ujemnego tempa, osiągnęli najszybsze czasy w wyścigu, oprócz kobiet z klasy S13 dla których strategia równomiernego tempa była najskuteczniejsza. Wyniki badania sugerują przyjęcie wielu strategii w różnych klasach niepełnosprawności.[5] Odnosząc tę informację o indywidualnym dobieraniu strategii tempa pływania do zawodników niepełnosprawnych w tym niewidomych, można wywnioskować, że wcale równomierne rozłożenie tempa nie zawsze jest receptą na sukces. Chociaż można by przypuszczać, że jest to trafne rozwiązanie dla pływaków, którzy nie widzą, gdzie płyną, nie mogą utrzymać kursu i przyspieszając mogą tym bardziej narazić się na kontakt z liną. Jednakże okazało się, że przyspieszenie w drugiej połowie dystansu dla części badanych skutkowało lepszym wynikiem. Analogicznie badania przeprowadzone w tej pracy polegały na pływaniu z zasłoniętymi oczyma swoim tempem, każdy pływak mógł zdjąć okularki po skończonej długości 25m. Kolejną długość pływacy zaczynali w kolejności, kiedy osoba płynąca przed z zasłoniętymi oczyma była w połowie długości pływalni tak, aby każdy zawodnik nie obawiał się, że dogoni lub zostanie dogoniony przez kogoś, żeby nie musiał dostosowywać prędkości do zawodnika płynącego przed nim.

Autorka dostrzega też sens korekcyjny pływania z wyłączeniem zmysłu wzroku dla dzieci z wadami kręgosłupa.

Na podstawie analizy uzyskanych wyników badań udzielić można następujących odpowiedzi na postawione pytania badawcze:

1. Trening pływania z zasłoniętymi oczyma wpłynął na poprawę techniki pływania. W grupie eksperymentalnej średnia wartość indeksu techniki podniosła się w testach 4x25m oraz 50m, wzrosła również jego wartość szczytowa w teście 4x25m.
2. Po 8-tygodniowym treningu pływania z zasłoniętymi oczyma zmianie nie uległy wszystkie badane wartości kinematyczne. W grupie eksperymentalnej wymienione średnie wartości nie uległy zmianie istotnej statystycznie: prędkość maksymalna, prędkość przy szczytowej wartości indeksu techniki oraz frekwencja przy szczytowej wartości indeksu techniki w teście 4x25m.

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Анотація

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ПЛАВАННЯ СЛІПИ ТА КІНЕМАТИЧНІ ЗНАЧЕННЯ

Стосунки між людиною та водою створюють унікальні, вічні та нерозривні стосунки. Ми народжуємося у воді, вона всередині нас протягом усього життя, ми повинні вживати її щодня, щоб вижити. Тому людина перебуває в симбіотичних стосунках з водою. Пересування у водному середовищі передбачає природне збереження навичок плавання та пірнання з внутрішньоутробного періоду. Малюки інстинктивно рухаються у воді, затримують дихання під водою, відкривають очі під водою і навіть можуть триматися на воді на спині. Уміння плавати як засіб пересування у воді можна порівняти з умінням ходити - пересуватися по суші - обидва закладені в розвитку людини. Плавання - це вид фізичної активності, який, розвиваючись з раннього віку, всебічно розвиває моторику. Уміння плавати сприймається як велика цінність, насамперед через безпечне користування водоймами, а також через його профілактичну та корекційну функцію при порушеннях постави, благотворний вплив на працездатність усіх анатомічних систем і підвищення загальної ефективності тіло.

Оволодіння спортивною технікою - це багатоетапний навчальний процес, темп якого залежить від рухових якостей, особливо координації, будови тіла і, звичайно, мотивації. Досягнення найвищого, майстерного рівня техніки відбувається на змагальному рівні плавання. Змагальну підготовку дітей забезпечують школи та спортивні підрозділи, а також спортивні школи та підрозділи. Програма навчання спортивного плавання починається з основ плавання в першому класі початкової школи. Після першого етапу підготовки (направленого базового) діти повинні в основному плавати всіма чотирма стилями на початковому рівні техніки: на спині, кролем, брасом і дельфіном. Наступний етап – комплексний період у 9-12 років, під час якого учні 3-5 класів вдосконалюють техніку окремих стилів, відбувається комплексна підготовка до плавання, підвищується працездатність організму. У VI-VIII класах плавці підготовлені до навчання на найвищому рівні за рахунок найбільш зручного розвивального моменту для тренувальних адаптацій та індивідуалізації техніки плавання. Початкова школа закінчується цілеспрямованим етапом спортивної підготовки, а в середній школі починається спеціалізований етап підготовки до спортивної першості. Найталановитіші спортсмени продовжують спортивну кар'єру в старшому віці, якщо вони заздалегідь грамотно підготовлені, і в цей період досягають найкращих результатів і успішно виступають на змаганнях.

Ключові слова: тест з плавання, контроль підготовки плавання, техніка плавання, плавання із зав'язаними очима.

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THE USE OF ARTIFICIAL INTELLIGENCE IN TATTOO DESIGN: A TWO-MACHINE CONFIGURATION FOR UNPRECEDENTED BLACK AND GREY REALISM

This research explores the integration of artificial intelligence (AI) in tattoo artistry, emphasizing its application in black and grey realism through a dual-machine setup. It examines how combining AI-generated sketches with traditional artistic techniques can enhance creativity and efficiency. Additionally, the study evaluates the use of two specialized tattoo machines – one for light tones and gradients, the other for dark shades and contrasts – to achieve exceptional artistic and technical results.

The study employs a multi-faceted approach, starting with AI tools such as MidJourney to generate initial sketches. These sketches are refined using digital platforms like Procreate to ensure anatomical accuracy, followed by freehand drawing to add depth and a personalized touch. During the tattoo process, a dual-machine configuration is utilized: one machine is calibrated for soft tones and smooth shading, while the other focuses on dark tones and bold contrasts, ensuring an efficient and seamless workflow.

Findings reveal significant advancements in tattoo design and execution. AI accelerates the creative phase, enabling artists to conceptualize complex designs with speed and precision. These designs are tailored to complement the human form, resulting in tattoos that are cohesive and highly detailed. The dual-machine setup facilitates smoother tonal transitions, enhances realism, and improves efficiency while reducing skin trauma for faster healing. Together, AI tools and dual-machine techniques elevate artistic standards, allowing the creation of lifelike tattoos with sculptural depth

The study introduces a pioneering hybrid system that merges AI-driven design processes with dual-machine tattooing methods. It seamlessly incorporates AI into tattoo workflows while showcasing a unique application technique, establishing new standards for precision and innovation in tattoo artistry.

The integration of AI technology and dual-machine techniques offers significant advantages for tattoo studios. These innovations optimize workflows, minimize skin trauma, and enhance the overall quality of tattoos. By implementing this framework, studios can boost both creative development and operational efficiency, achieving superior outcomes for artists and clients alike.

Keywords: Tattooing, black & grey realism, dual-machine set-up, shading method, tattoo art of the modern age.

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1. FORMULATION OF THE PROBLEM IN GENERAL TERMS AND ITS CONNECTION WITH IMPORTANT SCIENTIFIC OR PRACTICAL TASKS

In modern society, tattooing has emerged as a distinctive and multifaceted form of self-expression, blending artistic creativity with deeply rooted cultural traditions that have shaped human history. As a subject of scientific research, tattoo styles are analyzed through a wide range of perspectives, including their historical development, cultural significance, psychological impact, and artistic foundations. Scholars and researchers in this field aim to explore various aspects of tattooing to classify and understand the defining characteristics of contemporary tattoo styles, illuminating their complexity and evolution over time [8].

Consequently, the need to reduce the time spent on creating tattoo sketches drives artists to embrace modern innovative technologies that enhance the creative process. One such tool is neural networks – programs capable of analytically processing analog designs, identifying their features, and generating unique visual content based on them. These networks consist of numerous interconnected neurons that operate similarly to the human brain.

The application of artificial intelligence in design, particularly in the creation of tattoo sketches, represents a promising direction that is being intensively researched and developed. Recent studies highlight that technologies based on artificial intelligence significantly transform the creative process, offering innovative tools for generating visual content and optimizing designers' workflows.

2. ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

In modern society, the integration of artificial intelligence is becoming increasingly significant, drawing the attention of specialists from various fields. The application of artificial intelligence spans a wide array of tasks: from everyday activities to advanced technological developments. This study, however, focuses on a specific aspect – the use of artificial intelligence

in the creation of tattoo designs. This innovative approach not only expands possibilities for artists and admirers of unique art in tattooing but also encourages a reevaluation of the interplay between technology and art.

According to O. Kolisnyk, R. Mykhailova, O. Berehovyi, V. Vlasiuk, and D. Kurovska, neural networks like Midjourney exhibit high efficiency in generating multiple variations of graphic images, significantly streamlining the process of obtaining diverse conceptual ideas for further project development. This enables designers to save time during the initial stages of creativity and concentrate on tailoring sketches to clients' individual preferences. Researchers highlight that the use of neural networks enhances the quality and diversity of visual products [5].

In the study by T. Bozhko and V. Arefyev, the prospects of using neural networks in the creation of visual content for various products related to graphic design are examined. The authors conduct a detailed analysis of the effectiveness of platforms such as Maze Guru, MidJourney, and Leonardo AI in the context of character concept generation, location visualization, logo design, and the development of branding elements. However, attention is also given to the limitations of these technologies, particularly in areas such as font work, engineering graphics, layout design, and infographic materials. According to the authors, the inherent advantages of neural networks include high speed in creating graphic content and the ability to integrate various software solutions. At the same time, the disadvantages include the monolingual nature of the algorithms and the tendency for uniformity in results with similar queries. The results of the study demonstrate that neural networks can significantly optimize the process of developing graphic content by offering innovative solutions to design challenges, especially in fields such as computer game development, printed material creation, and brand identity formation. However, the authors emphasize the importance of further technical advancements in neural networks to solve more complex design problems, outlining prospects for deeper research in this area [2].

The replacement of human activity with artificial intelligence in the field of art is becoming increasingly common. In 2005, the first artificial intelligence capable of drawing human portraits was created, enabled by facial recognition and image reconstruction technologies. Drawings produced in this manner resembled human-created works so closely that their handmade origin was beyond doubt. However, this fact remained unnoticed by art professionals until 2018. It was then that the French team «Obvious» used a generative adversarial network («GAN») to create a portrait of Edmond de Belamy, an imaginary French aristocrat, which was sold at auction for $432,500. This event came as a surprise to the art and marketing industry, as prior to this, similar generated works had not achieved such significant prices. This event not only sparked discussions regarding the valuation of art created by artificial intelligence but also raised questions about the risks of displacing human creative labor and the potential devaluation of personal contributions in art [4; 5].

The ethical implications of AI usage in graphic design development were also explored. Specifically, Melanie Stockton-Brown's work, «Inking Cultures: Authorship, AI-Generated Art and Copyright Law in Tattooing», examines the interplay between artificial intelligence (AI), authorship issues, and legal regulation in the tattooing industry, particularly in the context of AI-driven artistic design creation. The author provides a thorough analysis of the cultural, legal, and creative dimensions of tattooing, focusing on the challenges of defining authorship in algorithmically generated artistic works. The article introduces the concept of a new model of collective authorship, which acknowledges the tattoo artist's role as a creative agent, alongside the cultural and personal contexts of clients [8].

The researcher conducts a pilot empirical study based on an analysis of user comments on the YouTube platform to explore the professional tattooing community's perspectives on the impact of AI-generated designs on their practice. The article's primary conclusion is that AI cannot be regarded as a traditional «author» of tattoos due to the multifaceted nature of the creation process, which blends human artistry, cultural heritage, and clients' personal narratives. This study addresses gaps in the academic literature regarding the effects of artificial intelligence technologies on the tattooing field, while proposing a culturally sensitive approach to tackling the legal and creative challenges in this profession [8].

3. IDENTIFICATION OF PREVIOUSLY UNRESOLVED PARTS OF THE GENERAL PROBLEM TO WHICH THE ARTICLE IS DEVOTED

The art of tattooing is currently undergoing profound changes, seamlessly intertwining centuries-old traditions with innovative technological approaches that are rapidly finding their place in this creative process. One of the most impressive and promising trends today is the integration of artificial intelligence (AI) in the development of tattoo designs. Thanks to the capabilities of artificial intelligence, the creation of complex sketches is significantly simplified, allowing artists to draw inspiration from a wide range of ideas and stylizations. However, even the boldest AI-generated concepts require subtle adaptation to the individual anatomical features of the human body, which becomes an essential part of the artistic process.

At the same time, traditional tattooing techniques have their limitations in reproducing smooth color gradients and high levels of detail, which often become challenges for artists. In response to these modern demands, a dual-machine tattooing technique was developed – an innovative method aimed at achieving stunning realism with precision down to the smallest details. This approach opens up new possibilities for the black & grey realism style, ensuring impeccable tonal transitions and exceptionally natural rendering of forms.

The primary goal of this study is an in-depth analysis of the impact of artificial intelligence on the process of tattoo design formation and the evaluation of the effectiveness of the dual-machine technique for precisely and elegantly executing realism stylistics. The integration of these modern tools has the potential to radically change perceptions of the art of tattooing while simultaneously expanding the creative possibilities of artists.

4. FORMULATION OF ARTICLE OBJECTIVES

The article aims to analyze the impact of artificial intelligence (AI) on the tattoo design creation process, specifically the use of neural networks and platforms like MidJourney to accelerate creative processes and generate innovative ideas. The study focuses on evaluating the effectiveness of the dual machine technique in ensuring smooth tonal transitions and the realism of tattoos, as well as examining ethical and legal aspects of authorship and intellectual property rights in the context of AI-generated designs. Additionally, the article explores the integration of traditional tattooing methods with modern technological approaches, identifying development prospects for tattoo art and its influence on the black & grey realism style.

5. PRESENTATION OF THE MAIN STUDY MATERIAL WITH FULL JUSTIFICATION OF THE OBTAINED SCIENTIFIC RESULTS

The art of tattooing is rapidly evolving, blending centuries of traditional expertise with a surge of recent technological innovations. One of the most notable trends in recent years has been the use of artificial intelligence (AI) in the initial design phase.

It has revolutionized the workflow entirely: preliminary sketches can now be created in seconds, a task that previously required hours of human effort. While AI has transformed the way designs are conceived, the actual artistic process of tattooing remains rooted in transferring these concepts onto skin. Meanwhile, visionary tattoo artists are pushing boundaries not only in design but also in the very techniques used to create tattoos. Clear evidence of this evolution can be seen in the authorial twin-machine setup – a two-tattoo machine system employed in one session: one configured for lighter colors and softer shading, the other for darker colors and heavy contrast. This system delivers smoother gradients, reduced session times, and depth that redefines excellence in black & grey realism. Artificial intelligence is swiftly becoming an indispensable creative tool across all artistic fields, and tattooing is no exception [1; 3]. Platforms like MidJourney enable tattoo artists to generate dozens of potential sketches in mere minutes.

One prompt can produce a range of visually engaging compositions, sparking ideas that would have taken hours to create by hand. The speed and agility of AI open up an entirely new universe of creativity: from detailed mythological environments to abstract forms and sculptural motifs that might otherwise never be imagined. However, sketches produced by AI are rarely «tattoo-ready» [6]. They are not anatomically correct, often requiring adjustments to the curves and planes of the body, and need refinement before they can serve as the foundation for a high-quality, long-lasting tattoo. This is where the

artist's interpretative work begins: redrawing, restructuring, and reshaping the image to fit an arm, back, or chest, while achieving balance. One of our hallmarks is a patented, multi-step process for creating sketches using both technology and traditional skills. In the first phase, we use MidJourney to generate numerous iterations of the concept, exploring a variety of potential compositions, styles, and moods for the future tattoo [3]. In the second phase, we transfer those images into Procreate, meticulously refining the details: adjusting proportions, perfecting lines, and designing the piece to naturally complement the body.

MidJourney has become one of the leading AI-based generative art platforms, widely utilized for creating tattoo sketches. According to scientific sources and analytical reviews, the platform facilitates the creation of highly detailed, stylish, and innovative visual images based on textual prompts. This opens up vast opportunities for self-expression and personalized approaches in the art of tattooing. However, experts emphasize that while MidJourney is a powerful tool, the final design requires professional refinement and adaptation to the anatomical specifics of each individual, carried out by the tattoo artist.

Scientific research highlights that integrating artificial intelligence technologies with traditional tattoo techniques not only accelerates the sketch creation process but also fosters the emergence of new stylistic approaches. This effectively blurs the line between digital and manual art. Thus, MidJourney becomes an innovative tool that transforms the creative process and opens up new perspectives in the development of the tattoo industry.

The role of using the Procreate application in enhancing communication between the tattoo artist and the client is particularly notable. Thanks to the ability to pre-create visualizations of the future tattoo directly on a photo of the client's actual body part, it becomes possible to make more informed decisions regarding composition and style. This technological solution not only accelerates and optimizes the creative process but also significantly increases the level of individualization and creativity in modern tattoo art.

Procreate represents one of the leading digital tools for sketching tattoos, popular among contemporary artists due to its multifunctionality. Specifically, the application provides extensive access to working with layers, various types of brushes, high-level detailing, and allows testing the placement of designs directly on the client's body. Analysis of scientific literature and specialized reviews reveals that platforms like Procreate significantly transform the traditional approach to tattoo design. They enable artists to experiment with shapes, proportions, color characteristics, and placement of future designs before the artwork is applied to the skin.

Moreover, with Procreate, it is simple to modify developed sketches, integrate images generated by artificial intelligence, adapt them to the anatomical features of each client, and create unique, original works. This combination of automation and the individual artistry of the artist ensures a new level of quality and creative self-expression in the field of tattoo art.

The final process involves freehand drawing directly by hand, with signature flair, understated strokes, and layered depth. This process of layering – from AI concept development to digital redrawing and finally freehand completion – ensures every tattoo is truly one-of-a-kind, with a degree of detail and expression unattainable through a single method alone. This fusion of AI-driven creativity and the interpretive skill of the tattoo artist has produced a hybrid process where technology inspires and accelerates design [1; 3], yet the artist remains the ultimate author of the artwork. While the design has evolved, a similar transformation has occurred in the application stage of tattooing. For decades, most tattoo artists used one machine per session, constantly reconfiguring the same machine for multiple uses: lighter shading, darker filling, fine lines, and so on [6]. This constant reconfiguration, while functional, had clear limitations.

Chopping voltage, needle group switching, or pausing to rezero often disrupted rhythm, slowed progress, and could lead to uneven shading. The author's double-machine setup addresses all these issues directly. Instead of relying on one machine to handle everything, the artist uses two, each performing a distinct role. The first machine is precisely calibrated to render light tones, delicate transitions, and smooth gradations. It creates the delicate highlights and glints that bring a face to life, as well as the appearance of light on stone or skin. The second machine is set for dark tones and deep contrast, producing shadowy depth, sculptural weight, and richness that anchors the composition.