Characteristic Analysis and Value Manifestation of Digital Interactive Art: Postprint

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Abstract

Interactive art constitutes a significant component of contemporary artistic forms, with its core essence residing in "interactive experience." Digital media technology is fundamentally transforming artistic expression across multiple dimensions, including creative thinking, creative methodologies, and user experience. Digital interactive art integrates scientific and technological elements with cultural and artistic dimensions, generating technologically sophisticated and experientially novel works from the spectator' s perspective, thereby enhancing public aesthetic agency and exhibiting substantial aesthetic, social, and commercial value.

Full Text

Feature Analysis and Value Manifestation of Digital Interactive Art

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Abstract: Interactive art constitutes an important component of contemporary artistic forms, with "interactive experience" as its core content. Digital media technology is transforming artistic expression across multiple dimensions, including creative thinking, creative methods, and user experience. Digital interactive art integrates science and technology with culture and art, creating technologically sophisticated and novel experiential works from the perspective of viewers. This approach enhances public aesthetic initiative and possesses extremely high aesthetic, social, and commercial value.

Keywords: digital media technology; interactive art; creative thinking; creative methods; value manifestation

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Interactive art emerged in the early 20th century as an artistic expression form involving artists or public participation, exemplified by touchable and playable sculptures or fairy tale characters in Disney amusement parks that pull visitors into dancing. The advent of interactive art has endowed art with greater inclusivity and accessibility.[1] In interactive artworks, artistic reception is process-based, and the completion of an artwork often depends on the completion of the artistic activity. Digital interactive art introduces digital media technology into interactive art creation, achieving multi-sensory, multidimensional interaction through novel appearances and interaction methods to create better interactive effects. Digital interactive art has evolved from a one-way viewing mode to a two-way interactive mode, where viewers' participation methods and scale play a crucial role in the final presentation of the work.[2-4] Viewers can fill in the "blank spaces" of a work based on their own understanding during the viewing process, a behavior that constitutes an important part of the work' s completion.[5-6] Through interaction, viewers complete their understanding of the work and integrate their personal interpretation into the work's composition, forming its uniqueness.

Mid-20th Century: Viewer-Centered Design Concepts

The "viewer-centered" design concept gained full affirmation in the art field by the mid-20th century, laying the foundation for interactive art creation.

1980s: Digital Technology Revolution

In the 1980s, the robust development of digital technology liberated artists' understanding of creative expression from traditional "pen and paper" forms. Increasingly, artists utilized computer technology to create new artistic expression methods, making works more relatable to life and the public. Art dissemination gradually became popularized with technological development. With the proliferation of networks, the public' s demand for artistic experiences became more urgent, prompting artists to use computer technology to achieve emotional interaction among creators, works, and viewers. Artistic creation during this period broke down barriers between viewers and works, integrating into public life, while the richness of media forms promoted the diversity of digital interactive art forms. Interactive films and interactive games began to flourish.[7-9]

1. Feature Analysis of Digital Interactive Art

1.1 Diverse Presentation Methods

Digital interactive art exhibits diverse presentation methods, appearing everywhere from mobile phones people casually pick up to artworks in galleries. Based on different presentation methods, its forms can be categorized into installation interaction, image/video interaction, and interface interaction.

Image-based interactive artworks primarily use projection and LED displays as presentation methods, which can be divided into single-screen projection and multi-screen immersive projection. The principle involves receiving instruction information data from viewers through sensors, processing it through computer systems, and feeding it back to processors to drive screen transformations. This mode allows audiences to see feedback from their own instructions on the screen and is a common pattern in digital interactive art. For example, the interactive artwork "Floating Koi and Lotuses" created by Japanese TeamLab studio was exhibited at Mifuneyama Rakuen Park. Viewers can see lotus flowers blooming in the pond and koi fish shuttling through, with colorful and magnificent visuals. Various real-time behaviors of on-site viewers also play a role in real-time depiction of the pond scenery. The koi fish projected onto the water surface can interact not only with their own kind but also with viewers who enter the pond. When viewers paddle a boat through, the fish react like real creatures. When the boat is stationary, they gather around; when the boat moves, they scatter away. Viewers can feel every ripple on the water surface, creating endless fascination.

[Figure 2: see original paper] Floating Koi and Lotuses (Image source: http://xuanqun.com/)

Installation-based interactive artworks emerged in the initial stage of interactive art, featuring mechanical appearances composed of different physical materials according to interaction requirements. For example, the "Waterfall Swing" (《Waterfall Swing》) produced by Dash 7 Design Studio installs rows of mechanical solenoids at the top of a steel swing, spraying out a water curtain that flows down like a waterfall. However, swing riders can shuttle back and forth through the gaps in the waterfall without getting wet. This primarily relies on sensors that collect rotation angle and speed information each time and send it to a computer, which predicts the swing' s future trajectory based on this data. According to the prediction results, the system sends instructions to the device to timely "carve out" gaps in the water curtain, ensuring viewers pass through smoothly.

[Figure 1: see original paper] Waterfall Swing (Image source: http://xuanqun.com/)

Interface-based digital interactive art can be experienced through common display devices. Viewers only need to operate mobile terminals or computers to complete the interaction process, offering wide audience reach and high popularity. With the development of VR technology, AR technology, and wearable

devices, human-computer interaction methods are becoming increasingly rich, and interactive experiences are becoming more stunning. Artists design artistic scenes and input them into computers, and viewers obtain interactive experiences by operating mobile terminals or computers. Such art forms transmit work content to viewers through electronic device display windows, offering convenience and speed. Interface-based digital interaction often emerges to serve users and is widely used commercially, thus frequently possessing "customizable" attributes. It continuously improves and develops through interaction between designers and experiencers, allowing experiencers to choose among multiple options provided by the work, while designers can further modify and adjust the work based on experiencer feedback. Such works are often personalized and dynamically developed. Computer games are undoubtedly typical representatives of interface-based digital interactive art. American scholar Adams believes that if computer games possess interactivity and aesthetic experience, have a reward orientation with more artistic indicators, and can be analyzed within a larger cultural environment, games originally for entertainment will be gradually recognized by the public and exist as an interactive art form. If the advantages of the Internet as an interactive medium are fully utilized, and the trend of development is followed to reflect the creative spirit of art, such artworks undoubtedly have tremendous development space.

1.2 Changes in Artistic Creation Methods

The powerful computing and cognitive capabilities of contemporary artificial intelligence are influencing the creative thinking of modern artists. Creative thinking is based on human perception, breaking conventional problem-solving methods, changing established experiences while still being able to plan and solve problems clearly, and obtaining innovative and flexible thinking outcomes. AI technology, premised on big data, helps artists integrate, judge, and make decisions, stimulating the generation of creative ideas. It then utilizes outstanding computing power to assist artists in completing newer forms of interactive artistic expression. If traditional artistic creation relies on artists'own aesthetics, experience, and techniques for output, then digital interactive art with AI intervention explores creative ideas based on content, introducing mental models, conducting data collection and analysis, and studying human perception of surrounding environments and things to describe, analyze, and process information about object representations. In digital interactive art creation, AI technology can collect and analyze data on public aesthetics, artistic styles and characteristics, and technology usage. Artists can then determine artistic creativity for content based on analytical conclusions combined with their own experience, conduct environmental analysis, interaction behavior analysis, etc., and propose effective digital interactive art expression forms. After experiencing the interactive process of the artwork, feedback from viewers based on their feelings will also stimulate new creative points in artistic creation, thereby continuously improving the work. Digital interactive art uses technological means to carry traditional artistic aesthetic ideas and expressions, with holographic projection

and virtual reality being commonly used technical means. It primarily relies on Internet media and related devices that can accept perceptual information for reception and dissemination. The creation of digital interactive artworks relies on technology for data processing, collecting general feedback needs of humans during interaction, promoting the naturalization of interactive art, using intelligent means to assist artists in artistic expression, and enhancing public art experience. This breaks the "artist-centered" creative thinking in traditional art creation, emphasizing "viewer-centered" from the beginning of creation, which is significantly different from traditional art creation methods.

1.3 Opening New Artistic Frontiers

Digital interactive art has entered the public eye and flourished alongside rapid technological development, and it actually has an inseparable relationship with natural sciences. The development of science and technology has led to many interdisciplinary fusion design works appearing in digital interactive art. Such works utilize cutting-edge technology to present natural science content that is difficult to display in traditional artistic expression, through multidimensional combinations of form, sound, and motion effects, endowing natural sciences with new aesthetic forms and turning them into artworks. Natural science knowledge such as biological growth, mathematical algorithms, and bacterial reproduction has never been considered related to art. However, due to technological development, much of it can now appear in vivid artistic forms. These works open up new frontiers for art, combining art and technology to achieve "art within technology, technology within art." They are not only highly aesthetically pleasing but also achieve the purpose of conveying professional knowledge. The public can master scientific knowledge and improve scientific literacy during the interaction with works. For example, the work "Explore The Ocean" that combines ocean climate with digital art is a model application in this regard. This work is an interactive scientific poster created jointly by cicom Lab and GEOMAR Helmholtz Ocean Research Center. Using the Hapag Lloyd expedition ship to explain profound ocean science, it employs detailed 3D animations and vivid data visualization to elaborate global processes in the ocean. While viewers complete interaction through multi-touch screens, they also enhance their understanding of ocean science and climate change knowledge, and can use voice comments for self-study.

1.4 Leap in Artistic Experience

In the viewing process of traditional static arts such as painting and sculpture, viewers can only appreciate the artist's expressive intent through color and form combinations. Many viewers cannot truly understand the meaning of works, so static artworks hardly stimulate viewers' interactive enthusiasm nor can they provide feedback on viewers' viewing activities. When digital interactive technology is introduced into static art, it can change the silent and passive artistic expression form of static art and achieve interactive elements in static artworks

through transformation of work forms. Current AR technology, VR technology, and 3D imaging technology provide strong technical support for the interactivity of static artworks, enabling static works to become dynamic. For example, the widely exhibited and well-known "Animated 'Along the River During Qingming Festival' " is a classic work that recreates traditional Chinese painting through digital media technology. In this work, 54 scenes and over 700 dialogues between characters were designed. Viewers can not only see figures walking in the picture but also hear children playing and laughing in the streets. Through autonomous operation on the screen, they can also have verbal conversations with people in the painting, achieving the transformation of traditional artworks from single-dimensional to multi-dimensional forms. Painting works do not necessarily have to be displayed in static planar forms; they can also constitute more attractive dynamic works through elements such as light, sound, and images. This work has reference significance in both digital technology application and painting image processing, and has also helped Chinese traditional painting reach the world through this dissemination method. Digital interactive art integrates various artistic expression methods such as music, painting, craft art, and sculpture, presenting them as brand-new artistic expression methods after integration through interactive technology. In digital interactive art, viewers fill in the blank parts of works through the interaction process. While viewing works, they also participate in their creation, breaking the passive viewing mode. The development of digital interactive art has enabled infinite possibilities for artistic expression, allowing artistic value to be more comprehensively displayed.

1.5 Art for the Masses

"Viewer-centered" is often the most important path for interaction realization in digital interactive art, which requires catering to public aesthetic literacy. Overly profound aesthetic elements are not suitable for interactive artworks; instead, they should feature friendly interfaces, narrative directions that resonate with the public, and novel and smooth interaction processes. Therefore, digital interactive works typically have obvious characteristics of entertainment, readability, comfort, and 趣味性. Especially when digital interactive art enters the commercial field, only by standing from the user' s perspective in product design and dedicating efforts to providing users with wonderful experiences will it have a large user base and strong user stickiness. If artworks can provide both aesthetic enjoyment and game-like pleasure, and ultimately provide educational enlightenment that triggers deeper thinking, users will reach the peak of pleasant experiences. Therefore, interactive artists are dedicated to creating interactive artworks that encompass these characteristics.

1.6 Personalized Aesthetic Perception

Non-interactive artworks are presented to viewers only after completion, with their themes unchangeable—that is, regardless of viewers' opinions, they are discussed and judged as completed, fixed objects. However, the completeness

of interactive artworks requires viewers to jointly complete them during interaction. Due to differences in viewers' artistic cognition, imagination ability, and behavior methods, the final completed works will inevitably have varied forms. Traditional aesthetic principles and evaluation standards can only evaluate the partial state of artists' created works, making it difficult to comment on the complete state of works after viewer participation. Only later through collecting viewer feedback data can further data analysis be conducted. The experience viewers gain during the interaction process brings immediate aesthetic perception. In the process of perfecting the artwork, each person ultimately forms their own unique version of the artwork. Digital interactive art allows viewers to have thousand-faced artistic experiences and personalized aesthetic perceptions.

2. Value Manifestation of Digital Interactive Art

The breakthrough of digital interactive art relative to traditional art lies in the introduction of the interactive concept. Technology itself is only a means to achieve interaction, while interaction changes the inherent expression paradigm of traditional art. Strong interactivity is not only a characteristic of digital interactive art but also its exploration direction.

In the two-way interactive mode of digital interactive art, viewers experience and participate in works through multi-dimensional senses. Within the framework of the artwork, they become both aesthetic participants and constituent elements of the work, enriching sensory experiences while also becoming determinants of the artwork' s final presentation. Digital interactive art breaks the two-dimensional limitations of traditional art, changing artistic creation methods, dissemination methods, and reception methods. It simultaneously possesses characteristics of trendiness, avant-garde nature, or criticality, opening up multi-directional aesthetic paradigms. Through participation in aesthetics, viewers obtain brand-new aesthetic satisfaction, bringing forth new aesthetic value. Its advocated aesthetic concepts of experience, participation, and integration align with contemporary public aesthetic expectations, achieving the aesthetic pursuit of appealing to both refined and popular tastes.

In traditional artworks, the boundaries between aesthetic subjects and objects are clear, with artists as information senders and viewers as information receivers. In digital interactive art, the concept of viewers as the main body is its core concept. Viewers have partial control over the artwork, blurring the boundaries between aesthetic subjects and objects. Digital interactive artworks are no longer single outputs of artists' aesthetics. After integrating viewers' emotions, they possess higher display value and experiential value. Digital interactive art actively embraces audiences with "open" artworks, possesses distinct public characteristics, brings the concept of art sharing, promotes the dissemination of aesthetic education and culture, and advances the democratization of art, thus possessing high social value.

Digital interactive art possesses strong applicability and comprehensiveness. While creating brand-new experiences for viewers, it also brings new inspiration for innovation in commercial advertising. The establishment and growth of commercial brands have always relied on the most advanced media technology and production techniques. History proves that cutting-edge media technology is always first applied in commercial fields, and digital interactive technology is no exception. In brand communication, the creation team generally first produces original creations, and then the marketing team, based on brand positioning and characteristics, comprehensively designs relevant digital interactive artworks, hoping to increase customer traffic through wonderful ideas and novel entry points. Digital media art emphasizes viewing methods and integration effects, stimulates entertainment spirit, and effectively stimulates consumers' emotions by leveraging its connectivity and interactive nature, starting from user experience.

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