

## Research on Digital Human Character Design Applicable to Stage Art

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### **Abstract**

*With the rapid development of digital technology, digital human character design has brought richer visual experiences and creative expressions to stage art. This thesis focuses on its unique application in stage art, exploring design and performance optimization, immersive experiences, and multimedia integration. The study shows that digital human character design enhances stage art with immediacy, interactivity, and multimedia integration, while also driving innovation in traditional stage art expressions.*

**Keywords:** *Digital Human, Stage Art Design, Character Design, Immersion Experience, Light and Shadow Effects, Sound Eesign, Art and Technology, Emotional Expression*

### **1. Introduction**

With the continuous advancement of digital technology, stage art now includes more digital elements beyond traditional sets, lighting, and props. Digital human character design has become increasingly innovative and unique in this field.

This study will analyze the artistic expression and technological innovation of digital human design in stage art, highlight its innovative role in traditional stage art, and explore its future development. The goal is to provide new creative ideas and practical methods for stage art design, promoting the deep integration of stage art and digital technology.

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## 2. Theoretical Background

Stage art enhances live performances and audience experience through visual elements. Traditionally, it uses physical props and crafts, but now it incorporates digital technology for richer visuals.

A Digital Human is a virtual character created with computer technology, simulating human appearance and emotions. It evolved from basic animation to advanced motion and facial capture, and is widely used in media and virtual reality. In stage art, digital humans improve visual effects and interactivity, providing a new experience for the audience.

## 3. Design and Performance Optimization

### 3.1 Expressive Design and Animation Quality

**Enhancing Visual Impact.** Enhancing the visual impact of digital humans relies on detailed material treatment. Refining skin texture, clothing material, and accessories improves their realism. In Anyma's EVA 0, in Figure 1, the metallic sheen and exposed internal mechanics add visual texture and rich storytelling, boosting both visual appeal and emotional resonance.

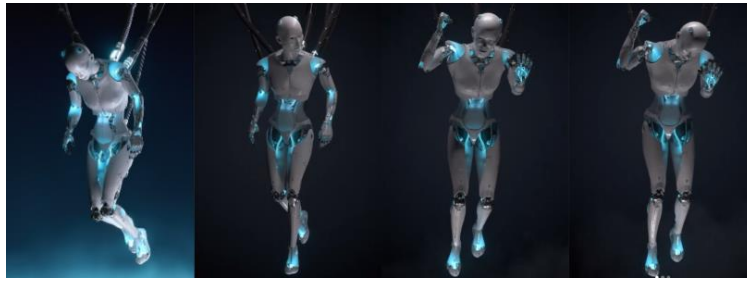
Color contrast is also crucial. Contrasting or harmonious color combinations make the stage attractive without being overwhelming. In Figure 1, cool metallic textures contrast with warm plastic colors and red electric details on the arm, creating depth and highlighting functionality. This use of color psychology triggers emotional responses, increasing the visual appeal of the characters.



Figure 1. Phase II EVA 0

**Animation Effects.** In animation design, digital human movements are choreographed to accurately reflect their identity, personality, and emotions. These movements focus on precision and smoothness while deepening characterization through body language. They also trigger visual effects that interact with the environment and stage, enhancing expressiveness and real-world interaction, fully immersing the audience in the performance. Well-designed animation effects bridge the virtual and real, enhancing the viewing experience.

In Anyma's initial design of EVA 0, the focus is on exploring consciousness. As shown in Figure 2, actions like pounding the screen convey dissatisfaction, with synchronized lighting and sound effects highlighting traits of perseverance and resistance, presenting a complex and expressive digital human.



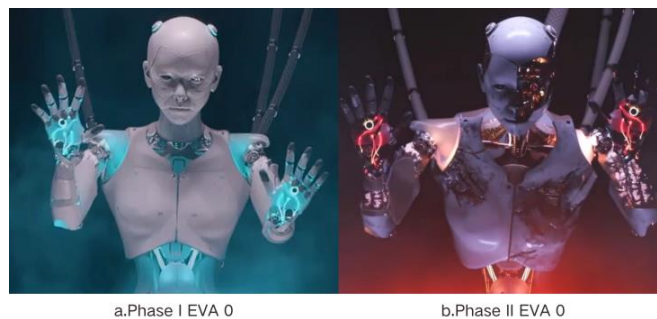
**Figure 2. Digital Human Exploring Consciousness**

### 3.2 Sustainability and Modifiability

**Durability of Design Concepts.** The durability of the design concept is crucial for digital human forms. The design should be based on a lasting aesthetic philosophy, ensuring it remains appealing and doesn't become outdated over time. Such designs transcend cultures and trends, maintaining their artistic value in diverse contexts.

While retaining a recognizable style, digital human design should also be highly adaptable. This means designers can innovate and evolve the design while keeping the core artistic concept intact, allowing the digital human to stay current and meet the audience's evolving aesthetic needs.

**Flexibility of Design Elements.** Flexibility in design elements is crucial for the modeling of digital humans. Designers should create key elements like clothing, hairstyles, accessories, and equipment to be easily configured and replaced. For example, in Figure 3, the digital human *EVA 0* has a basic form based on human structure, without additional elements like clothing and hair, making it simple and easy to modify. This allows for adjustments in key details while maintaining overall features, enabling different stages of the digital human's story to be effectively presented in performances.



**Figure 3. Digital Human at Different Stages**

The art design of digital humans should be coherent and unified, yet diverse enough to adapt to different themes. For thematic design, modeling elements can be flexible, allowing for the addition of specific elements without altering the overall structure. This adaptability helps match different plot backgrounds or cultural themes, enriching the digital human's expressive power and interactivity.

For example, in Figure 4, inspired by Michelangelo's *Pietà*, the digital humans *EVA 0* and *ADAM X* represent the Madonna and Jesus on stage with thematic music. The scene includes natural elements like vines and petals, blending the digital human figures with nature and technology. This design reflects the interplay between science, technology, and nature.

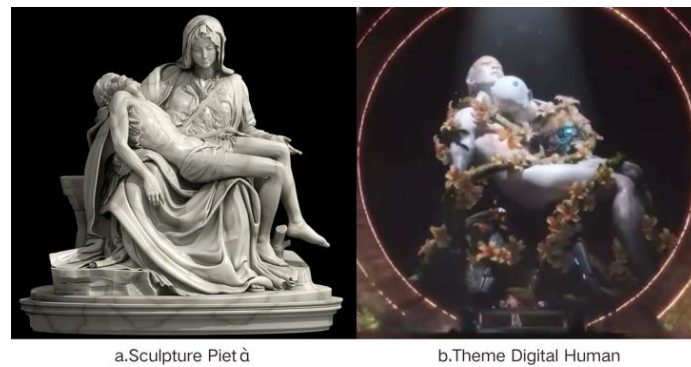


Figure 4. Sculptures and Digital Human

## 4. Immersive Experience and Enhancement

### 4.1. Light and Shadow Effects

Light and shadow effects, along with the movements of digital humans, are crucial for audience immersion. Many music producers now focus on the visual aspects of performances. Eric Prydz, known for his outstanding visual designs, excels in using 3D lighting to create spatial effects. Coordinating lighting with digital characters enhances the 3D visual impact, deeply engaging the audience.

**Dynamic Light and Shadow Effects.** The coordination of light and shadow effects is evident in the synchronization of stage lights with digital characters on screen, creating multi-layered visuals by combining foreground stage lights with background effects.

In Eric Prydz's HOLO series, when stage lights dim or brighten, the digital figures on screen adjust their shadows and lighting accordingly.

**Interactive Light and Shadow Effect.** When the digital human moves, stage lights follow their trajectory to create dynamic light and shadow interactions. The real-time light effects enhance the performance. For instance, in Figure 5, when the digital human presses a remote control switch, stage lighting responds with red infrared beams at specific positions, guiding the audience's focus and highlighting key visual elements.



Figure 5. Lighting Effects

### 4.2 Synchronization of Sound Effects

To ensure a consistent audio-visual experience, sound processing must be perfectly synchronized with

visual elements. The digital human design and stage art style should match to create a specific atmosphere and mood.

Digital human characterization should align with sound effects to convey personality, emotions, and story background. Sound effects enhance the character's image, helping the audience understand them better. The digital human's movements should match the rhythm and intensity of the music. At musical climaxes, visual focus and digital human movements should intensify, enhancing audience perception. Changes in the digital human's expressions should also align with music and sound effects, deepening the audience's emotional connection to the character.

## 5. Multimedia Experience and Integration

### 5.1 Spatial and Dynamic Adaptation

To ensure the adaptability of digital human images and animations in different spaces and layouts, targeted adjustments are necessary.

Designer Anyma often incorporates regional cultural and environmental elements. For example, in Figure 6, in a performance in Barcelona, Anyma used the essence of Gothic architecture's rose window in the design. The digital human hangs upside down in the center of the radiating rose window, creating a visually stunning and symbolic effect that aligns with the region's characteristics.

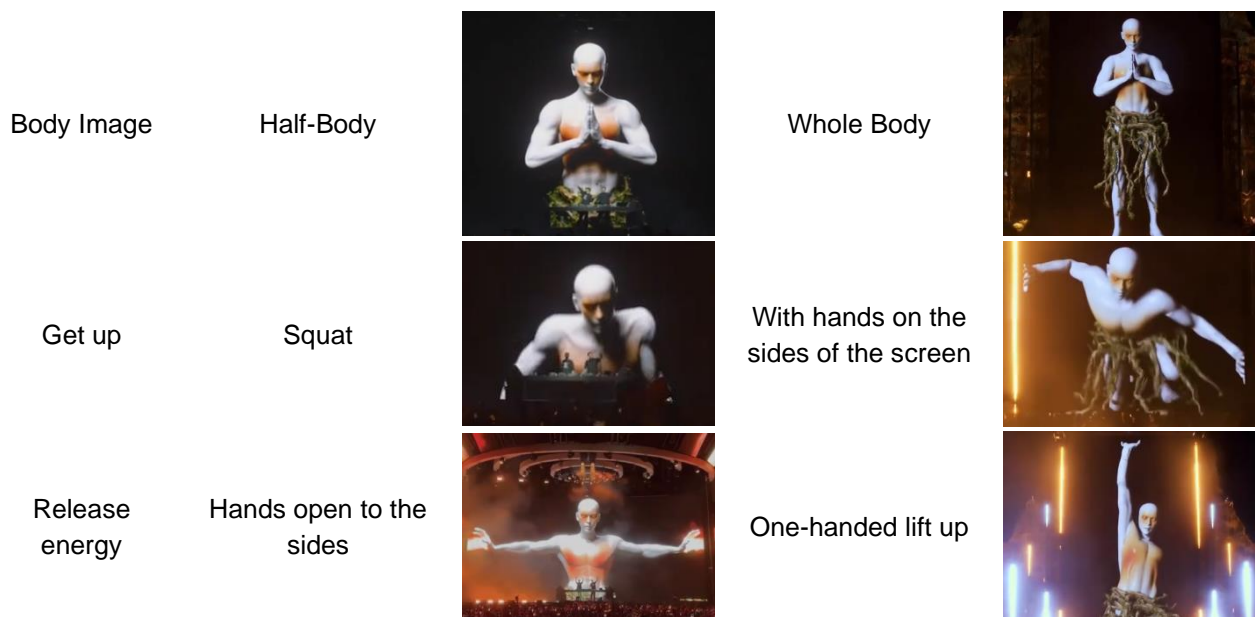


**Figure 6. Rose Window Applications**

In pursuit of the theme Explore Your Future, designer Anyma meticulously tailored the styling details and motion animations of the digital human for different screen ratios. Table 1 shows the differences in Adam X's design between a 16:9 horizontal screen and a 9:16 vertical screen. These differentiated designs ensure that the digital human presents the best visual effect and audience experience in various screen formats.

**Table 1. Comparison of Screen Parameters**

Detailed design	16:9 landscape	9:16 Vertical
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## 5.2 Cross-Media Integration

Digital humans can be displayed on large screens and combined with various multimedia formats. Designer Eric Prydz often uses holographic projection in his performances to create 3D visual effects, making audiences feel immersed in a virtual world of dynamic images.

In Prydz's HOLO series, holographic projection and 3D visuals are core features. For example, in Figure 7 from the 2023 Ultra Miami performance, multi-layer holographic projection technology creates images that appear suspended in the air, enhancing immersion and visual impact for the audience.



Figure 7. 2023 Ultra Miami Performance

## 6. Conclusion

This thesis discusses the application of digital human image design in stage art, highlighting its benefits in design optimization, immersive experiences, and multimedia integration. The study shows that digital human design enhances stage performance offering flexible modeling capabilities and embracing a myriad of artistic styles, coordinated with other elements. Advanced technology enables digital humans to deliver ultra-immersive visual effects, enriching the stage art experience. The integration of digital technology with stage art fosters innovation and holds significant research value and development potential. In the future, digital humans will continue to drive innovation in stage art, emphasizing diversity, interaction, and immersion.

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