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DIGITAL REPLICATION METHODS OF HIGH-PRINTING FOR MODERN ILLUSTRATION

Abstract. *The article is devoted to the analysis of modern methods of digital replication of letterpress techniques in the context of current illustrative practice. Technological approaches to the reproduction of textures, reliefs and characteristic properties of traditional printing techniques (lino-engraving, woodcut, embossing) using graphic editors, algorithmic texture modeling systems, generative models of artificial intelligence and 3D scanning are considered. The features and potential of the digital environment in reproducing the authenticity of material techniques are highlighted, and the creative value of the synthesis of traditional and innovative approaches is also determined. It is shown that digital replication contributes to the formation of a new aesthetic of modern illustration, expanding the tools of artists and preserving the expressiveness, rhythm and texture inherent in letterpress.* ***Purpose of the article.*** *The purpose of the study is to systematize modern methods of digital replication of letterpress techniques, analyze their technological capabilities and determine the impact on the formation of the visual language of modern illustration. The article also aims to reveal the creative potential of synthesizing traditional graphic methods with digital tools.*
Research methods. *The work uses a set of methods:*
comparative analysis of traditional letterpress techniques and their digital interpretations; visual and stylistic analysis of illustrative works; research into the functional capabilities of modern graphic editors and generative AI models; algorithmic modeling of textures and simulation of relief surfaces; generalization of practical experience in using digital technologies in artistic activity. ***Research results.*** *As a result of the work, key approaches to digital replication of letterpress effects were identified: creating textures using algorithmic methods, using generative AI to model manual techniques, building relief surfaces in 3D environments, and combining digital and traditional techniques. It is proven that digital replication not only reproduces the aesthetics of classical techniques, but also expands the capabilities of a modern illustrator, contributing to the emergence of new artistic strategies. It has been established that the synthesis of material and digital methods enhances the expressiveness, rhythm, conceptuality and textural richness of modern illustrations.* ***Conclusions.*** *Digital replication of letterpress techniques is a relevant tool of modern illustrative practice, as it allows preserving the artistic authenticity of historical graphic methods within the digital media environment. Modeling the texture, relief and character of manual techniques becomes possible thanks to the use of generative AI, 3D scanning, algorithmic textures and classic graphic editors. The synthesis of traditional and digital approaches creates a new quality of visual language, makes works more flexible in production and more responsive to modern requirements of design, publishing and digital media. Replication does not replace traditional techniques, but expands their functional spectrum, forming a relevant toolkit for new generation illustrators.*
Key words: *digital replication, high-printing, illustration, digital illustration.*

МЕТОДИ ЦИФРОВОЇ РЕПЛІКАЦІЇ ВИСОКОГО ДРУКУ ДЛЯ СУЧАСНОЇ ІЛЮСТРАЦІЇ

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Анотація. *Стаття присвячена аналізу сучасних методів цифрової реплікації технік високого друку в контексті актуальної ілюстративної практики. Розглянуто технологічні підходи до відтворення текстур, рельєфів та характерних властивостей традиційних друкарських технік (ліногравюри, дереворит, тиснення) за допомогою графічних редакторів, алгоритмічних систем моделювання фактур, генеративних моделей штучного інтелекту та 3D-сканування. Виокремлено особливості та потенціал цифрового середовища у відтворенні автентичності матеріальних технік, а також визначено творчу цінність синтезу традиційних та інноваційних підходів. Показано, що цифрова реплікація сприяє формуванню нової естетики сучасної ілюстрації, розширюючи інструментарій художників і зберігаючи властиву високому друку експресивність, ритміку та фактурність.* ***Мета.*** *Метою дослідження є систематизація сучасних методів цифрової реплікації технік високого друку, аналіз їхніх технологічних можливостей і визначення впливу на формування візуальної мови сучасної ілюстрації. Стаття також передбачає виявлення творчого потенціалу синтезу традиційних графічних методів із цифровими інструментами.* ***Методи дослідження.*** *У роботі застосовано комплекс методів: порівняльний аналіз традиційних технік високого друку та їхніх цифрових інтерпретацій; візуально-стилістичний аналіз ілюстративних творів; дослідження функціональних можливостей сучасних графічних редакторів і генеративних моделей ШІ; алгоритмічне моделювання фактур і симуляція рельєфних поверхонь; узагальнення практичного досвіду використання цифрових технологій у мистецькій діяльності.* ***Результати дослідження.*** *В результаті роботи визначено ключові підходи до цифрової реплікації ефектів високого друку: створення текстур за допомогою алгоритмічних методів, застосування generative AI для моделювання ручних технік, побудова рельєфних поверхонь у 3D-середовищах та комбінування цифрових і традиційних прийомів. Доведено, що цифрова реплікація не лише відтворює естетику класичних технік, але й розширює можливості сучасного ілюстратора, сприяючи появі нових художніх стратегій. Встановлено, що синтез матеріальних і цифрових методів підсилює експресивність, ритміку, концептуальність і текстурну насиченість сучасних ілюстрацій.* ***Висновки.*** *Цифрова реплікація технік високого друку є актуальним інструментом сучасної ілюстративної практики, оскільки дає змогу зберігати художню автентичність історичних графічних методів у межах цифрового медіасередовища. Моделювання фактури, рельєфності та характеру ручної техніки стає можливим завдяки використанню генеративного ШІ, 3D-сканування, алгоритмічних текстур та класичних графічних редакторів. Синтез традиційних і цифрових підходів утворює нову якість візуальної мови, робить твори гнучкішими у виробництві та більш відповідними до сучасних вимог дизайну, видавничої справи і цифрових медіа. Реплікація не замінює традиційні техніки, але розширює їхній функціональний спектр, формуючи актуальний інструментарій для ілюстраторів нового покоління.*
Ключові слова: *цифрова реплікація, високий друк, ілюстрація, діджитал-ілюстрація.*

Problem statement. In modern illustration, there is an increased interest in the aesthetics of traditional letterpress, which is distinguished by tactility, relief and material expression. However, work in classical techniques (linoleum, woodcut, embossing) requires special equipment, significant time and technical resources, which complicates their use in conditions of rapid digital production. At the same time, the issue of transferring the authentic properties of letterpress to the digital environment without losing artistic value is becoming relevant. Systematic research devoted to the digital replication of relief techniques is practically absent, which enhances the relevance of our work.

Analysis of recent publications. Recent studies on the impact of digital technologies on illustration and graphics demonstrate a gradual shift in emphasis from traditional techniques to complex digital approaches that combine the materiality of manual methods with the flexibility of digital tools. Aaron Hertzman's classic work Introduction to 3D Non-Photorealistic Rendering (1999) is fundamental to understanding the principles of digital simulation of manual artistic techniques, in particular silhouettes, contours and textured

surfaces [1]. Although the publication is historical, it laid the theoretical foundations for the further development of methods for digital reproduction of graphic styles, which is relevant in the context of research on digital replication of letterpress.

The works of M. Efimova (2015), as well as the collective monograph under the general editorship of G. Efremova (2020) highlight innovative approaches to the design of book products and the transformation of the educational space under the influence of digitalization. These studies emphasize the importance of integrating digital tools into production processes and note that modern publishing design actively uses the possibilities of digital replication of traditional artistic methods, however, the problem of transferring texture and relief remains insufficiently studied [2; 3].

The publication by Y. Kamenetska (2024) examines the impact of digitalization and artificial intelligence technologies on book illustration. The author emphasizes that AI is becoming a tool for modeling graphic techniques, in particular those that imitate the materiality of traditional printing. However, digital replication of letterpress printing as a separate direction is studied in passing, which emphasizes the relevance of a more detailed systemic analysis [4].

The study by A. Maltseva et al. (2017) aims to determine the impact of digital technologies on the development of illustration in graphic design. The article outlines the main trends in the digital transformation of illustrative practices, but there is no focus on the possibility of simulating classical printing techniques, in particular letterpress textures [5].

D. Mirshonichenko's qualification work (2024) analyzes digital methods of illustrating fiction and pays attention to practical aspects of using digital technologies in modern publishing. The author systematizes digital stylization techniques, but the issue of replicating letterpress textures remains insufficiently explored [6].

The materials of the Ukrainian Biennial of Digital and Media Art (2021) reflect trends in contemporary digital art, where artists actively use generative graphics, 3D modeling, and mixed media technologies. Although the highlighted activity is not a scientific study in the narrow sense, it demonstrates current visual practices, including experiments with imitation of printing techniques, but these are rather artistic cases than methodological analysis [7].

Thus, the above summary shows that the issue of digital replication of letterpress printing is partially covered in the context of the general digitalization of graphics, however, there are practically no systematic studies dedicated specifically to methods of reproducing the texture and relief of traditional letterpress printing techniques in the digital environment. This determines the scientific novelty and relevance of the proposed study.

The aim of the article is to analyze and systematize modern methods of digital replication of letterpress techniques, to identify their technological features and artistic possibilities, and to outline their influence on the formation of a new visual language of modern illustration. The aim also involves determining the potential of combining traditional graphic practices with digital tools to create expressive, texturally rich, and conceptually coherent illustrative solutions in the modern media environment.

Presentation of the main material. The rapid development of digital technologies over the past decades has significantly transformed artistic practice, changing approaches to the creation, representation and reproduction of images. In the field of modern illustration, these transformations are most noticeably manifested, because illustrative art has always been sensitive to visual innovations, new materials and technical capabilities. One of such areas that is gaining particular relevance is the digital replication of traditional graphic techniques of letterpress printing - in particular, linocut, woodcut, engraving on plastic and other types of relief printing.

Despite the fact that classic letterpress printing historically relied on manual labor, the materiality of the medium, the tactility of the surface and the uniqueness of each print, modern digital graphics tools allow not only to imitate its visual style, but also to expand it, creating new artistic forms. Digital replication does not provide for a complete replacement of the traditional process, but it offers powerful opportunities for experimentation, preservation and scaling of the aesthetics of relief techniques.

Letterpress as a visual and technological basis of traditional graphics. Letterpress is one of the oldest types of graphic art, the essence of which is to print from a relief surface. Parts of the matrix that remain convex after cutting or engraving hold the paint and form an impression. Among the classic varieties, one can distinguish: woodcut (xylography) – the oldest technique, which forms a characteristic play of contrasts and a hard, expressive line; linocut – a technique of letterpress printing on linoleum, which allows for softer, smoother shapes and a more plastic line; engraving on plastic and other modern materials that expanded the tools of artists in the 20th–21st centuries.

The visual character of letterpress printing is based on several key artistic parameters: sharply defined form; contrast of black and white; surface texture; «imperfections» of the material, which become part of the artistic image; rhythm of lines, which forms a compositional framework.

These properties form a unique aesthetic, which today is becoming valuable for modern illustration, especially in the context of trends towards manuality, craft approaches, materiality and a departure from an overly "polished" digital style.

Digital replication of traditional techniques: possibilities and aesthetic parameters. Modern digital tools (Adobe Photoshop, Procreate, Krita, Clip Studio Paint, Affinity Designer, etc.) allow you to create visual effects that imitate textures, sharp linear contrasts, texture and unevenness of the print. However, "digital replication" does not mean mechanical imitation. It is about creatively recreating the artistic principles of traditional graphics using digital tools, including: personal texture brushes that simulate relief cuts; the use of grain, noise, and irregularities to approximate real texture; multi-layered compositions that create the effect of printing with several boards; modeling characteristic «imperfections»: paint gaps, cutter marks, line breaks; the ability to precisely control composition, color, and stroke density.

The main advantage of digital replication is that the artist can recreate the aesthetics of manual techniques without the limitations of physical material, while preserving the spirit of the graphic tradition. Illustrators are able to work faster, on a larger scale, and create commercial projects where the classic manual process would be technically or financially impossible.

In this context, digital replication becomes not a fake, but a modernization of the technique, its adaptation to the requirements of the modern media environment.

Comparison of traditional techniques and their digital interpretation. The study examines three illustrations that demonstrate different aspects of relief graphics: traditional linocut; digital illustration made in the style of linocut; woodcut with the characteristic structure of a woodcutter.

Traditional linocut demonstrates the natural «living» characteristics of the material: the natural width of the line, small fluctuations in the movement of the hand, the microrelief of the print that absorbs the paint unevenly. In the digital interpretation of linocut, an imitation of these properties is observed through an artificially generated texture, but the digital tool allows for greater precision and variability.

In turn, woodcut is distinguished by the rigidity and sharpness of the lines that arise from the structure of the wood. Its visual energy is often more dramatic. Digital replication of woodcut requires the use of special brushes that imitate movements along the wood fibers.

These examples demonstrate that digital replication can be either very close to the original or interpretively free – depending on the artist's goals.

The study analyzed three original illustrations by artist E. Mazur, representing different approaches to creating a graphic image in the context of traditional letterpress techniques and their digital imitations. This allows us to trace how the artist transforms the material nature of linocut and woodcut into a digital environment, preserving the characteristic plasticity of the stroke, rhythm, and texture.

1. Traditional linocut (Ill. 1). The first image demonstrates the classic linocut technique, in which the artist works directly with the material, cutting out the image on a linoleum matrix. This work is characterized by: the clear contrast of the black printing background and the whitened cut-out forms; the unevenness and lively structure of the stroke, caused by the physical movement of the cutter; the presence of artifacts of manual work, in particular small residual grooves that cannot be fully predicted or «sterilized»; the material texture of the relief, which creates the effect of depth and tactility.

The composition with the house, the ladder and the night sky emphasizes the expressive possibilities of linocut – the rough but poetic fragmentation of space, in which the texture takes on the role of a carrier of emotionality. This example is a starting point for comparison with digital replications.

Ill. 1. E. Mazur. Linocut. *2025*

2. Digital imitation of linocut (Ill. 2). The second image is marked as "linocut slant", created in a digital environment. The work follows traditional techniques, but is done with the help of graphic editors. In this case, the artist: models the characteristic line notches that imitate the movement of the cutter; applies high contrast and the division into black and white planes inherent in linocut; uses digital brushes with the effect of engraving cutting; achieves the visual authenticity of the technique, but at the same time preserves the digital purity of the lines.

Unlike manual linocut, the digital version allows you to create a more controlled rhythm, without random material defects, and easily adjust the stroke layout. However, the artist deliberately retains the "imperfections" in the hatching, which maintains the plausibility of the replication. This is an example of how modern illustrators use digital tools to accurately reproduce the aesthetics of letterpress printing without physically cutting a matrix.

Ill. 2. E. Mazur. 2D graphics. *2025*

3. Woodcut (Ill. 3). The third illustration, made in the woodcut technique, demonstrates a different typology of relief printing. Unlike linocut, woodcut involves working with a solid wooden block, which gives: deeper and harder lines; higher detail due to thinner cutters; sharper contour; a sense of "metallicity" of the stroke due to the resistance of the material.

In the round portrait image, the artist achieves a refined decorativeness: the ornamental frame and smooth line transitions emphasize the manual nature of the matrix. This example is important in the analysis because it demonstrates an aesthetic

Ill. 3. E. Mazur. Woodcut. *2025*

that is more difficult to imitate digitally due to the hardness, depth, and material nature of the wood.

Generalization. The analyzed works of E. Mazur allow us to trace a wide range of methods for reproducing the aesthetics of letterpress printing – from completely material techniques to digital replications. They demonstrate: the possibility of accurate stylistic imitation; preservation of key features of the technique in the digital environment; at the same time – the loss of material unpredictability in replications; the significant potential of digital tools for modernizing classical aesthetics.

Features of digital replication strategies in modern illustration. Modern illustrators use digital replication of letterpress printing in various visual areas: book illustration – enrichment of emotionality and creation of a sense of artisanal approach; poster design – graphicity and contrast inherent in relief techniques work well in poster compositions; editorial illustration – model textures allow us to create unique stylistic solutions; brand identity and packaging – manual «aesthetics» create the effect of authenticity and trust; animation – the ability to stylize a moving image as a relief print.

It is worth paying special attention to the fact that digital replication allows you to reproduce effects that would require many hours of work, complex tools, or rare materials in traditional techniques. This increases accessibility and expands the boundaries of experimentation.

Limits and Challenges of Digital Replication. Despite its many advantages, digital replication also has certain limitations.

– Loss of materiality. Even the most accurate replication cannot replace real embossing, matrix texture, or the uniqueness of each printing pass.

– Danger of uniformity. The popularity of digital brushes for imitating engravings can lead to a uniformity of styles if the artist does not supplement the toolkit with his own textures.

– Ethical and copyright issues.

Using stencil brushes can reduce the artist's individuality.

– The problem of «excessive cleanliness».

The digital environment often makes strokes too «neat» – sometimes you need to deliberately add defects to get a believable effect. However, these difficulties only emphasize that digital replication should be a conscious artistic strategy, not a technical «imitation for the sake of imitation».

The Importance of Digital Replication for the Development of Contemporary Illustration. Digital replication of letterpress techniques plays a key role in the transformation of contemporary illustrative practice, as it combines historical material tradition with the flexibility and speed of digital tools. It not only preserves the visual language of classical graphic methods, but also adds new semantic and technological dimensions to them, making these techniques relevant in the context of the modern media environment.

Firstly, digital replication contributes to the democratization of access to relief techniques, which in traditional execution require a special workshop, materials and significant time resources. The ability to reproduce texture and relief using graphic editors or generative systems opens these artistic techniques to a wider audience, including young designers, students and artists working exclusively in digital formats.

Second, the digital environment creates conditions for the development of new authorial styles, in which the traditional line language, texture and relief of letterpress take on hybrid forms. Illustrators can combine material and digital techniques, mix linocut plastic with algorithmically generated surfaces, model complex multi-layered compositions or stylize a moving image under relief printing. This forms a new artistic vocabulary that combines craftsmanship and digital experimentation.

Third, digital replication actualizes traditional techniques in areas where they cannot be applied directly: editorial illustration, web design, UX interfaces, media graphics, animation, branding and packaging. The aesthetics of letterpress – contrast, rhythmic structures, graphic imperfection – work well in digital communications, where expressiveness and quick reading of the image are valued.

Fourth, replication contributes to the preservation of cultural heritage: digital methods allow for the analysis, documentation and reproduction of material techniques, forming archives of textures, line systems and relief surfaces. This is especially important in the context of education and popularization of classical graphic practices.

Finally, digital replication stimulates a rethinking of tradition. It does not replace material linocut or woodcut, but expands their functional spectrum, making these techniques more adaptable and relevant to modern artistic tasks. Such a synthesis opens up opportunities for the emergence of new aesthetic solutions and conceptual strategies in graphic design and illustration.

Thus, digital replication of letterpress is not just a technical tool, but an important factor in the development of modern visual culture. It forms a new format of interaction between tradition and innovation, ensuring the evolution of the artistic language of illustration in the digital age.

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