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Use of Artificial Intelligence Technologies in Visual Design

Yapay Zekâ Teknolojilerinin Görsel Tasarım Alanında Kullanımı

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Abstract

Artificial intelligence (AI) refers to computer systems crafted to replicate human cognitive functions such as learning, perception, and problem-solving. Recently, AI technologies have gained widespread popularity across various domains, including healthcare and finance. They have also significantly impacted visual design. This study investigates AI technologies' burgeoning influence and utilization in visual design, delving into their effects and applications. It scrutinizes how AI innovations transform visual design processes, influence creativity, and shape design practices. The research emphasizes the emergence of AI-powered design tools, their impact on designer creativity, and their potential advantages and drawbacks to creative processes. It also examines the ethical and practical challenges of integrating AI into design practices. By thoroughly assessing AI's impact on visual design, the study aims to prognosticate future technological advancements.

Keywords: *Artificial Intelligence, Visual Design, Digital Design*

Öz

Yapay zekâ (AI) makinelerin öğrenme, algılama ve problem çözme gibi insan zekâsını taklit edebilmesi için tasarlanmış bilgisayar sistemleridir. Son yıllarda yapay zekâ teknolojileri, sağlıktan finansa birçok alanda hızla popülerleşmiştir. Görsel tasarım alanında da yapay zekâ önemli bir yere sahip olmuştur. Bu çerçevede çalışma hızla gelişen yapay zekâ (AI) teknolojilerinin görsel tasarım alanındaki etkilerini, kullanımını ve yapay zekâ (AI) teknolojilerinin görsel tasarım alanındaki uygulamalarını incelemektedir. AI teknolojilerinin görsel tasarım süreçlerine getirdiği yenilikler, yaratıcılık süreçlerinde AI'nin etkisi ve tasarım pratiğindeki rolü ele alınmaktadır. Çalışmada AI destekli tasarım araçlarının gelişimi, bu araçların tasarımcıların yaratıcılığını nasıl etkilediği, AI'nin yaratıcılık üzerindeki potansiyel fayda ve risklerini, tasarım pratiğindeki etik ve pratik boyutları üzerinde durulmaktadır. AI'nin görsel tasarım alanına getirdiği değişimleri kapsamlı bir şekilde analiz ederken, aynı zamanda bu teknolojilerin gelecekteki gelişimine dair öngörülerde bulunmayı hedeflemektedir.

Anahtar Kelimeler: *Yapay Zekâ, Görsel Tasarım, Dijital Tasarım*

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Introduction

Artificial Intelligence (AI) is a branch of computer science that enables computers or computer-controlled robots to mimic human intelligence functions. These functions include learning (acquiring knowledge and processing it using rules), reasoning (using rules to reach specific conclusions), perception (recognizing elements in sounds, visuals, or other data formats), and communication using language. According to Aksu (2018: 298), studies on artificial intelligence often focus on examining human thought processes to develop similar artificial algorithms, and these studies typically concentrate on software. According to Pirim (2006: 84), the fundamental aim of artificial intelligence is to mimic the workings of human intelligence using computers.

Artificial intelligence applications have found their place in many areas of our lives. From medicine to finance, from the automotive industry to customer services, AI technologies have widely used. Autonomous driving systems in cars, smart assistants (such as Siri, Alexa), recommendation systems, personal health monitoring devices, and automated investment advisory services are some examples of artificial intelligence encountered in everyday life. It is also effectively used in many areas such as weather forecasting, natural language processing, and biometric systems.

Artificial intelligence can analyze complex data. However, this ability is dependent on being trained with large data sets. The increase in data with digitization is a fundamental factor for machine learning. Thus, artificial intelligence uses its ability to accurately learn and interpret data to achieve specific goals and perform tasks (Nilsson, 2010: 603).

AI systems generally work by learning from large data sets and creating models on these data. This process usually involves machine learning and deep learning techniques. Machine learning is the process of developing algorithms to learn from data and make decisions with what is learned. Deep learning, a sub-branch of machine learning, utilizes artificial neural networks that mimic the functionality of the human brain to process data. AI is nourished by large data sets, which are collected, cleaned, and finally processed to enable the system to make accurate predictions and decisions. Using collected data, models are trained on these data sets to perform specific tasks. For example, an image recognition system is trained with thousands or millions of images to recognize various objects. Once the model is trained, its performance is evaluated through testing, assessing parameters such as accuracy, speed, and efficiency. When the model is sufficiently successful, it is then deployed for real-world applications.

According to Ayvaz Tunç and Yavuz (2023: 123), AI technologies particularly enhance the aesthetic elements and visual innovations, thus increasing creative opportunities for artists and designers and facilitating the creation of original works.

AI's data processing and automatic learning capabilities are making groundbreaking changes in visual design. Traditional design processes are typically time-consuming and require subjective decisions. However, AI accelerates these processes, helping designers to solve complex visual problems. For instance, AI-powered tools can automatically adjust a design's color palette to suit users' aesthetic preferences. They can also produce dynamic content based on user interactions.

Inspiration and creativity are the cornerstones of visual design, and AI is elevating these elements to a new dimension. Meanwhile, data-driven recommendations and analyses from algorithms offer designers new perspectives on creating original works. Additionally, AI learns from art history and cultural texts, enabling designers to draw inspiration from

the past and blend this information with modern design aesthetics to produce innovative designs. Designers save time using AI tools, enhancing their creativity and solving complex visual problems more effectively. For example, AI-powered programs are capable of analyzing complex data to offer personalized design suggestions or inspire innovative design styles from large data sets.

However, the use of AI in visual design also has some disadvantages. The opportunities presented by AI also along certain challenges and ethical issues. The reduction in originality, designers taking a passive role in creative processes, and data security are factors that complicate the effective use of AI in the design sector. Balancing the artistic aspect of design done by human hands with the development of AI technologies is a significant question. Moreover, issues of originality and copyright of content produced by AI continue to be ongoing discussions in the sector. Despite these issues, the opportunities provided by AI technologies continue to open new doors in the design world. Thus, AI is recognized as an important tool in transforming design processes and enhancing efficiency in the sector.

Artificial intelligence is a continually developing and expanding field. As technology progresses, the applications and capabilities of artificial intelligence are also expanding, thus offering more effective solutions in both the business world and daily life. Today, technology has penetrated every aspect of our lives, and creative processes related to creativity are also sharing in this transformation. Visual design, in particular, stands out as one of the most affected creative fields by technology. Artificial intelligence is one of the most revolutionary forces in this area, transforming designers' workflows and offering them new possibilities previously unimaginable.

In the realm of visual design, AI brings both significant advantages and certain challenges. On the positive side, AI tools can automate repetitive tasks, enhance efficiency, and provide designers with advanced creative insights through data-driven analysis. These tools are capable of generating personalized design suggestions, analyzing user preferences, and even creating entirely new designs based on complex algorithms, all of which expand the designer’s creative toolkit. However, there are also notable disadvantages. AI's ability to replicate patterns and existing designs may limit originality, as it relies on previously collected data rather than generating novel ideas. Furthermore, excessive reliance on AI tools can diminish the creative autonomy of designers, potentially leading to homogenized outputs and a reduction in manual design skills. Ethical concerns, such as the ownership of AI-generated content and data privacy, also pose significant challenges for the integration of AI in visual design.

This study examines the innovations and challenges brought by AI technologies in the field of visual design, as well as how these technologies are incorporated into design processes and how they expand designers' creative expressions. The impact of artificial intelligence on the field of visual design, including creativity and ethics, has been addressed in this research, and innovative AI design tools have been reviewed. The tools and capabilities offered by artificial intelligence to designers have been discussed in detail, exploring the contributions of this new era to the design world and its potential limits.

The primary objective of this study is to comprehensively explain the impacts of artificial intelligence on the field of visual design. The integration of AI into design processes, its effect on creativity, and the challenges and opportunities faced by designers have been thoroughly examined. In this regard, the research questions are formulated as follows:

What is the impact of AI technologies on visual design processes and products? How do these technologies affect the creativity and efficiency of designers? What dimensions of this change are represented by AI-supported design tools, industrial applications, and ethical issues? The foundation of this study is an extensive literature review. Academic articles, conference proceedings, industry reports, surveys, and expert opinions have been meticulously examined to understand the effects and applications of artificial intelligence in visual design.

During the research, academic databases such as Google Scholar were utilized to retrieve articles related to artificial intelligence and visual design. Reports from significant conferences in the fields of design and technology have been used as crucial resources reflecting current developments. The literature review has prioritized studies that focus on the intersection of artificial intelligence and visual design, incorporating innovative applications and theoretical approaches. Furthermore, recent publications reflecting current industry developments have been particularly valued. In this analysis, main themes such as the impacts, applications, ethical, and technological challenges of artificial intelligence on visual design were identified, and the literature was examined in depth under these themes.

1. Intersection of Artificial Intelligence and Visual Design

The advancement of technology and the proliferation of personal computers in the mid-20th century have increased the impact of information and communication technologies on experimental design studies. This change has required designers to master digital technologies and adapt to new applications. Innovations arising from the creative aspects of visual design as well as technical and scientific interactions have enhanced technical inquiries in the design process and supported scientific and technological developments. Digital systems and applications have created simulations that envelop individuals. In the 21st century, people have been introduced to concepts like artificial intelligence and cyberspace, achieving a reality perception distinctly different from previous eras. Today, the distinction between reality and image in the simulation world people inhabit is disappearing, replaced by systems constructed through codes and algorithms. These systems replace rational reality, resulting in digital visualizations that manage and control visual perception, aligning with Jean Baudrillard's concept of hyperreality discussed in his simulation theory (Baudrillard, 2011: 44).

According to Mazzone and Elgammal (2019: 26), artificial intelligence consists of various algorithms designed to perform activities similar to human intelligence, such as decision-making, image recognition, language translation, and creativity. Technological advancements have increased with the widespread adoption of next-generation information and communication technologies. The experience gained by a robot through deep learning being stored in its memory ensures that production is unique and irreplicable.

When existing algorithms are insufficient to optimize the system, the subjective decision-making process can be improved by incorporating a set of variation algorithms that increase the adaptability and performance of the system (Soddu, 2018: 72). Significant advancements have been made particularly in the field of artificial intelligence. These technologies provide considerable convenience to humanity, from applications on our smartphones to smart robots used at home or work. Additionally, artificial intelligence is

employed in numerous areas including facial recognition technologies, tumor detection, driverless vehicles, and industrial robots. According to Canan and Acungil (2018: 57), at the core of artificial intelligence lies the imitation of the human brain's functioning mechanisms. McCarthy (2007: 2), considered the creator of the concept of artificial intelligence, likens AI to humans and defines it as the engineering of making intelligent computer software. This foundational view of AI as a mimicry of human cognitive processes has shaped much of the early development in the field, influencing both theoretical and practical advancements.

During the 1956 Dartmouth Workshop, 12 participants conducted studies on machines' abilities to use language, abstract, conceptualize, solve problems unique to humans, and learn independently (Tegmark, 2019: 62). The research conducted at this workshop laid the groundwork for AI as a multidisciplinary field, emphasizing the replication of uniquely human abilities within computational systems. Artificial intelligence is a technology capable of processing algorithms and producing various visual results. This field offers a multidisciplinary work environment by bringing together knowledge and techniques from different disciplines such as mathematics, computer science, art, design, and psychology (Rezk, 2023: 2). After 2010, robot technology and artificial intelligence entered a rapid development phase. In parallel, in 2011, Apple introduced Siri, a software developed as a personal assistant, for smartphones (Eberl, 2019: 39).

In recent years, artificial intelligence has become a significant focus of interest in both academic and professional fields. While examining how AI-supported design tools can be integrated into creative software, Smith and colleagues' (2020) studies on the development and use of AI-supported design tools also discuss how AI-supported tools have created a significant transformation in user technology (UX) design. Particularly, AI's capability to analyze user data and apply this information to design processes has initiated a new era in UX design. Different perspectives exist on this topic. For instance, according to Swanson (2019), as AI design applications become more widespread and accessible, the perceived value of the graphic design field and graphic designers might decrease in society's eyes. On the other hand, Jacob (2019) suggests that professional designers could simplify their design processes using AI design tools, thereby achieving broader creative processes and reaching higher goals with the aid of these tools.

Artificial intelligence is increasingly making its presence felt in various fields, including control systems, medical diagnostic systems, language translation systems, music association applications, driverless vehicle design, automatic financial analysis, individual education applications, and marketing analytics. There are numerous examples of the use of artificial intelligence in business, healthcare, law, education and military fields. To date, many applications have been developed using various artificial intelligence algorithms. One notable example is IBM's Deep Blue, a program that defeated the world chess champion Gary Kasparov on May 11, 1997 (McCorduck, 2004: 481).

The use of artificial intelligence in the design world is rapidly increasing. In fields such as graphic design and visual communication design, artificial intelligence supports many design applications. The technology of artificial intelligence also opens new doors in the art field, offering new opportunities for artistic expression. The use of artificial intelligence in art creation is not a new idea. For instance, according to Wikipedia (2023), artist Harold Cohen wrote a computer program named AARON in 1973, capable of producing original

and artistic images. AARON's software was developed using the LISP programming language created by John McCarthy.

Thanks to the algorithms written by Cohen, after the program is run, it can make an infinite number of different drawings without Cohen's intervention. Initially, AARON only drew black lines, but Cohen added color with his intervention (Malina, 1991: 629). Over time, AARON began to operate independently of Cohen and has produced artworks quite different from Cohen's artistic style (Sağlamtimur Özel, 2010: 219). AARON's independence remained limited to coloring and did not become fully autonomous. However, AARON's works are exhibited in prestigious museums around the world. According to Sawyer (2012: 144), among the systems that display artificial intelligence's creative abilities, AARON stands out as a prominent example. British artist Harold Cohen developed AARON in 1973, and it is considered one of the most successful and impressive software for producing visual art works. Cohen programmed AARON to create drawings through a repetitive design process. AARON is defined as an artificial intelligence system that operate autonomously, interactively, and offline, and in its latest version, it is capable of producing on its own. Designed to produce creative drawings and paintings in the field of visual arts, AARON and another example of AI in creating visual art works is Simon Colton's The Painting Fool. The Painting Fool has a more independent structure than AARON. While it does not physically apply paint to canvas, it simulate various styles in a digital environment. These two software share common features; they coded information, data sets, parameters, and combinations to create original art and design works (Mantaras, 2017: 17). Such AI-driven tools demonstrate the increasing role of automation and machine learning in the creative process, particularly in generating artistic outputs that once relied solely on human intuition and skill.

This integration of AI into creative workflows naturally extends to graphic design, a field that similarly blends technical knowledge with artistic creativity. The graphic design process involves elements such as creativity, knowledge, and aesthetics. Therefore, graphic designers utilize their knowledge and experiences while creating their designs. At this point, the difference between artificial intelligence design tools and graphic designers becomes apparent. For example, in daily, weekly, or monthly publications such as magazines and newspapers, the grid system is used, making fast and accurate data entry crucial. In this context, AI applications offer significant ease in accelerating work in such publications (Karaata, 2018: 197).

Artificial intelligence has introduced many innovations in the field of visual design, accelerating and transforming the work in this field. The use of artificial intelligence in this field has brought both positive and negative aspects. In this context, a word cloud has been created concerning the advantages and disadvantages of artificial intelligence technologies.

Looking at the positive aspects, AI tools automate routine and repetitive tasks for designers, enhancing efficiency and speeding up work processes, analyze user data to offer personalized design suggestions, and through innovative design tools, help make better decisions on visual design elements like colors, typography, and compositions, and offer creative alternatives. It is known that artificial intelligence tools have many positive and negative contributions to the field of visual design. In this sense, within the framework of the research literature review, the positive and negative effects of artificial intelligence on visual design have been revealed and are shown by creating a word cloud in Figure 1 and Figure 2. Accordingly, while the advantages of artificial intelligence tools

in the field of visual design include creativity, practicality, new ideas and inspiration, workload reduction, saving time and experiential designs, their disadvantages include limiting creativity, the problem of orjinality, extreme addiction, access and cost, copyright and ethical issues,and originality problems.

Figure 1. Word cloud related to the advantages of using artificial intelligence in visual design (Wordart / Access Date: 06.04.2024).

Moreover, by enabling individuals with less technical skill to produce professional-level designs, AI contributes to making design more democratic in terms of accessibility. One of the contributions of artificial intelligence to visual design is its ability to analyze large data sets and provide in-depth information about user preferences and behaviors. With this information, designers can create more personal and effective designs tailored to the target audience. They can simulate how designs will perform and foresee their impact on user experience. This is particularly critical in improving user experience in web and mobile application designs.

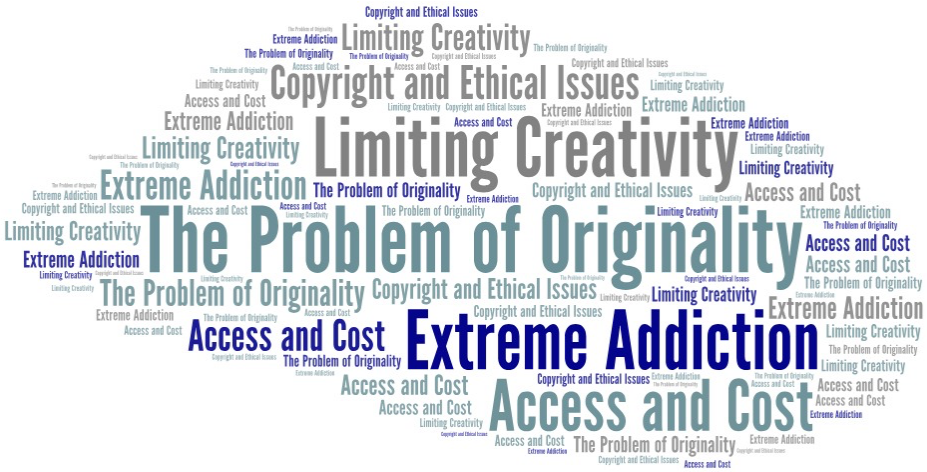

Figure 2. Word Cloud related to the disadvantages of using artificial intelligence in visual design (Wordart / Access Date: 06.04.2024).

There are still uncertainties regarding the copyright of designs produced by artificial intelligence. Moreover, whether these designs can truly be considered creative or original remains a contentious issue. On the other hand, if designers rely too much on AI tools,

their fundamental design skills and creative thinking abilities may weaken. While AI tools provide convenience, they can create excessive dependence for designers, potentially harming the designer's creative development in the long run. Additionally access to advanced AI design tools can sometimes be costly. Factors such as expensive subscription fees can limit all designers from benefiting from these technologies.

On the other hand, an academic survey found that designs produced by AI in studies guided by designers using AI design applications are not superior to those produced by human designers. At this point, creativity comes into play. AI design tools have not yet reached the creative capabilities of designers and are seen as auxiliary tools. Furthermore, there are still doubts about the capacity of AI design applications to produce aesthetic and creative designs. However, it has been determined that AI tools can save time in the design process. Yet, it is thought that the use of these applications might reduce the abilities of the designers using them (Gürdal Pamuklu and Bakar Fındıkçı, 2023: 189). Since artificial intelligence is usually trained on existing data sets, the designs it produces can sometimes be repetitions of existing examples rather than being genuinely creative. This situation can limit creativity and obstruct the emergence of truly innovative and original designs.

Another criticized and negatively perceived aspect of AI tools is their limitations on creativity. The copyright issues of content produced by AI still involve unclear processes, raising ethical concerns. High-quality AI tools are often expensive, which can make it difficult for small businesses or individual designers to benefit from these technologies. Another downside is that designers might become dependent on these tools, losing their fundamental design principles and manual skills. Designers embracing these technologies need to balance the opportunities and risks these tools offer. Additionally, there are concerns about role changes in terms of job potential. This could lead to significant changes in the roles and skills of workers in the design sector.

The artist has embarked on exploring avenues rather than just creating art with traditional methods and human-specific concepts such as consciousness, emotion, and intuition. Artificial intelligences that paint, design, compose music, or write poetry are creating works that have never existed before, thanks to deep learning and statistically-based structures. Instead of focusing on art with traditional human feelings and deep life experiences, artists are now enriching their creative processes with different methods (Edmonds, 2018: 5).

In a general framework, the view that artificial intelligence has the potential to revolutionize the visual design world is predominant. However, as a contrary view, it is thought that while AI can support design processes, it will not completely replace creativity and the human touch. In this context, the importance of human touch and creativity should not be forgotten. Artificial intelligence is a very important aid that enriches design processes. However, the soul of artistic expression and design will still be determined by humans. Therefore, the contribution of AI to creativity in the field of visual design should be evaluated with both its positive and negative aspects. In this framework, while designers use AI tools, they should be cautious of the potential disadvantages while maximizing the advantages of these technologies. In this context, AI should be seen as a supportive and enriching tool for design processes but should not dominate the designer's creative freedom and individual skills.

2. Artificial Intelligence Supported Visual Design Tools

When discussing visual design, the exploration of graphics and their communication methods comes to the forefront, encompassing a process that extends from print to digital design tools. During this process, the use of computers and elements such as the structure and meaning of visual design are seen as cultural outputs of the act of creativity. Various strategies should be developed in visual design to enhance creativity and develop solutions for problem-solving. Each designer has their own unique methods in this regard. However, today, artificial intelligence applications are performing many design activities repeatedly using programmed algorithms and machine learning. In this context, AI applications for design include creative elements and can also operate by leveraging various cultural experiences and accumulations initially without any design process (Karabulut, 2021: 1530).

Today, there are numerous design software programs that operate with artificial intelligence and machine learning techniques. In the field of visual design, whether it be image processing, page layout, web design, or creating vector designs such as logos, there are many programs that benefit from artificial intelligence. Additionally, with the day-to-day advancements in artificial intelligence technologies, AI applications that can independently design through algorithms with aesthetic concerns are emerging (Karabulut, 2021: 1530).

AI visual design tools are tools that enable designers to work more efficiently and creatively and produce visual content using AI technologies. These tools are used in various fields such as visual arts, visual communication design, graphic design, web design, illustration, animation, and many others. Within the scope of the research, the design tools that are prominent in the search engines and popularly preferred in the field of visual design are exemplified. Some popular tools and their features in this area include:

Adobe Sensei: Adobe's AI platform, Adobe Sensei, is integrated into software like Photoshop, Illustrator, Premiere Pro, and other Adobe applications. Sensei provides AI-powered tools capable of image analysis, pattern recognition, and automatic editing. For example, object selection in photos, image restoration, and sound editing can be automatically performed with the help of artificial intelligence (TransMedia, 2024).

Canva: Known for its user-friendly interface, the Canva program offers AI-powered design suggestions. It provides automatic color and font suggestions, layout designs, and image selections based on the text entered by users. Therefore, it is particularly useful for amateur users and situations requiring quick content production (Briefy, 2024).

Dall·e and Dall·e 2: Developed by OpenAI, these tools can create entirely new visuals based on users' descriptions. For example, they can produce visuals compatible with detailed and creative descriptions such as "a group of cats having a picnic on an alien planet," thereby revolutionizing creative visual content production. Dall-e can quickly convert written texts into images. The GPT-3 based Dall-e works by examining text headings that match millions of images. Dall-e, said to have made significant progress in data visualization, is a GPT-3 model with 12 billion parameters trained using a dataset consisting of text and images to create images from text descriptions. It has various capabilities such as creating versions of animals and objects, combining unrelated concepts in logical pictures, generating text, and converting existing images (OpenAI, 2021). It is possible to visualize a sentence written using key words on the OpenAI

website. In the more advanced version, An example found in Visual is a re-illustrated version of Leonardo da Vinci's famous work, the Mona Lisa. Here, a detailed description of the desired visual from AI programs is very important. In another example, an illustration created by AI from the words "happy family, seaside, car" is shown. The Mona Lisa painting was chosen as a random sample to create a visual design example because it is a world-famous example and was preferred by the researcher. An example is given in (Figure 3).

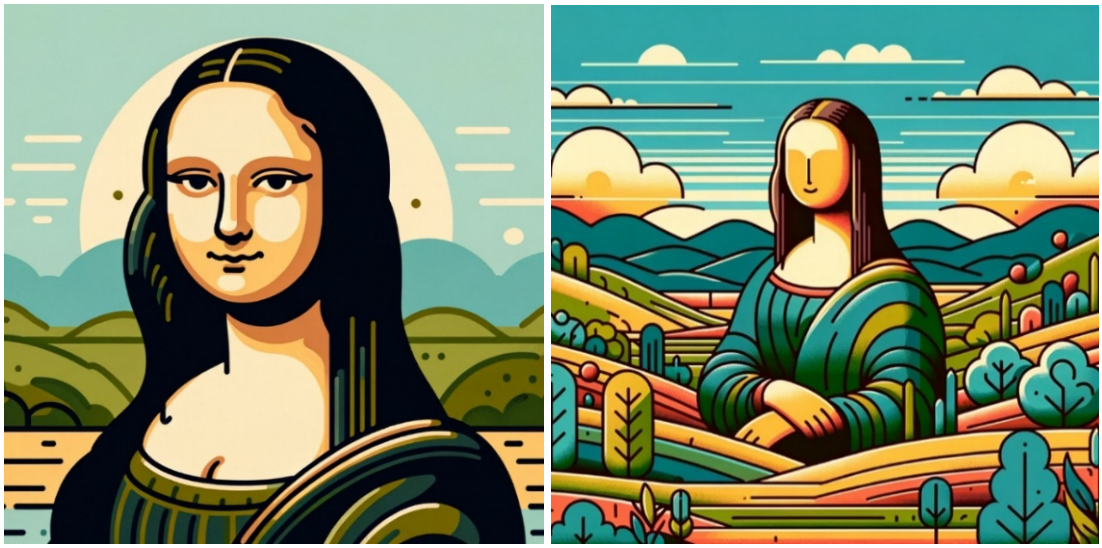

Figure 3. Illustrations of Mona Lisa in various styles (OpenAI / Access Date: 12.05.2024).

Similarly, in Figure 4, an example is seen in which the words happy family, car, seaside are entered in order to create an illustration in a different example structured with a theme and a few words.

Figure 4. An Illustration depicting a happy family by the seaside with a car (OpenAI / Access Date: 12.06.2024).

Deep Dream Generator: This tool is a tool that allows you to create realistic images. Deep Dream, an artificial intelligence visual creation application with an algorithm trained with millions of images, offers its users an easy use. Unlike other applications, it asks you to upload an image at the beginning (GarantiBbva, 2024).

GetIMG: Offering over 20 AI models, GetIMG stands out from most image generators. GetIMG, an AI image creator, allows you to create missing parts of any photo or create stunning large works of art on an infinitely sized canvas with its advanced editor. There are literally no limits. It is possible to easily change small details in any image or change the entire features of the image (GarantiBbva, 2024).

RunwayML: A platform designed for video editing, real-time image processing, and machine learning projects. Users can train their own machine learning models or edit their videos and animations using existing models. This tool is quite popular among artists, designers, and developers (RunwayML, 2024).

Leonardo: Another artificial intelligence program used in animation production, Leonardo AI, can convert text to visuals, modify existing visuals, expand a specific visual, and perform concept and character design (Leonardo AI, 2024).

Midjourney: MidJourney AI is an artificial intelligence program that creates visuals from text. Like other systems, MidJourney AI takes commands in the form of words and word lists to produce images (McLen, 2024). Visuals include packaging designs created by Midjourney featuring visual illustrations.

Figure 5. Packaging designs featuring visual illustrations generated by midjourney (Midjourney / Access Date: 06.05.2024).

Artbreeder: Utilizes genetic algorithms and artificial intelligence techniques to allow users to combine existing visuals to create new images. It is particularly used in character design and digital art works. With this AI tool, users can mix various visual features to create unique faces, landscapes, and even artworks (Futurepedia, 2024).

According to Karabulut (2021: 1532), while AI applications in the field of graphic design do not completely replace designers, they are thought to offer various solutions and save time. Additionally, artificial intelligence is expected to shorten working hours by supporting designers, thereby allowing them more time to devote to creative processes.

When examining the current state of artificial intelligence, it is evident that it produces innovative and valuable visual products for humanity. Boden's definition of historical creativity might be applicable to AI today because in the past, AI had not advanced as far in data visualization nor achieved results as closely resembling the illustrations produced by designers as it does today. Currently, it is achieving quite successful results in the field of data visualization.

When viewed positively, AI visual design tools bridge creativity and efficiency, offering designers and artists opportunities to create works in ways that were not previously possible. The technologies that continue to develop each day appear likely to further expand the boundaries of visual arts and design in the future.

3. Artificial Intelligence: Creativity and Education

According to Nilsson (2010), artificial intelligence focuses on the study of intelligent behaviors. Its primary aim is to develop a theory capable of artificially replicating the intelligent behaviors of natural entities (Charniak and McDermot, 1985). Kok et al. (2002) describe artificial intelligence as systems that think and act logically. Generally, artificial intelligence is explained as the assembly of human-specific cognitive abilities in a non-biological structure. The impact of artificial intelligence on creativity is widely discussed in the literature. An early technical definition states that expert systems are computer programs offering solutions to complex problems that could be solved by an expert's knowledge and experience (Benfer et al., 1991: 3).

The ability to create involves the capacity to produce new and original ideas, products, or combinations to achieve a purpose (Samurcay, 1983: 6). Becer (2015: 47) defines creativity as the ability to think of what no one else has thought of. Gartenhaus (2000: 15) describes creativity as the ability to generate ideas and possibilities that go beyond habits and beliefs, leading to personal discovery, change, and deep understanding. Artificial intelligence systems trained with extensive datasets and developed analytical capabilities exhibit human-like thinking methods in their outputs. This situation has led to a redefinition of the concept of creativity (Ayvaz Tunç and Yavuz, 2023: 125). Inspired by Claude Shannon's information theory, it has been suggested that visuals produced by artificial intelligence might lead to a perception of uncertainty in modern societies. However, it is also emphasized that these visuals need to carry aesthetic elements, and creative abilities can be enhanced with artificial intelligence (Fiske, 2003: 30). While some studies suggest that AI can expand human creativity and offer new forms of creative expression (Ahmed and James, 2021), other studies warn that AI might limit creativity and mechanize design processes (Fischer and Chen, 2020). Creativity is known as a human-specific trait. However, today, it is observed that artificial intelligence can also produce creative solutions. Margaret Boden (2004: 1) in her work "The Creative Mind:

Myths and Mechanisms," states that creativity is a miracle of the human mind, defining creative ability as the capacity to produce new, surprising, and valuable ideas or works. In this context, it is noted that artificial intelligence has the potential to perform creative works independently of human consciousness and experiences.

The use of AI in visual design education is also an important issue. Studies on how students learn AI technologies and how these technologies can be integrated into educational processes highlight the importance of innovative applications in this area (Park and Lee, 2023). It is also emphasized that discussions continue on how AI in design education can affect ethical and creative thinking both positively and negatively (Nguyen and Patel, 2022).

Ramon Lopez de Mantaras, the president of the Spanish Artificial Intelligence Research Institute, states that artificial intelligence and new technologies have changed nature of the creative process. According to de Mantaras, we might consider computers not just as tools aiding human creativity but as independent creative entities. He defined this situation as computational creativity, a new sub-discipline of artificial intelligence. According to de Mantaras, computational creativity involves efforts to develop software that displays behaviors considered creatively acceptable by humans. Such creative software can undertake autonomous creative tasks such as inventing mathematical theories, writing poetry, painting, and composing music. Furthermore, computational creativity helps us understand human creativity and allows us to develop programs in collaboration with creative individuals, moving beyond the mere tool function of software (Mantaras, 2017: 2). While artificial intelligence offers many tools and techniques that support and enrich creativity in the field of visual design, it particularly provides new perspectives for designers experiencing creative blockages. Moreover, by deeply analyzing user data, it guides designers in creating more appropriate and effective designs for their target audiences through personalized design suggestions.

The ethical dimensions of AI hold significant place in the literature on visual design. Studies on how AI applications affect issues like privacy, data security, and creative control indicate that these technologies must be used responsibly (Li and Zhou, 2021). Artificial intelligence can question traditional design rules and produce entirely new, experimental design forms. This carries great potential for innovation in the fields of visual arts and design. In cases to the contrary, particularly when a designer needs to detail a visual very well, it is necessary to clearly and understandably specify the desired visual design to the AI tool in the explanation part, known as prompt engineering in artificial intelligence.

As artificial intelligence are intertwined increasingly with visual arts, visual communication, and graphic design, these areas are merging more and more. Within the field of design, the use of AI tools, especially in illustrations, becomes prominent. In this context, the integration of AI into the creative process has not only transformed traditional approaches but also expanded the boundaries of what is possible in visual representation.

Illustration, as a form of visual expression, is commonly used in works ranging from visual communication design to art. The word "illustration" is derived from the Latin word "lustrare," meaning to illuminate and make clear. This linguistic origin underscores the role of illustration in visually articulating complex ideas, a function that aligns with AI's capability to enhance clarity and precision in design outputs. "Lustrare" itself comes from "lucere," meaning light and brightness. In the field of visual graphic design, an illustration

is defined as a pictorial work done for explanatory, exemplifying, or decorative purposes (Ambrose and Harris, 2010). Today, illustrations are being produced by artificial intelligence, moving away from human production. The use of AI technology in this field is transforming illustration processes, offering new creative possibilities and conveniences.

Artificial intelligence provides various automated tools for illustrators. For example, AI tools that adjust line quality, suggest color palettes, or optimize compositions are important in enabling illustrators to work faster and more efficiently. AI-supported design platforms open up a wide creative space that helps illustrators in producing original works.

Conclusion

The findings clearly demonstrate the impact of artificial intelligence on visual design tools. A literature review shows that these tools provide time and cost efficiency in the design process. Especially in the context of design, the innovations brought by AI in color and layout suggestions, typography choices, and user interface design enable designers to make faster and more effective decisions.

Research and studies on the impact of artificial intelligence on creativity present a complex picture. While some designers state that AI offers new creative possibilities and expands the design process, others have expressed concerns that AI limits creative expression and standardizes designs. This indicates that the role of AI in design is evolving and that a balanced approach is needed in this field. Additionally, it is expected that AI technologies will play a more integrated role in design education in the future.

Ethical issues hold significant importance in the applications of artificial intelligence in visual design. Serious concerns have been identified, especially regarding data privacy, user privacy, and creative control. Responsible use of AI and the establishment of ethical standards are crucial for integrating this technology in a sustainable and acceptable manner.

Overall, artificial intelligence offers significant changes and opportunities in the field of visual design. However, the effective and ethical use of this technology should be supported by ongoing dialogue and research within the design community. It is believed that this study, which focuses on artificial intelligence a topic that has recently become very popular in the field of design will guide new research in visual design. Future studies are suggested to involve design students or individuals in the art and design sector to gather data through surveys and obtain their opinions. Additionally, the impact of AI on visual design should be carefully evaluated not only in terms of technological advancements but also in terms of ethics, education, and creativity.

To further elaborate on the intersection of visual design and artificial intelligence, it is clear that AI tools are reshaping the landscape of visual design by introducing efficiencies and novel capabilities that were previously unimaginable. These tools facilitate rapid prototyping, automate repetitive tasks, and enable the exploration of vast design spaces through generative design techniques. On the positive side, AI enhances creativity, allows for personalized designs at scale, and drastically reduces the time needed for design iterations. However, there are also negative aspects to consider. The reliance on AI can lead to a homogenization of design outputs if not carefully managed, potentially stifling individual creativity and reducing the diversity of design expressions. Moreover,

there is a risk that designers may become overly dependent on technology, possibly undermining their fundamental skills.

Looking to the future, it is anticipated that AI will continue to evolve and integrate more deeply into all aspects of visual design. As AI technologies become more sophisticated, they are likely to offer even more advanced tools that anticipate design trends and user preferences, further influencing the creative process. Nevertheless, it is imperative that the design community remains vigilant about the ethical use of AI, ensuring that these tools enhance rather than replace the human element of creativity.

In conclusion the symbiosis between AI and visual design has poised to unlock unprecedented opportunities and challenges. As we stand on the brink of this technological evolution, it is crucial for designers to embrace AI not just as a tool, but as a collaborative partner that can expand the horizons of what is possible in visual design. This partnership, if navigated thoughtfully, has promises to enrich the design field while honoring the timeless values of creativity and aesthetic judgment.

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Visual References

Figure 1. Word cloud related to the advantages of using artificial intelligence in visual design (https://wordart.com/create / Access Date: 06.04.2024).

Figure 2. Word Cloud related to the disadvantages of using artificial intelligence in visual design (https://wordart.com/create / Access Date: 06.04.2024).

Figure 3. Illustrations of Mona Lisa in various styles (OpenAI / Access Date: 12.05.2024).

Figure 4. An Illustration depicting a happy family by the seaside with a car (OpenAI / Access Date: 12.06.2024).

Figure 5. Packaging designs featuring visual illustrations generated by midjourney (Midjourney / Access Date: 06.05.2024)

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