Application of Virtual Humans and Virtual Scenes in Studio Layout Design (Postprint)

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Date: 2025-07-09T15:34:21+00:00

Abstract

With the rapid development of contemporary digital technology, virtual technology is being increasingly widely applied in studio layout design. This paper aims to conduct an in-depth investigation of the innovative applications of virtual human and virtual scene technology in modern studio layout design, and to provide prospects for their application methods, advantages, challenges, and future development trends. 【Purpose】 This study selects typical application scenarios and conducts analysis from dimensions including functional implementation, scene construction, and interactive design, systematically demonstrating the application effects and innovative potential of virtual technology in studio layout. 【Method】 The research finds that the application of virtual humans and virtual scenes not only drives innovation and development in broadcasting technology, but also introduces greater possibilities and opportunities for program production. 【Result/Conclusion】 As technology continues to advance and application domains expand, virtual technology will play an increasingly important role in studio layout design.

Full Text

Application of Virtual Humans and Virtual Scenes in Studio Layout Design

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Abstract

With the rapid development of digital technology today, virtual technology is increasingly widely applied in studio layout design. This paper aims to explore in depth the innovative applications of virtual human and virtual scene technologies in modern studio layout design, examining their implementation

methods, advantages, challenges, and future development trends. This study selects typical application scenarios and analyzes them from dimensions including functional implementation, scene construction, and interactive design to systematically demonstrate the application effects and innovative potential of virtual technology in studio layouts. The findings reveal that the application of virtual humans and virtual scenes not only drives innovation and development in studio technology but also creates more possibilities and opportunities for program production. As technology continues to advance and application fields expand, virtual technology will play an increasingly important role in studio layout design.

Keywords: Virtual Human; Virtual Scene; Studio; Intelligent Studio Space; Layout Design

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With the rapid advancement of computer graphics technology, artificial intelligence algorithms, and multimodal sensing technologies, traditional studio design—limited by physical space and the complexity of physical set construction—has struggled to achieve diverse and flexible scene effects. The introduction of virtual humans and virtual scenes has brought revolutionary changes to studio layout design. By utilizing computer-generated imagery and 3D modeling technology, virtual technology can create realistic and vivid visual effects that greatly enrich the presentation of studio content.

The application of virtual humans and virtual scenes in studio layout design not only enhances the visual effects and watchability of programs but also offers significant practical benefits. Virtual technology reduces the cost and time consumption of physical set construction while improving production efficiency. Traditional physical sets require substantial human, material, and financial resources and cannot meet the demand for rapid changes and diverse scenes. In contrast, virtual technology can quickly generate and switch between different scenes as needed, substantially reducing production costs and time expenditures. Additionally, the use of virtual humans and virtual scenes enhances program interactivity and immersion. The real-time interactive capabilities of virtual humans also diversify program formats, attracting greater audience attention and participation. Furthermore, virtual scenes provide more possibilities for studio layout design, allowing designers to fully exercise their imagination to create effects that are difficult to achieve with traditional physical sets, thereby delivering novel and unique visual experiences that are crucial for enhancing program quality and competitiveness.

1. Application Methods of Virtual Humans and Virtual Scenes in Studio Layout Design

1.1 Role Positioning and Functions of Virtual Humans

Virtual humans can play multiple roles in studio layout design, enabling diverse functions. From hosts to performing guests to audience interaction facilitators, virtual humans inject new vitality and creativity into program production with their unique advantages and expressive capabilities.

As hosts, virtual humans add a novel dimension to studio design and programs with their distinctive images and styles. They can move freely between different scenes without temporal or spatial constraints, guiding program flow and introducing guests and content. The emergence of virtual hosts not only enriches program formats but also improves audience viewing experiences. Through sophisticated motion capture and speech synthesis technologies, virtual hosts can display natural and smooth hosting styles, seamlessly interacting with on-site guests to create a more vivid and engaging program atmosphere [Figure 1: see original paper].

In studio program recording, virtual humans can also serve as performing guests in various artistic performances. They can present special effects and movements impossible to achieve in the real world, delivering stunning visual impact. For example, virtual humans can instantly change costumes and appearances on stage or perform highly difficult dance moves, adding more creativity and highlights to programs. Moreover, virtual humans can interact with real guests in performances, jointly creating brilliant stage effects [Figure 2: see original paper].

Virtual humans can also play the role of audience interaction facilitators in studio layout design. They can act as virtual audience members, participating in program interaction segments and engaging in real-time interaction with real audiences. This creates a sense of co-presence for viewers, enhancing program participation and interactivity.

1.3 Integration of Virtual and Physical Elements

The integration of virtual and physical elements in studio layout design demonstrates significant complementary advantages. Virtual elements—such as virtual humans and virtual scenes—offer unlimited creative space with their flexibility and freedom from physical constraints, enabling rapid response to program requirements and creating effects difficult for traditional physical elements to achieve. Physical elements, such as real stages, props, and lighting, provide audiences with more intuitive and authentic viewing experiences through their realism and texture. The combination of virtual and physical elements allows each to maximize its strengths in its respective domain while compensating for each other's shortcomings. This complementary advantage not only enriches the possibilities of studio design but also enhances program visual effects and

watchability. Through clever integration, they can jointly create more vivid and realistic scenes and atmospheres. For instance, incorporating real props and lighting effects into virtual scenes can make them more three-dimensional and authentic, while using virtual backgrounds and effects on physical stages can break through traditional stage limitations to create more stunning visual effects. Through virtual technology, audiences can interact with virtual elements in programs, while the realism of physical elements makes this interaction more authentic and engaging. This synergistic effect not only improves audience viewing experiences but also brings more creativity and possibilities to program production.

2.1 Enhancing Visual Effects and Artistic Expression

Virtual humans and virtual scenes significantly enhance the visual effects and artistic expression of studio layout design through design techniques such as rich colors and lighting, unique modeling and dynamics. Through advanced rendering technology and color management, virtual elements can present delicate and realistic color layers, forming sharp contrast or harmonious unity with physical elements to enhance the overall visual impact of the studio. Meanwhile, the flexible application of virtual lighting—such as dynamic projection and light-shadow interweaving—not only enriches scene layering but also creates unique visual atmospheres that immerse audiences in a space full of artistic charm.

The unique design of virtual humans and virtual scenes in modeling and dynamics is also crucial for enhancing studio visual effects. Virtual humans can be customized according to program requirements, achieving highly realistic or beyond-reality innovative designs in appearance, costume, movement, and expression. Unique modeling not only attracts audience attention but also enhances realism and interactivity through delicate dynamic performance and vivid facial expressions. Similarly, innovative design of virtual scenes in modeling and dynamics—such as fantastical landscapes and dynamic weather changes—brings entirely new visual experiences to audiences, making presentations more vivid and interesting.

The design principles and creativity of virtual scenes require consideration from multiple perspectives, including integration with program content, atmosphere creation and emotional resonance, and spatial hierarchy construction. Through design and innovation, virtual scenes can bring more vivid and interesting visual effects to programs, improving audience viewing experiences and participation. The primary principle of virtual scene design is close integration with program content; the scene design must not only match the program's theme and style but also accurately convey the program's core information and emotional tone. For example, in history programs, virtual scenes can recreate ancient palaces or historical sites through detailed modeling and rendering technology, allowing audiences to travel through time and experience history immersively. This integration not only enhances program watchability but also improves audience immersion and comprehension.

Virtual scene design should also focus on creating atmosphere to stimulate audience emotional resonance. Through clever use of lighting, color, materials, and sound effects, scenes can create different atmospheres—such as romantic, mysterious, tense, or joyful—to guide audience emotional changes and enhance program appeal. For instance, in music programs, virtual scenes can be designed as dreamlike stages with flowing colors, creating a strong emotional connection with singers through lighting effects and excellent sound conditions.

2.3 Improving Space Utilization Efficiency and Flexibility

The introduction of virtual humans and virtual scenes in studio layout design greatly expands space utilization efficiency and flexibility. Through advanced virtual reality technology, unlimited virtual space can be created that is not constrained by the physical world and can achieve more functions and scene changes within limited actual space. For example, through virtual technology, multiple different virtual scenes—such as time travel, natural landscapes, or future technology—can be simulated within one actual studio, with instantaneous switching between scenes that greatly improves space utilization efficiency and flexibility. For instance, the 2023 CCTV Spring Festival Gala creative program "When 'Mythical Beasts' Meet Mythical Beasts" utilized virtual technologies including naked-eye 3D and VR three-dimensional rendering to bring numerous ancient mythical creatures "out of" historical texts, presenting audiences with a wonderful visual feast that demonstrated the perfect combination of technology and art [Figure 3: see original paper].

The use of virtual humans and virtual scenes also makes scene switching in studios faster and more convenient. Traditional scene switching often requires substantial time and resources, including prop arrangement, lighting adjustment, and background changes. In contrast, virtual scenes can achieve instant switching through software operation, greatly saving time and costs. Additionally, virtual scenes can be preset and programmed according to program flow to ensure accurate and smooth scene transitions, bringing more creativity and possibilities to program production and making program content richer and more exciting.

3. Future Development Trends of Virtual Humans and Virtual Scenes in Studio Layout Design

With the rise of the metaverse concept, studio design will break through the limitations of single physical spaces and expand toward multi-platform, cross-dimensional virtual spaces. Generative AI technology will significantly improve the design efficiency and creative space of virtual elements. In the future, virtual scenes can automatically generate 3D models adapted to program themes through AI algorithms, while virtual humans can autonomously generate interactive scripts and improvisational performances based on natural language processing technology. AI has already achieved "input text to generate scene"

functionality in VR design, and this technology will be widely applied in real-time content production for virtual studios in the future, substantially reducing the threshold for creative realization.

The maturation of augmented reality (AR) and mixed reality (MR) technologies will promote seamless integration between physical stages and virtual scenes. Through spatial computing and real-time matting technology, virtual backgrounds can dynamically match the lighting and perspective relationships of physical props to create more realistic visual effects. The design concept of virtual-physical fusion will achieve "free adjustment of virtual-physical ratio" under MR technology support, meeting program requirements for different levels of realism.

Virtual production technology will drive studios toward green and low-carbon transformation. By reducing material consumption and energy waste from physical construction, the reuse rate of virtual scenes can reach over 90%. Additionally, the long-term use cost of AI virtual humans is lower than that of real actors, and they can be reused across programs to form sustainable IP assets. The commercial value of virtual idols will continue to be released under this trend. Virtual humans will evolve into "cultural symbols," expanding business models such as derivatives and virtual performances through IP operations to maximize user stickiness and commercial value.

Virtual humans and virtual scenes in studio layout design mark the entry of media production into a new era of innovation. They not only greatly enrich the visual expressiveness and artistic appeal of programs but also significantly enhance program interactivity and audience participation. Through advanced virtual reality and augmented reality technologies, virtual humans can break through the physical boundaries of traditional studios with personalized modeling and vivid dynamic performance to create more immersive participatory experiences. Meanwhile, virtual scenes can flexibly transform to provide diverse backgrounds and environments for programs, enhancing visual effects and interest.

Looking ahead, with the iteration of metaverse, generative AI, and mixed reality technologies, virtual humans and scenes will be deeply integrated into the underlying architecture of studios, driving media production from "technology empowerment" to "intelligent reconstruction," ultimately forming a new generation of media ecology where humans, machines, and scenes coexist symbiotically.

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(Responsible Editor: Li Yansong)

Note: Figure translations are in progress. See original paper for figures.