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# Impact Reconstruction and Future Opportunities of AI-Generated Technology in Multimedia Image Content Design for Stage Plays

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**Abstract: Under the background of the national cultural digitalization strategy, AIGC has comprehensively intervened in stage play creation, driving a revolution in visual art paradigms. With stage multimedia image design as the core, this paper analyzes the mechanism of AIGC and its practical ethical challenges from three dimensions: production process, visual expression, and creative subjectivity. The research finds that AIGC, as a structural tool, optimizes the creative ecology and assists in the digital upgrading of stage art. The study points out that while AIGC enhances the creative environment through its instrumental attributes, it is only by adhering to the artistic core, balancing technology and humanity, and improving copyright regulations that the symbiotic integration of both can be achieved, thereby empowering the high-quality development of digital stage art.**

**Keywords: AI-Generated Content; Stage Plays; Multimedia Imagery; Scenography; Human–Machine Collaboration; Digital Performance**

## 1. Introduction

Multimedia imagery in stage plays has undergone a significant transformation from a supplementary scenographic element to a central medium through which narrative, spatial, and affective dimensions are articulated. As a hybrid form integrating visual design, performance temporality, and audience perception, it plays a critical role in shaping both the aesthetic experience and interpretive framework of theatrical productions. Despite its increasing importance, the conventional production paradigm of stage multimedia imagery remains constrained by labor-intensive workflows, extended production cycles, and limited adaptability to live performance conditions [1]. These structural limitations not only restrict creative experimentation but also reinforce resource inequalities within the theater industry.

Recent advancements in AI-generated content technologies, including generative image synthesis, procedural animation, and real-time rendering, have introduced new possibilities for overcoming these constraints. While such technologies have been widely adopted in film, gaming, and digital media, their integration into stage-based contexts raises distinct theoretical and practical questions. In particular, the live, ephemeral, and co-present nature of theater distinguishes it from screen-based media, requiring a reconsideration of how AI-generated imagery operates within dynamic performance environments [2].

Current scholarship on AI and visual culture largely focuses on generalized media applications, often neglecting the specificity of stage practices. Moreover, existing research tends to adopt a techno-optimistic perspective, emphasizing efficiency gains while overlooking critical issues related to authorship, aesthetics, and institutional restructuring. In response, this paper situates stage multimedia image design as a critical site for examining the broader implications of AIGC. It seeks to move beyond descriptive accounts by offering a theoretically grounded analysis of how AI technologies reconfigure creative processes and artistic values within stage production. Through this lens, the study aims to contribute to ongoing debates on digital aesthetics and the future of performing arts in the age of intelligent systems.

## 2. Core Concept Definition and Theoretical Basis

### 2.1 Core Concept Definition

Stage play multimedia imagery can be understood as a context-specific visual system that operates within the constraints and affordances of live performance environments. It encompasses a range of media forms, including

projected visuals, LED displays, holographic elements, and computational effects, all of which are temporally synchronized with performative action. Unlike cinematic imagery, which is subject to post-production manipulation, stage imagery is inherently contingent, requiring real-time responsiveness and adaptability. Its aesthetic and functional value lies in its capacity to mediate between narrative progression, spatial construction, and audience perception [3].

AI-generated content, in this context, refers to computational systems capable of producing visual and audiovisual outputs through data-driven learning processes and algorithmic generation. These systems introduce a shift from deterministic design workflows to probabilistic and iterative production models. When applied to stage imagery, AIGC enables rapid prototyping, stylistic variation, and adaptive rendering, thereby expanding the operational scope of scenographic design. However, its significance extends beyond efficiency gains, as it also redefines the locus of creative agency by distributing authorship across human and non-human actors [4].

The notion of human–machine collaboration thus becomes central to understanding contemporary stage production. Rather than framing AI as either a replacement or a subordinate tool, this study conceptualizes it as part of a relational system in which human intention and algorithmic generation are co-constitutive. This perspective aligns with broader shifts in digital art practices, where creativity is increasingly understood as an emergent property of hybrid systems [5].

### 2.2 Theoretical Support System

The analytical framework of this study is informed by an interdisciplinary synthesis of digital aesthetics, stage narratology, and media ecology. Digital aesthetics provides a conceptual basis for examining how computational processes reshape visual perception and artistic expression, particularly in relation to immersion, interactivity, and abstraction. Stage narratology foregrounds the functional integration of visual elements within narrative structures, emphasizing the necessity of aligning technological interventions with dramaturgical coherence. Media ecology, in turn, situates these transformations within a broader socio-technical context, highlighting how emerging media infrastructures influence artistic production, audience engagement, and institutional configurations.

By integrating these perspectives, the study moves beyond a purely technical analysis and instead positions AIGC within a complex network of aesthetic, narrative, and ecological relations. This approach enables a more comprehensive understanding of both the opportunities and contradictions inherent in the adoption of AI technologies in stage art.

## 3. Multi-dimensional Impact and Practical Dilemmas of AI-Generated Technology

### 3.1 Core Impact: Reconstruction of the Design Ecology

The intervention of AI generation technology transcends a mere enhancement of efficiency in stage imagery design. Instead, it has facilitated a comprehensive reconfiguration of traditional multimedia design paradigms across three core dimensions: the creative workflow, visual expression, and the creative subject. This shift has fundamentally restructured the creative logic and representational forms of the industry. Concurrently, the process of technological empowerment has exposed critical issues concerning artistic originality, on-site adaptability, and copyright ethics. These challenges manifest as a profound tension—a dichotomy between technological rationality and artistic sensibility—necessitating a dialectical perspective to evaluate its dual impact.

From the perspective of the creative workflow, AI technology has thoroughly broken the inefficient mode of traditional manual design, achieving dual optimization of efficiency and cost [6]. Traditional stage image design involves multiple stages such as sketching, modeling and rendering, effect debugging, and on-site adaptation. A single set of core visual materials often requires a creative cycle of several days or even weeks, and the cost of modification and adjustment is extremely high. For small and medium-sized theater groups with limited funds and tight rehearsal cycles, it is difficult to achieve high-quality image creation. In contrast, AI generation technology can quickly generate multiple versions of visual drafts through text commands. Designers only need to fine-tune keywords, style parameters, and color ratios to complete effect iterations, significantly compressing the time cost of sketch design and

rendering. At the same time, AI can automatically complete auxiliary tasks such as material resolution adaptation, scene stitching, and format conversion, reducing manual repetitive labor and allowing creators to devote more energy to creative conception, narrative control, and artistic refinement [7]. According to practice data from some domestic pioneer theater groups, after adopting the human-machine collaborative model, the stage image creation cycle can be shortened by more than 60%, and labor and material costs can be reduced by nearly half, greatly improving creative efficiency and rehearsal progress.

From the perspective of visual expression, AI technology promotes the upgrade of stage imagery from static, singular presentation to dynamic, immersive interaction, achieving a revolution in aesthetic paradigms. Traditional stage multimedia imagery mostly consists of pre-fabricated static images or looped videos, which lack flexibility and interactivity and are difficult to adapt to the real-time changes of stage performances. AI generation technology can not only generate surreal, freehand, and stylistically diverse visual materials—breaking through the mental sets of manual creation to meet the aesthetic needs of various plays such as classical dramas, avant-garde theater, sci-fi stage plays, and ethnic operas —but can also rely on real-time rendering algorithms to achieve dynamic linkage between imagery and actor performance, plot rhythm, and live sound effects. It can even fine-tune visual effects based on audience reactions, forming a three-dimensional interaction system of "actor-image-audience". For example, works such as the National Theatre of China's Called by Dunhuang and the Shanghai Dramatic Arts Centre's The Three-Body Problem series of stage plays have used AI to generate dynamic images that fit the temperament of the plays. These works concretize the artistic conception of Dunhuang murals and cosmic sci-fi scenes, breaking the spatial limitations of the physical stage and making multimedia imagery a core participant in the narrative, greatly strengthening the sense of immersion and emotional empathy.

Finally, starting from the creative subject, AI technology promotes the role transformation of stage designers and gives rise to a demand for composite creative talents. Traditional stage image designers must be proficient in various professional design softwares such as PS, AE, and C4D, which places extremely high requirements on technical operational ability. The popularization of AI technology has lowered the threshold for tool usage, transforming the core responsibility of the designer from a "manual producer" to a "creative decision-maker, prompt engineer, and aesthetic gatekeeper". This transformation requires creators to no longer be limited to software operation skills, but to possess precise script interpretation abilities, clear command expression abilities, keen artistic aesthetic judgment, and on-site stage control. This forces stage creation teams to develop in a composite direction of "dramatic art + digital technology + aesthetic creativity," reshaping the industry's standard for talent competency.

### 3.2 Practical Dilemmas

Although AI generation technology has yielded significant dividends for stage imagery design, its practical application still confronts multiple dilemmas that constrain the full realization of its technological value [8].

First, the erosion of artistic originality and humanistic depth. AI-generated imagery, predicated on massive training datasets, is highly susceptible to homogenization and formulaic patterns, lacking the emotional resonance and artistic individuality inherent in manual creation. This tendency toward homogenization reflects the underlying biases of training datasets and algorithmic structures [9]. Excessive reliance on AI-generated materials in certain productions often leads to hollow content that lacks "soul," resulting in a disconnection from the narrative core and falling into the pitfall of "technological exhibitionism."

Second, the deficiency in on-site adaptability and systemic stability. Stage performances demand rigorous fluidness and visual precision. However, current AI real-time rendering technologies still suffer from latency, stuttering, and fidelity distortion, making them difficult to fully synchronize with the spontaneous contingencies and real-time rhythms of live theater. Furthermore, certain pre-fabricated AI assets lack the flexibility to accommodate fine-grained adjustments in stage space and lighting, thereby compromising the overall presentation.

Finally, the intensification of copyright and ethical controversies. Clear regulatory frameworks are currently absent regarding the ownership of AI-generated content, the

infringement of training data, and the subjectivity of artistic creation. The direct utilization of unauthorized training materials to generate stage imagery can easily trigger legal disputes. Concurrently, an over-dependence on AI may weaken the subjective initiative of creators, potentially diluting the humanistic essence and original value of stage art.

## 4. Future Opportunities and Practical Pathways

### 4.1 Development Opportunities

Based on the developmental trends of intelligent technologies and the imperatives of the digital transformation within the performing arts, the integration of AI generation technology with stage play multimedia imagery is not a transient trend but a long-term strategic direction. This convergence facilitates more than a mere technological upgrade; it represents a comprehensive paradigm shift in creative philosophies, industrial structures, and artistic aesthetics, harboring immense developmental potential. To address existing dilemmas, it is essential to formulate targeted practical pathways grounded in industry realities, thereby achieving a profound synergy and deep integration between technology and art.

AI technology is progressively driving the iterative upgrade of multimedia imagery in stage plays, moving toward deep development in customization, interaction, and personalization. This advancement continuously deepens the expressive efficiency of stage narratives and injects new vitality into stage play creation practices. In the future development process, as large-scale model algorithms continue to be optimized and refined, AI technology will possess the capability to deeply analyze the emotional context of scripts, character traits, and the rhythm of scenes. It will be able to precisely match the core requirements of a production to generate exclusive, customized visual content, truly achieving the creative goal of "one style per play, one special effect per scene". Building on this foundation, combined with cutting-edge technologies such as motion-sensing interaction, XR (Extended Reality), and holographic projection, efficient audience interaction ports can be established. This enables real-time linkage between audience behavior or voice and stage imagery, breaking the traditional "actors perform, audience watches" unidirectional output model. It pushes audiences to transform from passive viewers into active narrative participants, effectively enriching the narrative dimensions and artistic expressiveness of stage plays while helping to create immersive and interactive new viewing experiences.

At the same time, the application of AI technology is breaking the long-standing resource monopoly in the stage play industry, giving birth to new business formats in digital performance and driving stage art toward popularization, thereby opening new paths for industrial development. In traditional creation modes, the production of high-quality stage imagery requires significant investment in manpower, materials, and finances, keeping creation costs high. Only a few large-scale theater troupes have the capacity to afford this, which to some extent limits the innovative development of grassroots stage art. The advantages of low cost and high efficiency inherent in AI generation technology effectively lower the threshold for creating professional-grade multimedia imagery. This allows grassroots creative subjects such as small and medium-sized theater troupes, independent theater makers, and campus drama clubs to easily access professional-grade creative resources, effectively activating the innovative vitality of grassroots stage art and promoting the expansion of stage play types toward diversification. Meanwhile, the deep integration of AI imaging technology with emerging dissemination modes—such as online live streaming, virtual performances, and digital theaters—will break the spatial limitations of offline theaters. This further expands the dissemination boundaries and commercial value of stage plays, realizes the collaborative linkage of online and offline performance scenarios, and promotes stage art to gradually escape its niche dilemma and move toward a broader mass market.

Finally, from the perspective of artistic innovation and talent cultivation, AI technology will drive the construction of a brand-new digital stage aesthetic system while simultaneously forcing the upgrade and improvement of stage art-related disciplines and talent training systems. The deep collision and fusion of AI technology with traditional stage art will break the inherent boundaries between real settings and virtuality, giving birth to a new type of digital stage aesthetic where reality and virtuality

combine and freehand expression coexists with realism. This promotes cross-boundary integration between dramatic art and fields such as digital media, visual design, and computer technology, further enriching the forms of expression and aesthetic connotations of stage art and injecting new vitality into its innovative development. Concurrently, the industry's demand for composite stage design talent will continue to surge. This demand will, in turn, drive curriculum reforms in university majors such as Theater and Film, Digital Media, and Art Design, prompting institutions to build a "trinity" talent cultivation model of "artistic literacy + technical ability + creative thinking". The focus will be on nurturing composite stage art talents who can adapt to the development needs of the intelligent era, providing solid talent support for the sustained and healthy development of the industry.

### 4.2 Practical Pathways

To address the contemporary challenges in AI application, it is imperative to establish a systematic practical framework grounded in the ontological essence of stage art.

To begin with, the core principle of "human-led, technology-assisted" must be rigorously upheld, prioritizing artistic narrative and humanistic expression as the primary objectives while positioning AI as a supplementary generative tool. Through meticulous manual refinement, creative governance, and emotional infusion, the drawbacks of algorithmic homogenization in AI imagery can be neutralized, ensuring a high degree of congruence between visual content and the play's thematic core. Maintaining the centrality of artistic intention is crucial to preventing the instrumentalization of technology [10].

Furthermore, there is a pressing need to accelerate the refinement of copyright and ethical frameworks within the industry. This involves clarifying the attribution of rights and responsibilities among AI training datasets, generated outputs, individual creators, and theater troupes. Establishing a licensed repository for stage-specific AI assets will mitigate infringement risks, while a steadfast commitment to artistic ethics will prevent technological misuse from diluting the original value of stage performances.

In addition, research and development must be deepened to enhance technical adaptation. Specifically, real-time rendering algorithms should be optimized to accommodate the inherent "liveness" and ephemeral nature of stage plays. By constructing specialized platforms for technical testing and pre-visualization, the synergy between visual effects and performance rhythm, lighting, and acting can be iteratively polished to ensure the stability of live executions.

Ultimately, the collaborative development among industry, academia, and research sectors should be promoted. Establishing integrated platforms for universities, research institutions, and technology enterprises will facilitate targeted R&D in AI stage imagery. This strategic cultivation of composite talents will enable a reciprocal empowerment between academic inquiry and industrial practice, driving the standardized, high-quality application of AI technology within the domain of stage multimedia imagery.

## 5. Conclusion

The integration of AI-generated technology into stage multimedia image design represents a paradigmatic shift that redefines the relationship between technology and artistic practice. While it offers significant opportunities for innovation and accessibility, it also introduces complex challenges that require critical engagement. By conceptualizing AIGC as part of a hybrid creative system rather than a purely instrumental tool, this study highlights the need for a balanced approach that preserves artistic integrity while embracing technological transformation. Future research should further explore the empirical dimensions of audience reception, genre specificity, and technological implementation to deepen our understanding of digital stage art in the context of intelligent media.

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