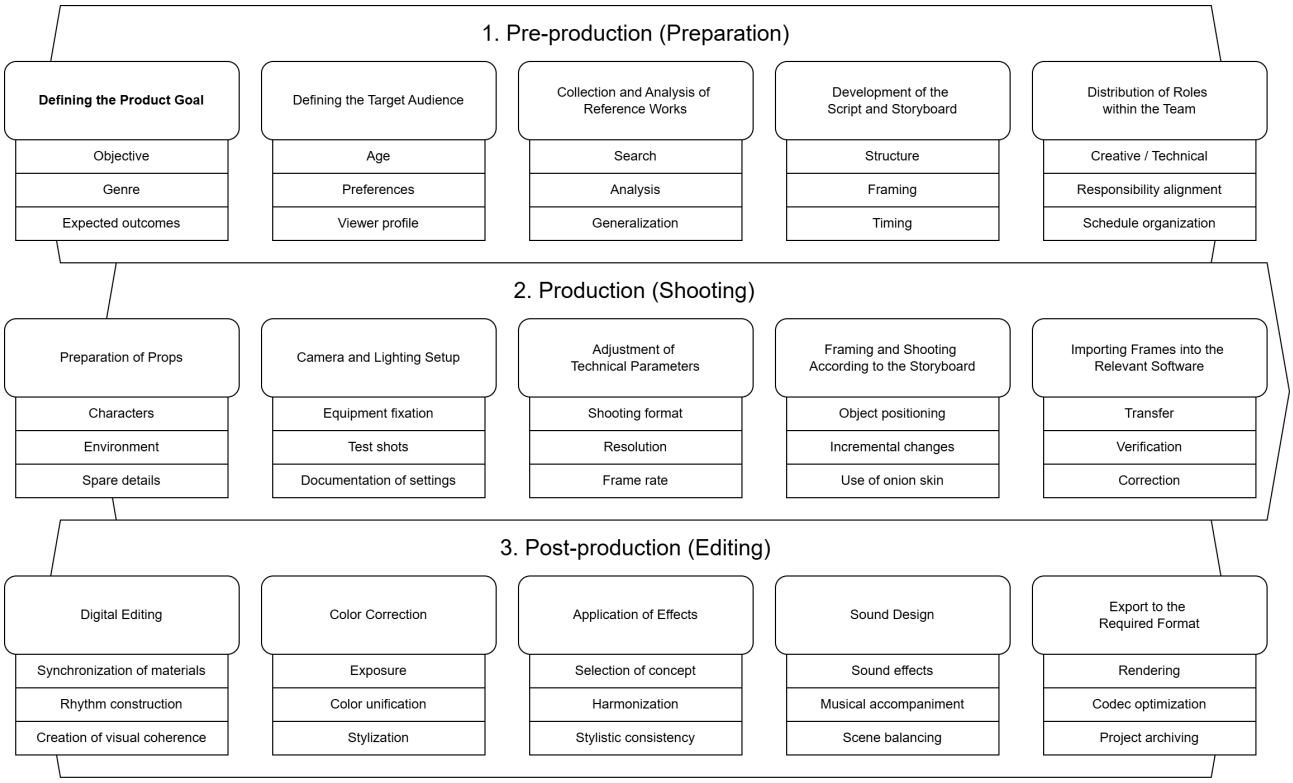

Figure 1. Video production algorithm using the stop-motion animation technique
Source: compiled by the authors

The video was produced in the technique of time-lapse cut-out animation using paper characters and handmade decorations. Shooting was carried out in a classroom adapted to the studio environment with a permanently fixed camera and using the Stop-Motion Studio mobile application (n.d.). Graphic materials and backgrounds were prepared using the Adobe Photoshop 2022 editor (version 23.0; Adobe Inc., San Jose, CA). The final editing took place in professional video editing environments (Adobe Premiere Pro 2022 (version 22.0; Adobe Inc., San Jose, CA, USA) and related instruments). Officially available licensed and training versions of the software were used. The full production cycle – from scenario development to final export – lasted four weeks. Shooting was carried out at a frequency of 12 fps in a 1920×1080 resolution. The final file was exported in .mp4 format with the H.264 codec. The total duration of the video was 2 minutes and 27 seconds.

In addition to the practice-based approach and case-study format, the study used elements of narrative and cinematic analysis to interpret the structure of the audio-visual series, and comparative analysis of relevant animation projects to typologise artistic solutions. To summarise the results obtained, the method of conceptual modelling was used, which helped to develop a scheme of mechanisms for developing trust in the

animation product. It should be noted that the proposed trust development scheme was an interpretive generalisation and did not reflect statistically confirmed patterns.

RESULTS AND DISCUSSION

The analysis of the narrative structure of the project in this study was considered not as an end in itself, but as a tool for identifying mechanisms for implementing the material aesthetics of SMA. Since, visual and plastic characteristics in SMA are inextricably linked to the organisation of action, narrative components are analysed through the prism of their cinematic realisation, which allows tracing the interconnection between the materiality of the image and the creation of a sense of authenticity. Thus, the analysis of the narrative structure and cinematic techniques of the project allowed considering them not as autonomous elements, but as ways to implement the material aesthetics of SMA, through which the effect of reliability and audience trust is formed.

Analysis of the created animation project. The video tells the story of an ordinary schoolgirl against the backdrop of Russia's full-scale invasion of Ukraine, which has been ongoing since February 2022. The girl receives an offer of quick earnings through social networks, the acceptance of which leads to disastrous consequences. The script consists of four key scenes, each of which serves as a separate narrative element – exposition, rising action, climax, and resolution. The key points of the plot are presented in the form of a storyboard, shown in Figure 2.

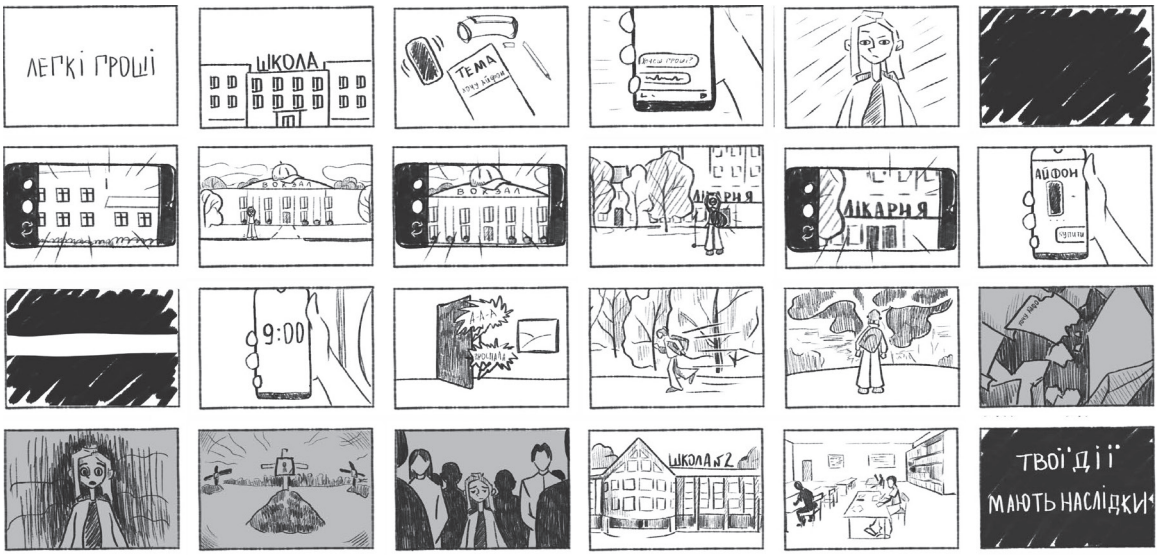

Figure 2. Storyboard – representation of the script as a sequence of frames
Source: Veterans' Support NGO "Palms for a Hero" (2025)

Exposition. The first shot shows the school as the main scene where the action begins. The camera moves towards the window, through which the pupils can be seen writing an essay on the topic "What is happiness?" during their lesson. A young schoolgirl, the main character of the video, captures the answer "I want an iPhone". Her desire is shared by a friend sitting next to her. Suddenly, a schoolgirl's phone receives a message with the meaning "Do you want to earn easy money?" and an attached web link. The girl hesitates at first, and then follows the link, which serves as a catalyst for further events.

The scene serves as an exhibition, outlining the spatial, social, and motivational coordinates of the story. The generalised image of the school and the typed interior form a recognisable everyday environment for the school-age viewer, which facilitates viewer identification. The neutral visual image of the main character – without any special external features and subcultural markers – emphasises her ordinariness, which allows a wide range of school-age viewers to identify with it. The smartphone, which is a fairly typical material desire for many teenagers, appears as a symbol of the initial motivation that is understandable to the viewer, which determines the initial vector of action. According to R. McKee (1997), the opening of the story should show the character's daily life before the balance is disturbed: therefore, information is presented through actions and objects, not explanations. A brief silence and an emphasis on a close-up of the face capture the moment of internal choice, marking the first transformation of the heroine – from a passive schoolgirl to the subject of the decision. Already in the first 30 seconds, a dramatic tie is formed, triggering the cause-and-effect development of events. Simultaneously, the material organisation of the stage – paper scenery, flatness of objects, and chamber composition – enhances the effect of recognition and "accessibility" of the environment, which

reduces the distance between the viewer and the image and contributes to the initial development of trust.

Rising action. The heroine continues to receive messages from the same number where she is assigned paid tasks and performs them: she takes photos of various official institutions – a school, a train station, and a hospital. The moment of each image is accompanied by a characteristic shutter sound. Each photo leads to a material reward – the girl gets new sneakers, a bag, and later the desired smartphone, but she never thinks about who and why needs these photos for such money. The stage is built in the form of a montage based on the principle of rhythmic repetition "tasks – photo – money accruals", where minimal variations in locations and objects form a gradual increase in meaning. Such a "repeat with variations", according to Y. Lavandier (2005), is a way of developing an action by increasing the value of each subsequent step; therefore, the mechanical reproducibility of a gesture turns it from random to systemic. Camera clicks serve as symbols of instant benefits, recording the process of gradual normalisation of the action due to its repeatability. The light, almost cheerful colour scheme of the frame contrasts with the minor musical accompaniment, forming an audio-visual counterpoint. Such counterpoints, according to R. McKee (1997), amplify dramatic tension through the semantic contrast between the visual series and the soundtrack. Combined with the material stability of the image and the repeatability of actions, this contrast highlights the hidden contradiction of the situation, as a result of which the image of the heroine gradually transforms from a confused schoolgirl to a performer of repeated automated actions. The repeatability of actions is enhanced not only by the editing structure, but also by the material constancy of objects in the frame: the constant texture of paper elements, and manual animation of movements create a sense of physical presence of the process, which normalises the actions of the heroine not only on the narrative, but also on the perceptual level.

Climax. The girl wakes up at home and realises that she overslept and is late for school. She hurriedly gathers and runs to the school. On the way, she looks at the phone and sees a few missed calls and disturbing messages from her friends. When she almost reaches the school, suddenly a rocket hits the school building, which leads to instant and large-scale destruction. After the explosion, the camera captures the burnt sheet with her writing "I want an iPhone" flying nearby in the air after the explosion: this shot is designed to remind the viewer of where it all started. This scene becomes a moment of shock and the culmination of the story.

The scene dramatically changes the temporal and emotional mode of the narrative: the everyday morning routine – waking up, rushing, driving to school – is interrupted by a sudden catastrophic intrusion. A rocket strike destroys the established order of events and instantly reassigns the heroine's previous seemingly insignificant actions, giving them a tragic dimension. This strategy of a sharp tonal break is based on the effect of shock and perceptual destabilisation of the viewer, when violent interference in the usual space of everyday life creates maximum emotional tension. A similar technique, according to the observation of L. Badley (2010) in a study of the aesthetics of Lars von Trier, is a sudden "break" in everyday reality that forces the viewer to experience an event as a direct affective experience. The scene becomes particularly expressive due to the material nature of the image: the physicality of destruction enhances the affective tone, transferring the event from an abstract level to a tangible "real" visual experience.

Resolution. There is a funeral, during which the girl cries, watching the process of burying her friend. The camera first moves up to the sky, "clearing" the exposition, and then descends and shows the viewer another school near the cemetery where the burial takes place. The camera zooms in on one of the windows, through which a schoolboy can be seen sitting at his desk. The frame captures the moment when a boy receives a message on the phone with the same meaning "Do you want to earn easy money?". The video ends with an open ending and a shot with the words "Your actions have consequences".

The final scene is built as an emotional climax and at the same time as a new launch of the dramatic circle. Funeral of a friend demonstrates the consequences of previous actions – an abstract "game" with photographing objects leads to a specific human loss. The camera, moving away from the grave and looking at another school, expands the boundaries of a private tragedy to the scale of a public problem. Montage goes to a boy who gets the same message: "Do you want to make easy money?", creates the effect of repetition and a closed loop: the story does not end, but is reproduced again. In this context, the material closeness of the final scene and the preservation of the visibility of manual animation enhance the emotional perception of the consequences, consolidating the effect of authenticity through the feeling of the viewer's "presence" in the depicted space.

This construction corresponds to the principle of dramatic resolution, when the ending not only summarises events, but also forms a new causal perspective. In the structure of the narrative, conflict is built as a contrast between the attractiveness of quick material benefits and the hidden threat of its consequences, which the heroine does not realise in the course of action. S. Field (2005) emphasised that the final act should "give an emotional end to the story and show the outcome of the conflict". In this scene, the outcome of the conflict – the loss of life – is presented as specifically as possible, which enhances the moral and social meaning of the narrative. The sequence of each scene and its role as a plot component are summarised in Table 1.

Table 1. Functional characteristics of scenes

Scene	Component	Content	Value
1	Exposition	Offer of easy earnings	Definition of the story background
2	Rising action	Regular execution of customer tasks	Emphasis of the systematic and purposeful actions of the heroine
3	Climax	Moment of missile strike on the building	Fixation of the clash of individual gain with collective tragedy
4	Resolution	Funerals and the beginning of a new story	Demonstration of the consequences and repeatability of the story as a hint of the larger and more systemic nature of the problem

Source: compiled by the authors

This scenario structure works as a sequential chain "temptation – repetition of an action – sharp tragic consequence – generalisation of a problem through an open ending". This model corresponds to the classical transformational drama according to C. Vogler (2007) and the principles of a multi-level, cyclical narrative where the ending is also a new beginning (Aronson, 2010). The proposed scenario allows consistently demonstrating the potential social and emotional consequences of adolescents' unconscious interaction with digital media, forming a context for further study of the communicative effectiveness of SMA as an educational and media-educational tool. According to this scenario, a schematic traditional storyboard was developed, the value of which as a creative tool in animation is confirmed in different periods by both classical authoritative sources (Thomas & Johnston, 1981; Williams, 2001) and more contemporary research.

The analysis of the developed animation project allows identifying a number of artistic and communication mechanisms that potentially affect the development of viewer confidence. In particular, the material texture of objects, the compositional chamber nature of the frame, and the consistently constructed causal narrative form the effect of authenticity at the visual and plastic level. The absence of excessive stylisation and preservation of signs of the physical presence of objects reduce the distance between the image and the viewer, which is consistent with theoretical provisions on the role of materiality in the perception of media reports. In this context, trust appears not as a result of external evaluation, but as a property inherent in the very structure of the visual statement. From the standpoint of dramatic theory, the effectiveness of this approach is associated with the possibility of establishing the primary identification of the viewer with the character and the absence of a communication barrier, which is a prerequisite for emotional involvement.

Materiality as an artistic principle of SMA animation. The organisation of SMA production involves direct frame-by-frame intervention of the animator in physical models, scenography of the physical space of the scene, as a result of which the texture of materials, light conditions, mechanics of manual manipulation and all visible details become integral expressive components of the screen image and comprehensively affect the perception of the final product. The final stages of digital editing and post-processing provide an opportunity to adjust the structure and rhythm of the video sequence, but in the SMA, these interventions remain limited and time-consuming, since a significant part of the expressive decisions is recorded directly during time-lapse shooting. Consequently, according to K.A. Priebe (2010), production efficiency largely depends on the maximum accuracy of the material obtained during the survey phase.

According to F. Thomas & O. Johnston (1981), the physical limitations of shooting techniques and the specifics of animated visual language form the need for stylisation as a leading artistic principle, because it provides a controlled level of detail and preserves the expressiveness of the frame. Excessive texture and small decorative elements create visual noise, disrupt the stability of time – lapse shooting, reducing the readability of movement and silhouette – therefore, preference is given to generalised and symbolic details that accumulate the semantic load of the composition. Generalised volumes, selective detail and stylised design provide better handling of animation and direct the viewer's attention to the plasticity of the gesture, enhancing the expressiveness of movement and emotional expressiveness of the character.

As noted by B. Block (2021), the colour palette in SMA functions not only as a decorative element, but also as a structural component of the artistic language of animation, forming its spatial organisation, emotional register, and dramatic logic. Since characters and scenery exist as material objects, colour acquires the properties of scenographic reality: through the texture of surfaces, black-and-white modelling, and the interaction of lighting, it determines the atmosphere of the frame and the nature of perception of space. Limiting the palette, contrasting differentiation of the figure and background and consistency of tonal solutions not only provide perceptual expressiveness of the movement, but also organise the composition, direct the viewer's gaze, and enhance the symbolic and emotional interpretation of the action, making colour an active means of drama of the image. However, SMA is defined by a number of materially determined limitations: since anima-

tion is created by physical manipulation of real objects, the movement of characters obeys the laws of weight, gravity, and structural mechanics, which narrows the amplitude and complexity of actions (Purves, 2019). In addition, the frame-by-frame nature of production makes the process extremely time-consuming and not flexible in terms of changes, because corrections after shooting often require complete re-shooting of scenes (Priebe, 2010). Such technological and time constraints form a specific aesthetic of the technique, where expressiveness is achieved through a compromise between the materiality of the object and the director's idea.

The application of the comparative table (Table 2) is aimed at typologising approaches to visual and narrative construction of SMA projects in the field of social communication, which allows identifying the specifics of the author's strategy and its difference from existing practices. To ensure the correctness of the comparative analysis, not commercial high-budget animation projects are involved in consideration, but close in scale of production, execution technique, and educational and social function – this approach allows comparing design solutions, and not financial or technological resources of production. Example 1 "Bim Bim" (Imago Animation, 2024) – created within the framework of the project "InterNet/Tak" with funding from the Department of Youth and Sports of the Lutsk City Council; example 2 – "Education for everyone" (Public Organisation "Vidchuy", 2025) – from the project "30 stories of my life" created by the Public Organisation "Vidchuy" with the support of the Ukrainian Cultural Foundation; example 3 – "Ukraine" (Horobtsova & Serhiyenko, 2025) is a non-profit project of photographers and animators from Kyiv.

Table 2. Comparative analysis of the use of SMA in social and communication projects

Video	"Bim Bim"	"Education for everyone"	"Ukraine"	"Easy money"
Purpose of communication	improvemnent of media literacy	social and educational advertising	demonstration of features	improvemnent of media literacy
Target audience	children and teenagers	children and teenagers	youth and adults	children and teenagers
Production	educational and institutional	educational and institutional	independent	educational and institutional
Animation technique	plasticine	paper animation	paper animation	paper animation
Narrative	metaphorical / social and digital	social and educational / emotional	emotional and symbolic	realistic causal narrative
Stylistic strategy	metaphorical	didactic and realistic	symbolic	dramatic and realistic

Source: developed by the authors based on Imago Animation (2024), Public Organisation "Vidchuy" (2025), O. Horobtsova & O. Serhiyenko (2025)

A common feature of the project examples shown in the table is the use of SMA, however, the way they are materialised is different. Plasticine animation in "Bim Bim" emphasises the physical plasticity of images, while paper technique in "Education for everyone", "Ukraine" and "Easy money" forms a flat, graphically conditional visual. As noted by the classics of time-lapse animation K.A. Priebe (2010), G. Bendazzi (2017), and B.J.C. Purves (2019), it is the physical presence of material and the appearance of manual labour that determine the perception of SMA as "animate matter". Thus, the choice of material determines not only the texture of the frame, but also the model of the viewer's distance. In "Education for everyone", trust is built mainly through the didactic structure of the message, in "Ukraine" – through emotional and symbolic generalisation, in "Bim Bim" – through metaphorical plasticity. Instead, "Easy money" combines paper material with a realistic causal narrative, which enhances the effect of recognising the situation and reduces the social distance between the message and the viewer. Thus, within a hyper-digital culture, materiality appears not only as a technical characteristic of SMA, but also as a determining aesthetic factor of trust.

Aesthetic mechanisms of trust development in SMA. Research on the influence of an animated product on the emotional involvement of a teenage audience, which was conducted by S.V. Sosniuk & T.V. Vlasiuk (2020), demonstrated that 2D graphics technologies most attract the attention of younger teenagers (12-15 years old), although 3D graphics cause the most positive ratings and the desire to act as a consumer. Analysing the impact of the animated format, the findings of J. Kuisma *et al.* (2010) were also considered, who demonstrated that a dynamic visual format enhances the cognitive processing of information and increases trust in the content presented. Although the researchers focused on advertising messages, their findings are relevant to adolescent audiences who are sensitive to emotional triggers and visual expressiveness. These studies were conducted using social surveys, which, despite a number of typical shortcomings: the tendency to social desirability of respondents, the central trend, and stereotyping of responses, are still relevant methods of superficial diagnosis. Generalisation of the results of the analysis of the author's project, and considering theoretical approaches to the perception of audio-visual content, allowed identifying three main

groups of SMA characteristics: audio-visual component, semantic and meaning-generating component, and communication context. The scheme shown in Figure 3 is formed based on an analysis of the author's project and generalisation of theoretical approaches to the perception of audio-visual content.

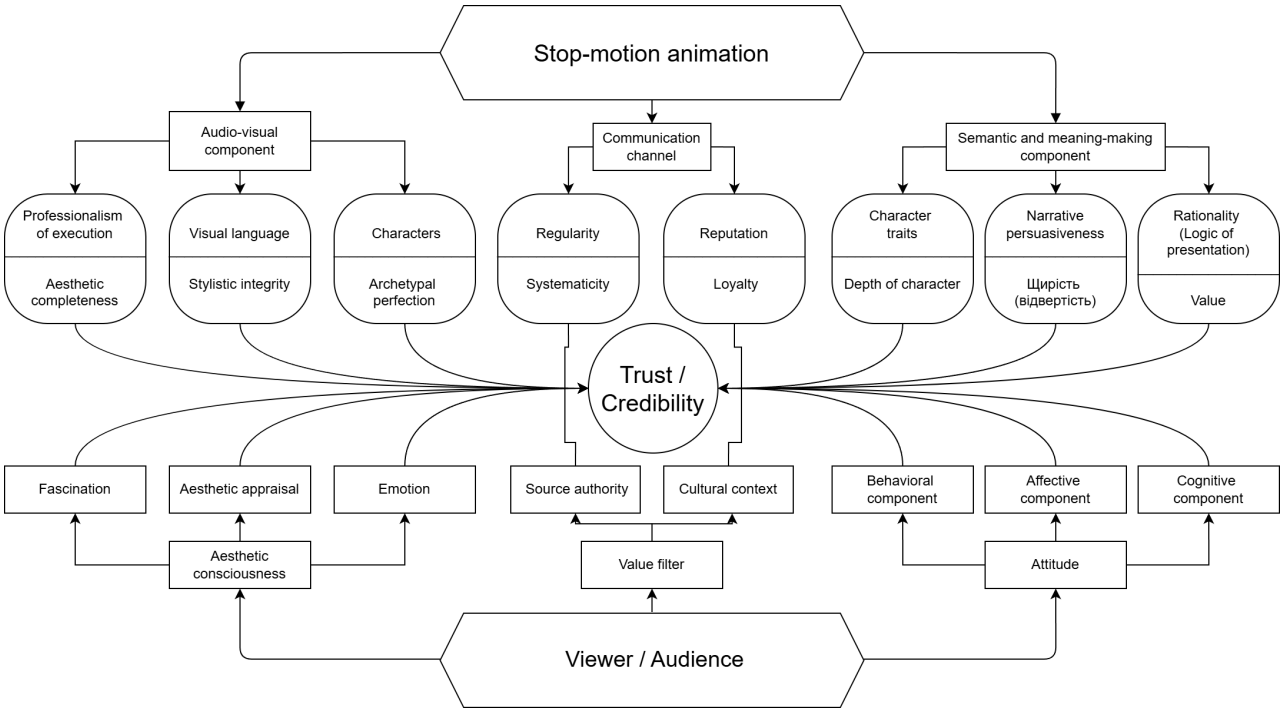

Figure 3. Model of viewer trust development in stop-motion animation
Source: created based on M. Kohring & J. Matthes (2007), S. Marković (2012), X. Cheng *et al*. (2017), M.A. Shareef *et al*. (2020)

According to the authors' hypothesis, connections are formed at the intersection of the characteristics of animation and the viewer, which foster trust in animation – a vital resource in the post-information age. The proposed model represents trust not as a consequence of a separate characteristic of an animation product, but as a result of the interaction of three structural blocks: audio-visual, semantic and meaning-generating, and communication component, which correlate with the cognitive and affective parameters of the viewer. The scheme demonstrates that the material organisation of SMA functions not only as a technical or stylistic feature, but also as an aesthetic mechanism that activates elements of aesthetic consciousness, value filter and recipient attitude. Thus, the proposed scheme is not an abstract theoretical model, but reflects the generalisation of patterns identified in the process of analysing a particular project and comparing it with existing research.

The audio-visual component initiates the primary level of fascination (Marković, 2012), forming the effect of tactile presence and reducing the sense of digital distance, and it is at this level that materiality appears as a factor in reducing the disembodied hyper-digital environment. The semantic and meaning-generating block, which covers the causal transparency of the narrative, the depth of characters, and rational argumentation, activates the appropriate levels of perception, ensuring the persuasiveness of the message. Communication component – the regularity and reputation status of the resource and context correlate with the viewer's value filter, determining the degree of previous trust in the source. At the intersection of all these parameters, an integral trust effect occurs, which is not only rational, but also visually plastic in nature. Thus, the model confirms that trust is formed as a multidimensional construct, where the materiality of SMA acts as a mediator between the artistic form and psychological mechanisms of perception. In the context of hyper-digital culture, this allows considering material aesthetics as an alternative to algorithmic standardisation of images and as a factor in restoring a sense of authenticity of media communication.

CONCLUSIONS

As a result of the study, it was found that the aesthetics of SMA in the context of hyper-digital culture can be considered as a factor of trust development. Its material nature helped to reduce the social distance between the message and the viewer, increased the level of trust, and provided deeper emotional involvement, which

was especially important when working with sensitive social topics. In the environment of digital redundancy, materiality acts not as a stylistic device, but as a semiotic marker of reliability. The analysis of the author's animation project revealed that the combination of the material organisation of the frame, compositional chamber, and causally constructed narrative, implemented through cinematic techniques (editing, framing, rhythmic organisation), forms an integral system of visual and communication influence. Within this system, materiality does not function in isolation, but in interaction with the narrative structure and audio-visual characteristics, providing emotional involvement of the viewer. Generalisation of the findings, and comparative analysis of relevant animation projects, showed that different approaches to material implementation (plastic, planar, symbolic) determine the specifics of the audience's perception, but it is the combination of materiality with realistic causal drama that contributes to the strengthening of the effect of recognition and trust.

Thus, the material aesthetics of stop-motion animation can be considered as an important resource for creating socially oriented media content that can effectively interact with the audience in a hyper-digital environment. It was established that the key condition for effectiveness is the analytical stage of design. A step-by-step model that integrates target audience research, narrative structure development, storyboarding, visual solution testing, and comparative analysis of relevant cases reduces communication risks and increases impact manageability. The proposed system of schemes formalises the algorithm for creating an SMA and creates prerequisites for reproducibility of the result in educational and social media projects. Thus, in the context of contemporary design practice, SMA appears as an interdisciplinary form in which materiality functions as a consciously constructed communicative resource. Its application opens up prospects for the development of project strategies aimed at restoring trust in a hyper-digital environment.

ACKNOWLEDGEMENTS

The authors express their gratitude to everyone who contributed to this study.

FUNDING

This study did not receive external funding.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Матеріальна естетика стоп-моушн анімації як чинник довіри: наративно-кінематографічний аналіз проєкту

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Анотація. Загострення кризи довіри до медіа та втома від стандартизованої цифрової естетики спонукають аудиторію до пошуку автентичного візуального досвіду. Стоп-моушн анімація відповідає цьому запиту через свою принципову матеріальність – здатність перетворювати фізичну присутність об'єктів на естетичний аргумент достовірності. У цьому контексті матеріальність постає не лише технічною характеристикою покадрової анімації, а самостійною естетичною категорією, що впливає на формування довіри та зменшення соціальної дистанції між повідомленням і глядачем. Метою статті було теоретичне обґрунтування стоп-моушн анімації як чинника формування глядацької довіри та виявлення художніх механізмів її реалізації, зокрема через наративно-кінематографічні засоби організації аудіовізуального ряду. Матеріалом для дослідження став авторський соціально-освітній проєкт, реалізований у межах міждисциплінарної співпраці кафедри візуального дизайну та мистецтва Національного університету «Львівська політехніка» з громадським сектором. Методологія поєднала контекстуальний, структурно-системний і порівняльний аналізи із practice-based research, що дозволило інтегрувати художнє проєктування у наукову площину та простежити взаємозв'язок між матеріальною організацією зображення, типом наративу та механізмами формування довіри. Результати дослідження засвідчили, що матеріальність у стоп-моушн анімації функціонує як естетичний механізм редукції соціальної дистанції та підвищення прийняття медіаповідомлення. Виявлено кореляцію між фактурною організацією зображення, композиційною камерністю та каузально вибудуваним наративом, реалізованим через кінематографічні прийоми (монтаж, кадрування, ритмічну організацію), які формують ефект достовірності на візуально-пластичному та емоційному рівнях. Доведено, що матеріальна естетика стоп-моушн постає самостійним художнім чинником довіри, розширюючи уявлення про функціонування цієї техніки за межами її технологічного визначення та актуалізуючи її потенціал у гіперцифровій культурі. Отримані результати можуть бути використані дизайнерами, освітянами та розробниками соціально-комунікаційних медіапроєктів для створення візуального контенту, орієнтованого на підвищення довіри аудиторії в умовах гіперцифрового середовища

Ключові слова: аудіо-візуальна комунікація; мультимедіа; медіаконтент; анімаційний ролик; анімаційний проєкт; техніка анімації; підвищення медіаграмотності

ART AND DESIGN

Scientific Journal

Volume 9, No. 1,
2026

Founded in 2017.
Published four times per year

Managing editor:
Olena Kryvonos

Printing proof 09.04.2026. Format 60×84 1/8.
Conditional sheet 14,88. Calculated sheet 14.9.
Circulation 100 copies. Order N 2214.

Publishing Address:
Kyiv National University of Technologies and Design
01011, 2, Mala Shyianovska Str., Kyiv, Ukraine
E-mail: knutd@art-design.com.ua
https://art-design.com.ua/en

ART AND DESIGN

Науковий журнал

Том 9, № 1,
2026

Заснований у 2017 р.
Виходить чотири рази на рік

Технічний редактор
Олена Кривонос

Підп. до друку 09.04.2026, Формат 60×84 1/8.
Ум. друк. арк. 14,88. Облік, вид. арк. 14,9.
Наклад 100 пр. Зам. 2214.

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