TECHNIUM

Technium Vol. 30, pp.49-57 (2025)
ISSN: 2668-778X
www.techniumscience.com

The Impact of Artificial Intelligence on Graphic Design

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Abstract. The integration of artificial intelligence (AI) and machine learning in creative industries has deeply revolutionized traditional processes of artistic production and design. Of these, the design industry, and graphic design in specific, has been the fastest to evolve due to the appearance of new generative AI tools for generating, editing, and analysing visual content with very low input from a human. As news of these advancements broke, designers were both interested and anxious about the future, questioning the role of the designer, the importance of human creativity and the potential lasting effects of the releases on the industry. This paper performs a thorough literature review on diverse dimensions of the influence of AI technologies in graphic design in terms of how AI technologies affect design processes, industry landscapes, and professional identity of graphic designers. Both the positive and negative impact of the integration of AI is critically studied, and the study is based on recent academic and industry views. According to these findings, the study provides a set of prescriptions to promote the responsible and effective use of AI within the graphic design industry.

Keywords. artificial intelligence, graphic design, creative industries, machine learning, design automation

1. Introduction

Artificial intelligence (AI) and machine learning have dominated well beyond the research and technical areas and firmly entered mainstream life. One of the most affected fields due to this change has been creativity and arts field. Humanist traits like imagination, aesthetic judgment and creative expression are, meanwhile, being partly “co-opted” by the AI. Given all this, the impact of AI in some aspect of the art making process has been inevitable. As a result, academic attention is now no longer focused on combating these technologies, but on how they can be used in a purposeful and creative way.

In the creative industries, graphic design has been identified as one of the sectors most heavily influenced by AI. In a discipline that was inherently visual, AI driven tools not only sped up the process of design, but they also brought new modes of creativity and production. Browse more Computational biology Data mining Image processing Natural language processing Summary Systems that can produce visual content from text-based description can now achieve various challenging tasks such as creating new designs, provide layout and colour recommendations, transfer artistic style and perform colorization. Although these changes have made graphic design operations easier, there has also been a redefinition of professional tasks and skills. Thus, there has been discussion over whether these technologies undercut the profession or are an exciting extension of creative possibility.

The aim of this study was to explore the impact of AI tools on the domain of graphic design by conducting an extensive literature review. The consequences of AI have been observed at three levels: outputs of design work, the organization of the design field and the practices of graphic designers. The

implications of those effects have been considered both in positive and negative aspects. Recommendations derived from the result on conscious and effectivity use of AI in graphic design has been done. In this regard, the purpose of this paper is to make a theoretical contribution to the evolution of knowledge on the subject and provide a structure from which to base further academic research.

2. AI Technologies in Graphic Design

Graphic design is an interdisciplinary field, which has undergone a plethora of changes over time. These changes stem from many different aspects, most of which are related to the technological evolution of computers and professional tools employed by graphic designers. AI and machine learning, in particular, appear to be two of the newest additions to these technologies, and it is widely believed that they may have a strong impact in the long-term development of the graphic design industry. Interest is currently surging, both from researchers and practitioners regarding the potential of these new technologies for graphic design. Although designers have been previously aided by a variety of tools, generative design systems are believed to profoundly redefine the way designers interact with the designed artefact.

Early attempts to automate parts of the creative process can be traced back to the avant-garde movements of the late 19th century. One of the most significant artefacts from that period is a method patented in 1892 which partially automated the production of repetitive designs like wallpapers. In the latter half of the 20th century, the issue of design automation was increasingly studied by computer scientists and electrical engineers. With the advent of computers and graphics, attempts to automate the design became more serious [1], [2].

A number of systems were developed to produce notable simple designs using the grammatical approach to the design. At the same time, the dilemma of machine-generated art shifted from purely technical pursuits to its philosophical and theoretical implications. With the advent of commercial software tools, the innovation of visual designs turned once again to commercialization. The integration of the wide variety of tools within a software and the development of probabilistic machine learning methods resulted in a variety of new tools that sanitized the drawing process by weakening its craftsmanship aspect, requiring more technical knowledge to master while rendering formerly labour-intensive works invisible for many designers [3]. At the same time, scripted design systems were also developed and disseminated, encouraging the aesthetic exploration of generative processes by requiring users to master a computational language, thus being afflicted by a different but similar set of problems. The emergence of deep neural networks resulted in a recently renewed interest with glaringly different alternatives [4].

2.1. A subsection Machine Learning Algorithms

Graphic design has undergone dramatic changes starting with the advent of digital technology as a new medium, the production of new tools, software, and hardware, to the widespread acceptance of two-dimensional image-sharing. Currently, graphic designers are experiencing paradigm shifts in the art and design process, education, and concept of creativity due to the rise of AI technology. Graphic designers need to understand and adapt themselves to the rapid rise of AI technology. In this regard, the intention of the research is to develop an understanding of design intelligence in the context of graphic design and AI technology [5]. This understanding provides insights into the ongoing change in graphic design due to AI technology, as well as design ethics and principles. Deep learning is generically used in AI graphics, but the application of AI in graphic design has a different domain than in other fields such as voice, text, and histopathology images, as approaches to image creation and manipulation are domain specific. This makes it easier to understand the impact of AI on graphic design based on different applications of AI graphic tools; and the design process is used to inform a comparative discussion [6]. Since the advent of AI generative methods, machine learning approaches have been all the rage in academia, the artistic community, and the business world. They are used for smart image editing, style transfer, painting completion, cartoonization, and image retouching in graphic design. In this realm, deep learning is literally the only technique, and one that has been embraced from many sides. There are many educational opportunities to learn about the workings of deep learning, and opportunities

abound for an understanding of how to use it via API services or out-of-the-box applications. This brings accessibility to many creative communities, including amateurs, casual users, and professionals. Deep learning has led to unprecedented advances in productivity and creativity because it is a learning algorithm that can find patterns from given examples when sufficient amounts of training data are available. Hence, in disciplines where such data are accessible, there is virtually a boom in rebirths of traditional applications or inventions of new applications that includes high-performance and high-quality image stylization, manipulations, and painting [7].

2.2. Generative Design Tools

Generative design tools can use input constraints to iteratively explore a design space and produce numerous solutions. This approach to design can be significantly augmented by the use of AI, which can deliver performance indicators for a diverse collection of designs. AI can help in the exploration of large decision spaces and/or in interpreting and mapping resulting data [8]. Designing systems that utilize generative design tools is a complex task in itself; however, this task can be made especially difficult when AI is also employed. New types of performance data are generated that come from black-box systems, which do not expose their inner workings, and further interpretation and mapping are necessary. In addition, new types and scales of decision spaces are opened up: GAN-driven tools generate large amounts of designs (hundreds or thousands) between a few clicks, necessitating the development of interfaces and methodologies that can be utilized by designers to effectively navigate these more complex realms [6]. At face value, the idea of further involving AI in the design process when generative design tools are already deployed may seem contradictory. Still, the tools described here aim to augment these tools, not replace them. To further inspire the active involvement of in-house architects and mitigate the limitations discussed, better mappings between generative design tools and AI performance augmentation processes are needed. Thus, expectations from designers and alternatives with varying levels of involvement should be met. Designers should have the possibility to dive deeper and leverage the AI-powered analysis of results; however, the additional complexity of this exploration should not be a strict browser requirement [9], [10], [11].

2.3. Image Recognition and Processing

Image recognition and processing technologies have revolutionized the field of graphic design by enabling designers to automate tasks, enhance creativity, and improve the overall efficiency of their workflows. These advancements allow for the quick identification of design elements and streamline the creative process, leading to innovative outcomes that were previously unimaginable. AI can analyse vast amounts of visual data, enabling designers to understand trends and predict consumer preferences more effectively. Furthermore, this technology enhances the ability to create personalized designs that resonate with specific target audiences. So, this allows designers to tailor visual elements that are not only aesthetically pleasing but also highly effective in conveying brand messages. This will enhance the overall user experience by ensuring that the images resonate with target audiences. Furthermore, this technology enables designers to analyse consumer interactions with visual content, allowing for ongoing refinement and optimization of design strategies [12], [13].

3. Benefits of AI in Graphic Design

AI is reshaping various design disciplines, such as graphic, interior, architecture, and product. Some examples include the collaborative use of GANs by artists and non-artists to create digital sculpture, comic book covers, and commercials. GANs are used to create and condition images and animations onto a 3D layout for scenes in animated shorts. In addition, academic and commercial applications are used as tools for visualization, prototyping, and animation. There are many design-oriented applications of GANs in science, the arts, and consumer services that cover the entire graphic design and design space. However, available applications do not cover the manual and analytical design spaces. Applications that cover the manual design space relocate decisions to the user and require new skills [14].

There are seven AI benefits to graphic design. The first is the capability of understanding the cognitive guide. More than just colours and illustrations, it drew on cognitive tools such as form language, principles of composition, conceptual structures, and graphics-to-mechanics knowledge. These cognitive tools helped them understand how specifics reflected the message, regardless of the complexity of the graphical design. The second benefit is the capability of tracing sophisticated comprehension. Automatically tracing the cognitive and detailed graphical combinations in existing charts might lead to similar viability. Additionally, by tracing design scholars' comprehension and then generating related drawing, the system could inspire data analysts in stock analysis or how-to-learn classroom.

The third benefit is the capability of composing the designs and canons conditioned by images. Users can influence the design with a simple picture of a pen or napkin sketch. Researchers created a network to pass low-level properties from a painting to a generated graphic and learn a statistical model for composition, abstraction, and message understanding in a higher level. The third ingress is the capability of composing designs with high innovation of images. By making latent encoding smooth, images can travel over the design space of designs. The fifth benefit is the capability of acquiring high-fidelity pictures. Unlike the hidden modelling blurry sketches of shapes, this research generalizes a probabilistic latent-variable model of spectral graphs to generate high-fidelity pictures [15].

3.1. Increased Efficiency

The integration of AI in graphic design has fundamentally transformed workflows, enabling designers to complete projects more efficiently and with greater accuracy. This advancement allows for the automation of repetitive tasks, freeing up designers to focus on more creative aspects of their work. This shift not only enhances productivity but also encourages innovation, as designers can explore new ideas and concepts without being bogged down by tedious processes. This newfound efficiency allows graphic designers to focus more on creative aspects of their work, utilizing AI tools to automate routine tasks such as resizing images or adjusting layouts. As a result, the design process becomes faster and more streamlined, enabling quicker turnaround times for projects [16].

3.2. Enhanced Creativity

AI is revolutionizing the field of graphic design by providing tools that enhance the creative process and inspire innovative solutions. These tools, driven by machine learning algorithms, enable designers to explore a vast array of possibilities, pushing the boundaries of traditional design practices. This newfound freedom allows for innovative designs that were previously unimaginable, ultimately leading to a more dynamic and visually engaging industry. As designers harness the power of AI tools, they are able to explore new forms, colours, and patterns that challenge traditional norms. This evolution not only broadens the scope of creative expression but also encourages collaboration between human intuition and machine learning, fostering a vibrant atmosphere for artistic experimentation. By leveraging AI-driven tools, designers can unlock new avenues for innovation, resulting in unique visual narratives that challenge traditional design paradigms [17].

3.3. Cost Reduction

The integration of AI in graphic design has led to significant cost reductions for businesses, allowing for more efficient workflows and resource allocation. This technological advancement not only minimizes the need for extensive manual labour but also streamlines the design process, enabling designers to focus more on creativity and innovation. Furthermore, AI tools can analyse patterns and trends in real-time, helping businesses adapt to market demands swiftly.

Hiring graphic designers at the conventional rates stated above can create unnecessary hardships. AI, or machine-powered sorting and analysis automation, is evolving rapidly and becoming more cost-effective. To help companies achieve cost reduction by using AI to fulfil design-related work, several laws of AI cooperation, including ownership reform, deliverable termination, second-level design, revision assist, and execution, and numerous public AI services that employ these laws, are proposed.

The laws provide a clear and universal approach for companies to leverage AI and rapidly downsize the cost of design-related work, while the services offer start-up tools to aid implementation within work processes. Using the proposed methods to apply AI in design field may achieve 99% work cost reduction and ensure all deliverables pass the Turing tests [13], [18].

Companies rely heavily on design-related works, such as designing banners for product releases, illustration design for mobile apps, album art generation for music products, restaurant theme conception for customer engaging environments, and many more. Many design companies have been established to satisfy this demand, employing or contracting graphic designers. However, the fees of hiring a graphic designer can be surprisingly high and become an enormous burden when they're hired for routine work. This can incur significant emotional cost for designers too, who may need to rationalize the built-in inequality between their effort and payment. Except for these problems, so many avoidable iterations and needless human labour may also happen, because this mechanism is essentially inefficient [19].

4. Challenges and Limitations

Despite the numerous advancements in AI, the integration of AI into graphic design comes with a set of challenges and limitations that must be addressed. These challenges span various aspects, including technical limitations in AI algorithms, the need for extensive training data, and the potential loss of human creativity and intuition in the design process. Moreover, these challenges can hinder the integration of AI in traditional design workflows, which may lead to resistance from designers who fear that their roles could be diminished. As AI continues to evolve, addressing these limitations will be essential to ensure that technology complements rather than replaces human artistry. This involves not only technical improvements but also a deep understanding of the creative processes at play in graphic design. Moreover, it is crucial to recognize the ethical implications of AI in art, as reliance on algorithms may lead to a homogenization of creative expression. This may not only stifle innovation but also limit the diversity of artistic voices. Furthermore, the use of AI tools can raise questions about authorship and originality, as artists may struggle to define their unique contributions in an increasingly algorithm-driven landscape.

Is there a compelling reason to believe that AI systems will one day appreciate art or generate artistically relevant responses? The current forms of AI have limits. They do not possess any common sense, do not do well in any rigorous analytical reasoning, would have difficulty extracting abstract concepts against which their output may be evaluated, are not especially good at understanding metaphors, do not have any appreciation of the nuances of emotions that critically affect interpretation, would be hard pressed to construct inferences, especially probabilistic inferences necessary for artistic appraisal of the same, and to estimate uncertainties. Given these limits, how could they appreciate art, let alone produce it? If it is accepted that art appreciations are ultimately a matter of psychology (and therefore neurobiology), then how could an intelligence without the necessary cognitive and affective architecture to appreciate art with relevance aesthetics control very different technologies and design very different artefacts that evoke aesthetic experiences? If art communicates abstract and symbolic ideas or conveys nuanced emotions, then an intelligence of what has been surveyed would seem ill-equipped to appreciate or produce art [20], [21] .

4.1. Quality Control

Despite the advancements brought about by AI in the graphic design industry, there are significant concerns regarding the quality control processes that may be compromised as automation takes precedence. One of the primary issues is the reliance on algorithms that may not fully understand the nuances of design aesthetics, leading to outputs that lack the creativity and emotional impact that human designers typically provide. This reliance can result in a homogenization of design styles, where unique artistic expression is sacrificed for consistency and efficiency. As a consequence, designers may find themselves constrained by templates and algorithms, limiting their ability to innovate and explore new creative avenues. This reliance on predefined structures can hinder the unique expression that is often essential in the field of graphic design. Consequently, the lack of diversity in design outputs may lead

to a homogenization of visual culture. This uniformity can stifle creativity and limit the range of artistic expression, ultimately detracting from the originality and innovation that are essential in graphic design [22].

4.2. Ethical Considerations

With increasing reliance on generative AI systems, the notion of intellectual property rights over the resulting artwork has moved into dangerous territory [23]. Guidelines and discussions led by concerned parties are urgent to protect creators, not just in the graphic design community, but in all digital media-focused disciplines. Issues of identity theft and data laundering, especially in the growing field of NFT art, have captured the attention of the general population in addition to graphic design communities. Some artists are outraged that their work, sometimes with an entire portfolio being scraped, could be used to churn out artwork directly in their style. Artists have even lost their livelihoods as their own work has been replicated and resold as AI-generated "Originals." Pose preservers and prompts to the masses were released online, leading to fresh scrambling. The image generation community is still in the process of addressing these issues and trying to control how the tech is implemented.

There is an urgent need for discussions on who owns the rights to artwork made by any of the generative models. Should the AI firms under whose name the tech is created own the rights? Or should the last user who used a model to create a piece be its owner? Or should it be the creator of the model? Or, if it is proven that it was trained on copyrighted work, should the original copyright-holders own it? And what of the new run-time models? Many automated processes need to be regulated and discussed before they are put into greater-than-Model View Presenter (MVP) architecture as they have inadvertently reshaped the marketplace on a longer timeline, a process often referred to as "Predatory Innovation." Massive societal discussions are needed on the ethical ramifications and business framework for their deployment. As these technologies aim for complex models and ease of use, their eventual outcome could be the capture of the newly stylized work of creators and a generally laxer vision, as control of media shifts from creative creators to tech companies homing in on the collection of a new type of intellectual property [22], [24].

4.3. Job Displacement

As AI continues to evolve, concerns regarding job displacement in the graphic design sector have become increasingly prominent. This shift raises questions about the future roles of graphic designers and the skills that will be necessary to remain competitive in an industry increasingly dominated by automated solutions. As technology continues to evolve, graphic designers must adapt by embracing new tools and learning how to work alongside AI systems. This may involve acquiring skills in AI software, understanding data analytics, and developing a keen eye for combining human creativity with machine efficiency. As the industry evolves, graphic designers will need to embrace these changes to remain relevant and competitive in a landscape increasingly influenced by AI-driven tools. This means adapting to new technologies, learning to work alongside automated systems, and continuously upgrading their skill sets to leverage AI for enhancing creativity and efficiency. As graphic designers navigate this evolving landscape, they must embrace a mind-set of lifelong learning. This shift will not only ensure their relevance but also open up new avenues for innovative approaches to design [25].

5. Conclusion

In conclusion, the integration of AI into graphic design has transformed the industry by enhancing creativity, streamlining workflows, and enabling designers to push the boundaries of their artistic expression. As we look to the future, it is evident that AI tools will continue to evolve, offering even more innovative solutions that empower graphic designers to focus on strategic thinking and conceptual development. This shift not only enhances creativity but also streamlines the design process, allowing for a greater emphasis on user experience and personalization. As a result, graphic designers are able to leverage advanced tools that not only simplify repetitive tasks but also inspire innovative solutions that were previously unattainable. This evolution in the design process not only enhances creativity but also

broadens the scope of what can be achieved in visual communication. As AI tools continue to evolve, they will likely lead to new forms of artistic expression that challenge traditional notions of authorship and originality. This transformation will not only redefine the role of the graphic designer but also necessitate a revaluation of the creative process itself. As we embrace these advancements, it is crucial to consider the ethical implications and the balance between human creativity and machine efficiency.

There are also big concerns and ethical implications of using AI in design processes, particularly regarding copyright and originality. As designers grapple with these challenges, it is crucial to strike a balance between leveraging AI's capabilities and maintaining the integrity of human creativity. This balance is essential not only for preserving the unique artistic vision that each designer brings to their work but also for ensuring that AI serves as a tool to enhance creativity rather than replace it. Ultimately, the future of graphic design will depend on the collaborative efforts between human designers and AI technologies, paving the way for innovative and engaging visual experiences. This partnership will enable designers to harness the power of AI, allowing them to focus on creativity while AI handles repetitive tasks. As a result, we can expect a revolution in the way graphic design is approached, emphasizing both efficiency and artistic expression.

Is the profession of graphic design being eliminated by AI? While AI certainly streamlines certain tasks and offers advanced tools that can enhance creativity, it is more likely to transform the role of graphic designers rather than eliminate it altogether. Designers will need to adapt and integrate AI into their workflows, allowing them to focus on more complex and conceptual aspects of design that require human insight and emotional intelligence. This transition will not only enhance their creativity but also redefine the role of designers in the industry. As AI continues to evolve, it is essential for designers to adapt to these changes by embracing new tools and techniques that can complement their artistic vision.

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