Crisis and Responses to Design and Design Education in the AIGC Era

Yi Luo*, Le Wang[a]

*467477261@qq.com, [a]564993966@qq.com

Shenyang City University, Shenyang,Liaoning,China,

Abstract. This scholarly article delves into the intricacies of merging artificial intelligence (AI) and generative design within the realm of design and design education. It provides an in-depth analysis of the interpretation of the digital creative industries as outlined in the *14th Five-Year Plan* and the National Development Goals 2035, emphasizing the significance of emerging sectors and the trajectory of the digital creative industries. Furthermore, the article elucidates key facets shaping the future of design, encompassing innovative product design, service design, spatial design, interdisciplinary proficiencies, and social design. Moreover, it comprehensively investigates the profound influence and prospective impact of AI and generative design technologies on design education, with a specific emphasis on fostering critical thinking abilities, algorithmic aesthetic education, research and judgment aptitude, social and visual acuity, as well as technological and iterative mindset. Ultimately, the article underscores the imperative for design education to undergo transformation and innovation in order to adapt to the evolving landscape of the AIGC era.

Keywords: AIGC era; design; design education; digital creative industries

1   Introduction

The rapid advancement and convergence of transformative technologies, such as the Internet, big data, cloud computing, artificial intelligence (AI), and blockchain, have profoundly impacted economic and social development. These developments have propelled the digital economy to unprecedented heights, reshaping global resources, economic structures, and the competitive landscape [1]. Understanding the ramifications of these technological advances, particularly in the field of design, is crucial as we stand at the forefront of this digital revolution.

AI-Generated Content (AIGC) has emerged as a formidable force, reshaping the creative landscape. It is imperative to examine the influence of AIGC on creativity and identify design domains susceptible to replacement by AI-generated designs. By exploring the capabilities and limitations of AIGC, we can gain valuable insights into the future of design and anticipate changes in design practices and methodologies.

Given these technological advancements, it is crucial to look ahead and anticipate transformative shifts in design work and methodologies resulting from the integration of AI technologies. What are the potential developments, challenges, and possibilities that lie ahead? By addressing these inquiries, designers can actively shape their future and embrace the opportunities offered by technological progress. As AIGC becomes increasingly pervasive, it is vital to explore the future trajectory of design education. How can designers adeptly navigate the integration of AI

technologies and cultivate the skills required to thrive in the digital era? These critical questions warrant thorough exploration and thoughtful consideration.

2   Opportunities: AIGC brings Modern Design to Life

2.1   The concept of generative design powered by AIGC

Generative Design powered by Artificial Intelligence and Generative Content (AIGC) refers to the utilization of AI algorithms and machine learning techniques to autonomously generate designs. This approach enables the creation of diverse design options that fulfill predefined requirements and constraints, ultimately identifying the optimal solution. The integration of generative design techniques accelerates the design process significantly and yields innovative solutions that transcend human imagination. It serves as an invaluable tool for designers, enhancing their ability to efficiently tackle complex tasks.

2.2   AIGC generative design in the Gartner technology curve

According to Gartner, the integration of generative AI in design is projected to significantly enhance and expedite various domains by 2025. It is anticipated that generative AI may even have the capability to create novel designs that humans might overlook. The 2022 Gartner Technology Maturity Curve identifies 25 emerging technologies, with two key themes directly pertinent to AIGC.

2.3   History of AIGC

The digital revolution has ushered in a paradigm shift in both the economy and the design industry, with digital computing serving as the catalyst. The foundation for machine intelligence, encompassing artificial intelligence and deep learning, lies in the accumulation, integration, and utilization of design data. Notably, since 1987, software tools such as Adobe have played a pivotal role in enabling graphic design, typography, template layout, packaging design, marketing brochures, web pages, and various other design applications. Over time, AIGC's influence has expanded beyond graphic design to include areas such as graphic media design, 3D, and dynamic spatial design[2].

2.4   Roles and Application Categories of AIGC Technology

AIGC, also known as AI-generated content, refers to content that has been created, generated, or edited through the utilization of artificial intelligence. This technology involves the analysis and assimilation of extensive data sets, enabling AI systems to comprehend, create, and optimize content effectively. AIGC finds applications in various content formats, including text, images, audio, video, and others[3]. In the era of intelligent creation, AIGC pushes the boundaries of innovation and enhances productivity by automating repetitive tasks and disentangling creativity from the creation process.

AIGC generative design addresses the need for streamlined, scalable, and widely accessible conceptual products. The iterative design approach provides the notable advantage of rapid experimentation and refinement. By simultaneously comparing thousands of design options,

AIGC simplifies the design process, empowering engineers and designers to make well-informed decisions efficiently.

AI Generative Design spans multiple design disciplines, encompassing graphic design, industrial design, environmental design, and information design. Graphic design encompasses diverse areas such as iconography, packaging design, and poster design. Industrial design encompasses product styling, office supplies, transportation, clothing, and more. Environmental design encompasses urban planning, architecture, interior design, and landscape design. Information design encompasses digital media, interactive design, and web design.

2.5　Tools: The Evolution of AIGC and GDAI Generative Design

The evolution of Internet content production can be categorized into three stages: professionally generated content (PGC), user-generated content (UGC), and artificial intelligence-generated content (AIGC). AIGC combines the power of artificial intelligence with content creation, enabling machines to produce high-quality and efficient content. This technology finds applications in areas such as smart hardware and big data analytics.

ChatGPT, an artificial intelligence-driven natural language processing tool, possesses the capability to comprehend and learn human language, engaging in conversations, interactions, and even performing tasks like writing copy, code, scripts, design notes, and textbook development[4]. Tools such as ChatGPT and other large-scale language models provide significant convenience in both professional and personal contexts, enhancing productivity and improving everyday experiences.

Midjourney, an AI drawing tool scheduled for release in March 2022, allows users to input text, and within approximately a minute, it generates the corresponding image using AI algorithms.

The combination of ChatGPT and Midjourney empowers users to design various entities such as buildings, tractors, and boxes. Nvidia GET3D generative design models, operating at the 3D modeling level, represent cutting-edge advancements in Nvidia's GET3D 3D generative models.

3　Challenges: The Concerns Arising from AIGC in the Design and Design Education Community

3.1　Quality and Intellectual Property Concerns in the Homogenization of AIGC Generative Design Works (Table.1)

Table .1. Homogeneity tendency included in AIGC and the methods to solve and reduce the homogeneity problem（Author's own drawing）

Problems	Solutions
(1) The similarity in style, perspective, and content structure from different sources. (2) Lack of creativity. (3)Inhibiting the development of innovative thinking by designers. (4) Intellectual property issues caused by AIGC	(1) Increasing the diversity of AI creations and improving AI algorithms (2) Encouraging collaborative designs between humans and AI (3) Relying on technological advances and education and training. (4) Developing AI ethical guidelines, laws, and regulations[5]

3.2   Impacts of AIGC Generative Design on Employment Opportunities and Working Conditions in the Design Industry

The proliferation of AIGC Generative Design has resulted in a substantial decline in job prospects within the design industry. Evidently, this trend is underscored by a notable surge in the availability of design courses offered by higher education institutions, juxtaposed with a decline in the monthly salaries received by graduates specializing in graphic design. Moreover, design firms, particularly those operating in the architectural design sector, have grappled with persistently high rates of employee layoffs.

3.3   The Impact of Artificial Intelligence on the Design and Design Education Sector: Challenges and Crisis

The rapid advancement of artificial intelligence (AI) technology presents a formidable challenge to the design and design education sector, with the potential to disrupt and replace a significant portion of traditional design jobs. The vulnerability of traditional design work to AI-driven automation has raised concerns about the gradual erosion or potential extinction of the conventional design industry[6]. The design environment currently grapples with multiple challenges, including the lack of adequate safeguards for design creativity, inadequate legal frameworks and regulations, fragmented and disorganized tendering processes for design projects, and inadequate treatment of designers[7]. Furthermore, the design education sector faces the risk of obsolescence, as it struggles to keep pace with the evolving industry landscape, insufficient attention to lifelong learning, and a dearth of innovation in design pedagogy.

These challenges are underscored by specific instances that highlight the current crisis within the design and design education sector. For instance, in the FRF "Fashion No Fur" public welfare poster design competition, there is a scarcity of works that effectively convey the theme of abstaining from hunting animals for fur. Similarly, when it comes to safety production, the most commonly encountered student work is centered around the depiction of a "helmet." Moreover, recent years have witnessed a rise in instances of plagiarism in graduation design works, casting a shadow over the integrity of the design education system. Examples include allegations of plagiarism by a multimedia web design student from the China Academy of Art, suspected replication of the work of Japanese designer Yasuji Kumeida by a student from South China Normal University, and suspicions of plagiarizing the work of German artist Hans Haacke by a student from the Department of Experimental Art at the Central Academy of Fine Arts. These instances not only demonstrate a lack of innovative thinking among students but also underscore the prevalence of similarities and clear signs of plagiarism, indicating a stagnation of originality and imaginative exploration.

4   Response: The Role of AIGC in Driving Reform and Transformation of Design Education

4.1   Job Roles and Responsibilities of Designers in the AIGC Era

In the era of AI-generated content (AIGC), designers find themselves positioned within three distinct perspectives: substitutions, irreplaceability, and collaborationism. As artificial intelligence gradually assumes certain technical and creative functions, designers face the imperative

of prioritizing user experience and enhancing their design practices. It is essential to recognize that disparities in learning capabilities may exacerbate inequalities that are likely to escalate in the future. Therefore, embracing lifelong learning becomes paramount for designers as they navigate the AI era[8].

Notably, the role of AI-generated designers has undergone a transformation, shifting from creators to editors. This necessitates an evolution in their design philosophy, embracing role shifts, and adopting transformative approaches. In this context, designers are confronted with an array of options, but the "paradox of choice" phenomenon introduces the risk of suboptimal decision-making. While the process of generating designs may follow a simplified three-step procedure, it is crucial to acknowledge that genuine creativity is an intricate and iterative cycle.

4.2   New Design Paradigms in Gartner Curves and their Impact on Design (Table .2)

Table .2. The major areas of research and application related to the Gartner Hype Cycle （Author's own drawing）

Intelligent Product Design and Manufacturing	Advancements in Product Display Category	Advancements in Product Information Media Category	Innovations in the Design Services Category	
(1) Enhancing Ergonomics and Intelligent Product Design (2) Dynamic Robotics and Computer Numerical Control (CNC) Design (3) Incorporating Gamification and Product Entertainment Design (4) Advancements in 3D/4D Scanning Printing and Nano 3D Printing (5) Intelligent Micro-Dust Detection and Information Detection (6) Exploring Bionic Design and Process Bionic Design (7) Unmanned Supermarkets	(1) Integration of Holographic Display and Product Design Works (2) Leveraging Automatic Content Recognition for Product Evaluation (3) Exploring Internet TV and its Implications for Product Display Design (4) Innovations in Stereoscopic	(1) Internet of Things (IoT) and Products: Exploring the Potential of IoT E-commerce Platforms (2) Enhancing User Interaction: Interactive Information Design and 3D Sensing Products (3) Revolutionizing Real-time Interaction: Mixed Reality Software Design for Voice Translation (4) Enabling Rich Media Communication: App Market HTML5 and Craft Integration (5) Hybrid Cloud Computing and Open-source Cloud Resources: Transforming Product Infor-	(1) Private Cloud Computing: Enhancing Design Management Efficiency (2) Streamlining Industry Events: Designing Efficient Processes and Marketing Campaigns (3) Unveiling Insights: Speech Mining and Information Design in the Product Industry (4) Cloud Computing and Product Design: Harnessing the Power of Design Cloud Libraries (5) Understanding User Behavior: Leveraging User Social Analytics for Design Marketing (6) Text Analysis for Effective Campaigns: Enhancing Product Campaigns	(11) Virtual Desktops for Designers: Enhancing Product Designer Desktop Design (12) Analyzing Virtual Worlds: Exploring Emotional Design in Virtual Environments (13) Leveraging Crowd Wisdom: Product Crowdsourcing and Management of Design Services (14) Multimedia Tablets: Enriching Design Tools and Workflows (15) Consumerization of IT: Implications for Design and Consumption (16) Personalized Design: Exploring

and Innovations in Intelligent Product Design (8) Harnessing Forecast Analysis, Market Analysis, and Product Analysis	Display and Naked Eye 3D Display Design	mation Management (6) AR Cloud Virtual Reality (VRAR\MR\ER): Innovations in Design and Display (7) Gesture Control and Product AI: Advancing Interaction Design (8) Mobile NFC/OTA Payments: Streamlining Product Transactions (9) Consumer Telematics and Product IoT: Expanding the Horizons of Product Connectivity	through Text Analysis (7) Big Data in Design: Advancing Data Processing Systems for Design Applications (8) BYOD and the Empowered Designer: Exploring New Tools for Product Designers (9) Wireless Sensor Networks: Optimizing Design and Management through Sensor Technology (10) Enhancing Design Supervision: Leveraging 3D Sensor Camera Monitoring	Biometric Approaches for Tailored Experiences (17) Concept Management in Design: Effective Product Design and Management Strategies (18) Enabling Communication: Speech Recognition for Seamless Interaction with Product Designers (19) Wireless Power Technology: Advancements in Fieldwork and Design Applications

4.3 Evolving Design Education Management in the Era of AIGC

In response to the challenges posed by the AIGC era, design education managers are embracing a range of strategies to foster innovation and adaptability. These strategies encompass interdisciplinary approaches, data-driven decision-making, the introduction of new specializations, curriculum updates, enhanced practical teaching methods, the development of teaching resources, closer integration of industry and education, a focus on teacher training, strengthened career guidance, an improved evaluation system, and a renewed emphasis on whole-person education[9].

4.4 Adapting Curriculum Integration to Future Design Education

When considering curriculum development, it is imperative to incorporate a combination of courses that reflect the emerging landscape of design, including AIGC, creative programming, and human-computer interaction. Moreover, the inclusion of courses on virtual reality, holographic design, big data, algorithmic design, game design, interactive hardware, and software is highly recommended, particularly within disciplines such as environmental art, product design, and digital media art. In order to provide students with comprehensive training, it is essential to integrate virtual reality tools and immersive environments into professional design courses. This integration ensures that students are equipped with the necessary skills to navigate and harness the potential of AIGC design within their respective fields. To facilitate effective learning experiences, virtual distance classrooms should be implemented to enable seamless online and offline interaction.

To support the teaching and learning process, the utilization of open AIGC resources, such as apps and applets, is encouraged. These resources can enhance students' understanding and ap-

plication of AIGC principles, fostering a dynamic learning environment. Additionally, it is crucial to place a strong emphasis on interdisciplinary integration and adopt a multidisciplinary approach to learning and research. By promoting collaboration across diverse disciplines, students can develop a broader perspective and acquire versatile problem-solving abilities.

Implementing modular teaching methods tailored to the unique needs of students is of paramount importance. By providing flexible learning options and customizable pathways, students can engage in personalized learning experiences that cater to their interests and goals. Creating a collaborative learning environment that fosters peer interaction and knowledge exchange further enhances the educational experience.

In order to stay at the forefront of design education, establishing partnerships between educational institutions and industry is crucial. These partnerships should focus on developing specialized educational software and creating virtual remote classrooms. By leveraging the expertise and resources of industry partners, design education can remain proactive in responding to future changes and ensure that the teaching and learning content remains relevant and aligned with industry demands.

5   Outlook: Anticipating the Future of Design in the AIGC Era

5.1   Definition Future Design

The trajectory of design is intertwined with the imperative of addressing critical global challenges, including poverty eradication, sustainable development, and the pervasive influence of artificial intelligence. In this context, design institutions bear a profound social responsibility and must embrace a forward-looking perspective. Referred to as "Design for the Future" or futuristic design, this paradigm entails the application of future-oriented insights and innovative thinking to tackle present and future problems. It necessitates designers to transcend conventional approaches and cultivate solutions that align with the principles of social sustainability. By embracing a holistic vision, future design endeavors to shape a world that is responsive to emerging needs and aspirations.

5.2   Essential Elements of Future Design

The delineation of the digital creative industry within the 14th Five-Year Plan and the National Development Vision 2035 encompasses novel modernization facets such as new industrialization, information technology, and the advancement of digital creative technology, content production, and innovative design. Design for the Future encompasses various domains, including architecture, transportation, industrial design, fashion design, and technological product design. Its fundamental constituents encompass innovative product design, service design, habitat design, interdisciplinary proficiency, and social design for fostering innovation and entrepreneurship[10].

Designing Futures pertains to the purposeful shaping and strategizing of future development through innovation, technology, and societal transformation. It encompasses strategic planning for design organizations and practitioners, integrated systems design thinking, sustainable and circular design practices, the fusion of design technology, art, and market dynamics, as well as the projection of social design innovation. In the context of AIGC technology, the trajectory of

design education should prioritize critical thinking, algorithmic aesthetic education, research discernment, social and visual acuity, technological literacy, and iterative thinking. By fostering these competencies, design education can effectively navigate the complexities of the AIGC era and empower designers to be catalysts of positive change[11].

5.3 The Influence and Prospects of AIGC Technology on the Prospective Landscape of Design Education

Nurturing the acumen of critical thinking among aspiring designers entails a multifaceted approach that fosters inquiry, skepticism, evidence-based analysis, persuasive discourse, identification of biases and logical fallacies, empathetic consideration of diverse viewpoints, comparative evaluation of arguments, and the cultivation of introspection and self-reflection[12]. By engaging in these cognitive processes, future designers can refine their intellectual capacities and enhance their ability to navigate the complex terrain of design.

In essence, the trajectory of design is intricately linked to its capacity to address global predicaments, embrace transformative innovation, and instill in designers the prowess of critical thinking. This paradigm shift necessitates a comprehensive reimagining of design education, whereby learners are empowered with the cognitive tools and intellectual dispositions to effectively navigate the challenges and opportunities that lie ahead.

6 Conclusion

The pervasive influence of AIGC technology has brought about a profound revolution in the realms of art, design, and education. As the rapid advancement of AIGC continues to unfold, it is imperative to adapt to evolving technological landscapes while safeguarding traditional skills and pedagogical approaches from potential threats. While AI-driven design is progressively transitioning from weak to strong AI, it has not yet attained the ability to supplant human emotional cognition. Therefore, the pursuit of high-quality design necessitates a synergistic amalgamation of human designers' innovative thinking with machine-generated designs, thereby averting the risk of design homogenization.

In the realm of design education, it is paramount to prioritize critical and creative learning, foster interdisciplinary integration, and embrace personalized instructional approaches. Teaching methodologies will undergo a notable transformation, shifting towards intelligent, collaborative, shared, inquisitive, connected, and experiential modes of learning. Moreover, design education should embrace and accommodate diverse learning styles, enabling students, peers, and resource providers to become valuable contributors to 3D and dynamic spatial design the educational process. The imperative for design education to undergo transformation and innovation in order to adapt to the evolving landscape of the AIGC era.

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