



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

Sviatoslav Berdinskykh*

PhD in Technical Sciences, Associate Professor
“KROK” University
03113, 30-32 Tabirna Str., Kyiv, Ukraine
<https://orcid.org/0000-0003-2911-7504>

Olena Yaremchuk

PhD in Art Sciences, Associate Professor
“KROK” University
03113, 30-32 Tabirna Str., Kyiv, Ukraine
<https://orcid.org/0000-0002-3982-8580>

Kalyna Pashkevych

Doctor of Technical Sciences, Professor
Kyiv National University of Technologies and Design
01011, 2 Mala Shyianovska Str., Kyiv, Ukraine
<https://orcid.org/0000-0001-6760-3728>

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:

Berdinskykh, 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.

*Corresponding author



Copyright © The Author(s). This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (<https://creativecommons.org/licenses/by/4.0/>)

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.

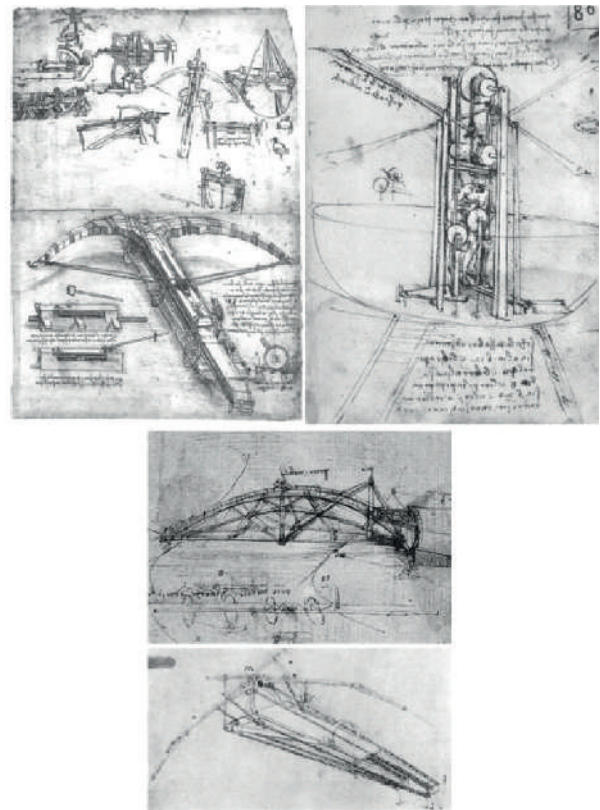


Figure 1. Drawings by Leonardo da Vinci – some of the first examples of project representation
Source: F. Zoellner (2014)

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

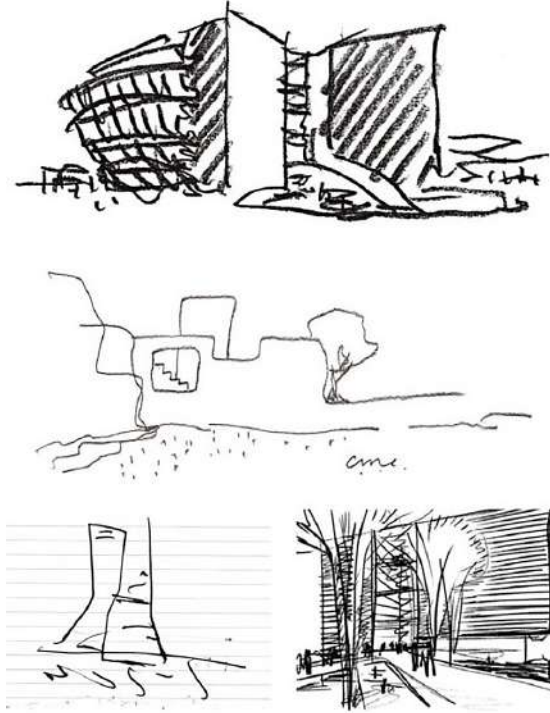


Figure 2. Sketch as a means of conceptualising design ideas

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 form-making 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.

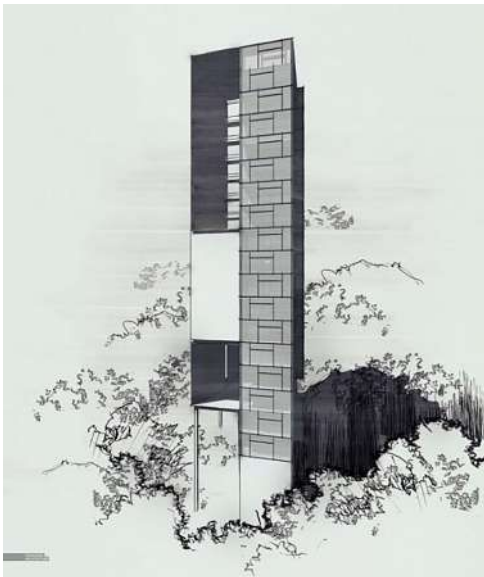


Figure 3. Digital imitation of sketching techniques in modern architectural visualisation

Source: A. Hogefe (n.d.)

The growing popularity of sketching is also tied to the promising development of its form-generating 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.



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 three-dimensional 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 CAD-oriented 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 hand-drawn 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.

REFERENCES

- [1] Abdullah, M., Khairani, M., Vincent, F., Abdul, A., Mohd N., & Ramlie, M.K. (2024). Learning to draw is learning to see: A comprehensive review of art and design practices in higher education. *Ideology Journal*, 9(1), 93-105. [doi: 10.24191/ideology.v9i1.563](https://doi.org/10.24191/ideology.v9i1.563).
- [2] Barreca, G. (2023). Drawing for the project: Dimension and space for an architecture imagined before its realization. *Disegno*, 13, 91-100. [doi: 10.26375/disegno.13.2023.11](https://doi.org/10.26375/disegno.13.2023.11).
- [3] Charitonidou, M. (2022). Frank Gehry's non-trivial drawings as gestures: Drawdlings and a kinaesthetic approach to architecture. *Journal of Visual Art Practice*, 21(2), 147-174. [doi: 10.1080/14702029.2021.2022292](https://doi.org/10.1080/14702029.2021.2022292).
- [4] Das, M., Huang, M., & Yang, M.C. (2024). Paper or tablet? The impact of digital tools on sketching during engineering design concept generation. *Journal of Mechanical Design*, 146(11), article number 111401. [doi: 10.1115/1.4065458](https://doi.org/10.1115/1.4065458).
- [5] Dzurilla, D., & Achten, H. (2021). What is architectural digital sketch? – A systematic inventory. In *eCAADe 2021: Towards a new, configurable architecture* (pp. 403-414). Novi Sad: University of Novi Sad. [doi: 10.52842/conf.ecaade.2021.1.403](https://doi.org/10.52842/conf.ecaade.2021.1.403).
- [6] Fakhry, M., Kamel, I., & Abdelaal, A. (2021). CAD using preference compared to hand drafting in architectural working drawings coursework. *Ain Shams Engineering Journal*, 12(3), 3331-3338. [doi: 10.1016/j.asej.2021.01.016](https://doi.org/10.1016/j.asej.2021.01.016).
- [7] Giesecke, F.E., Lockhart, S., Goodman, M., & Johnson, C.M. (2023). *Technical drawing with engineering graphics*. London: Pearson.
- [8] Gomez-Tone, H.C., & Raposo Grau, J.F. (2024). Characterization of conception drawing in architecture to face technological mediations. *Frontiers of Architectural Research*, 13(3), 425-438. [doi: 10.1016/j.foar.2023.12.013](https://doi.org/10.1016/j.foar.2023.12.013).
- [9] Hasenhütl, G. (2020). [Manual drawing transformation: A brief assessment of “design-by-drawing” and potentials of a body technique in times of digitalization](https://doi.org/10.1016/j.aest.2020.05.001). *The Journal of Aesthetic Education*, 54(2), 56-74.
- [10] Hogeefe, A. (n.d.). *Visualizing architecture*. Retrieved from <https://visualizingarchitecture.com>.
- [11] Itten, J. (2023). *Elements of fine art*. Kyiv: ArtHuss.
- [12] Kim, B., & Jung, E.-C. (2023). Three unique concept explorations in sketching based on conceptual combinations in associative extension and schematic structure. *Thinking Skills and Creativity*, 48, article number 101281. [doi: 10.1016/j.tsc.2023.101281](https://doi.org/10.1016/j.tsc.2023.101281).
- [13] Leandri, G. (2022). *Freehand digital drawing: A boost to creative design. The observer's eye and the draftsman brain*. (Doctoral dissertation, Universitat Politècnica de València, València, Spain).
- [14] Lorusso, M., Rossoni, M., & Colombo, G. (2020). Conceptual modeling in product design within virtual reality environments. *Computer-Aided Design and Applications*, 18(2), 383-398. [doi: 10.14733/cadaps.2021.383-398](https://doi.org/10.14733/cadaps.2021.383-398).
- [15] Makarouni, E. (n.d.). Tech for architects: 6 top tools for architectural sketching. *Architizer*. Retrieved from <https://architizer.com/blog/practice/tools/top-tech-tools-for-architectural-sketching/>.
- [16] Masi, Ch. (2021). Drawing for learning: A review of the literature. *Drawing: Research, Theory, Practice*, 6(1), 199-218. [doi: 10.1386/drtpr.00060.7](https://doi.org/10.1386/drtpr.00060.7).
- [17] Medium. (n.d.). *Morpholio trace*. Retrieved from <https://morpholio.medium.com>.
- [18] Morpholio. (n.d.). Retrieved from <https://www.morpholioapps.com>.
- [19] Novica, D.R., Wianto, E., & Campos, S.A. (2023). Drawing and ideation process in design education: A systematic literature review. *Cogent Arts & Humanities*, 10(1), article number 2219487. [doi: 10.1080/23311983.2023.2219487](https://doi.org/10.1080/23311983.2023.2219487).
- [20] Paans, O. (2024). Within the space of drawing: Lines and the locus of creation in architectural design. *Journal of Research in Philosophy and History*, 7(1), 36-69. [doi: 10.22158/jrph.v7n1p36](https://doi.org/10.22158/jrph.v7n1p36).
- [21] Pashukova, S.G., Chamberzhi, D.A., & Dubrivna, A.P. (2023). Sketching as an effective tool of creative activity. *ART-platFORM*, 8(2), 309-324. [doi: 10.51209/platform.2.8.2023.309-324](https://doi.org/10.51209/platform.2.8.2023.309-324).
- [22] Procreate. (n.d.). Retrieved from <https://procreate.com>.
- [23] Ranscombe, C., & Zhang, W. (2021). What motivates and discourages designers to use digital sketching? Comparing its use to externalise ideas versus communicating with external stakeholders. *Proceedings of the Design Society*, 1, 3441-3450. [doi: 10.1017/pds.2021.605](https://doi.org/10.1017/pds.2021.605).
- [24] Rayon. (n.d.). Retrieved from <https://www.rayon.design/>.
- [25] Scheer, D.R. (2014). *The death of drawing: Architecture in the age of simulation*. New York: Routledge.
- [26] Sketchbook. (n.d.). Retrieved from <https://www.sketchbook.com/>.
- [27] Smith, K.S. (2005). *Architects' drawings: A selection of sketches by world famous architects through history*. New York: Princeton Architectural Press.
- [28] Szot, J. (2020). Looking for truth. Photorealistic and non-photorealistic architectural visualizations. In *Defining the architectural space – the truth and lie of architecture* (pp. 63-73). Wrocław: ATUT Publishing House. [doi: 10.23817/2020.defarch.8-6](https://doi.org/10.23817/2020.defarch.8-6).
- [29] Tan, L., Tanaka, T., & Liu, J. (2025). Analyzing architectural drawing in the works of four contemporary Chinese and Japanese architects: A multi-dimensional approach. *Architecture*, 5(2), article number 23. [doi: 10.3390/architecture5020023](https://doi.org/10.3390/architecture5020023).

- [30] Tufail, M., Zaib, S., Uzma, S., Karim, R.M., & Kim, K. (2024). Exploring designers' cognitive abilities in the concept product design phase through traditional and digitally-mediated design environments. *Proceedings of the Design Society*, 4, 1135-1146. doi: [10.1017/pds.2024.116](https://doi.org/10.1017/pds.2024.116).
- [31] Valença, M.M. (2024). Creativity in architecture: Expressing conceptual foundations in sketch model experimentation. *Cogent Arts & Humanities*, 11(1), article number 2423522. doi: [10.1080/23311983.2024.2423522](https://doi.org/10.1080/23311983.2024.2423522).
- [32] Yıldızoğlu, N. (2024). Sketching versus digital design tools in architectural design. *Journal of Computational Design*, 5(2), 301-316. doi: [10.53710/jcode.1504947](https://doi.org/10.53710/jcode.1504947).
- [33] Zoellner, F. (2014). *Leonardo da Vinci – the graphic work*. Cologne: Taschen.

Цифрова трансформація скетчінгу в художньо-проектній діяльності

Святослав Бердинських

Кандидат технічних наук, доцент
Університет економіки та права «КРОК»
03113, вул. Табірна, 30-32, м. Київ, Україна
<https://orcid.org/0000-0003-2911-7504>

Олена Яремчук

Кандидат мистецтвознавства, доцент
Університет економіки та права «КРОК»
03113, вул. Табірна, 30-32, м. Київ, Україна
<https://orcid.org/0000-0002-3982-8580>

Калина Пашкевич

Доктор технічних наук, професор
Київський національний університет технологій та дизайну
01011, вул. Мала Шияновська, 2, м. Київ, Україна
<https://orcid.org/0000-0001-6760-3728>

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 ефективною візуалізації, який здатен передавати інформацію про основні проектні позиції та припущення, через використання системи графічних символів, яка характеризує особистісний стиль автора. Притаманна скетчінгу швидкість фіксації образу, свобода моделювання та природність створення зображень обумовлює раціональність його використання в творчо-пошукових процесах та у структурі моделювання властивостей проєктованих 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 проєктованих 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