From Physical to Virtual: Research on Art Exhibition Paradigm, Art History Inheritance and Intelligent Aesthetics in the New Era

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Abstract. In the context of rapid digital transformation, the integration of artificial intelligence, extended reality, and platform technologies is fundamentally reshaping the paradigms of art exhibitions, the transmission of art history, and the formation of aesthetic experience. This study systematically examines the transition from physical, space-centered exhibition models to data-driven and platform-based virtual environments, highlighting the emergence of decentralized, interactive, and globally accessible exhibition forms. By analyzing the evolution of virtual exhibition typologies, including immersive XR exhibitions, metaverse-based art spaces, and online digital museums, the research reveals how audience engagement is reconstructed through participatory mechanisms and user-generated content. Furthermore, the study explores the transformation of art historical transmission in the digital age, emphasizing the role of digital humanities, knowledge graphs, and artificial intelligence in enabling computable, visualized, and cross-temporal narratives of art history. In parallel, the concept of intelligent aesthetics is introduced to explain the shift from human-centered aesthetic judgment to algorithmically mediated and human–machine collaborative creation processes. From a cultural economy perspective, the paper investigates the reconfiguration of value creation and distribution mechanisms in digital art markets, including platform-based revenue models, NFT ecosystems, and the growing significance of user participation in co-creating cultural value. Based on these analyses, the study proposes an integrated three-layer analytical framework encompassing technological infrastructure, cultural logic, and economic systems, offering a comprehensive approach to understanding the interplay between virtual exhibitions, art historical reconstruction, and intelligent aesthetics. The findings contribute to expanding theoretical discourse in digital cultural economy and provide practical insights for museums, creative industries, and policy development in the era of intelligent media.

Keywords: Virtual Exhibition; Intelligent Aesthetics; Digital Art; Cultural Economy; Art History Transmission; AIGC; Platform Economy; Digital Humanities; NFT; Metaverse Art

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1 Introduction

1.1 Research Background

In recent years, rapid advancements in digital technologies have profoundly reshaped the modes of artistic production, dissemination, and exhibition. Traditional art exhibitions, historically rooted in physical spaces such as museums and galleries, are increasingly transitioning toward virtual and hybrid environments. This transformation is largely driven by the integration of emerging technologies, including extended reality (XR), virtual reality (VR), artificial intelligence-generated content (AIGC), and metaverse-based platforms [6][5]. These technologies enable the reconstruction of exhibition spaces beyond physical constraints, allowing artworks to be experienced in immersive, interactive, and globally accessible formats.

The rise of virtual exhibitions reflects a broader paradigm shift from "space-based display" to "data-driven and platform-oriented presentation." Unlike conventional exhibitions that rely on spatial authority and curatorial control, virtual exhibitions offer decentralized access and participatory engagement, reshaping the relationship between artworks, audiences, and institutions [2][3]. In particular, XR technologies facilitate new forms of sensory interaction, while AI-driven systems enable dynamic content generation and personalized user experiences, significantly enhancing the expressive capacity of digital art environments [6][1].

At the same time, the global cultural industry is undergoing a structural transformation characterized by the convergence of the digital economy and the creative economy. Digital platforms, online art markets, and blockchain-based systems have introduced new mechanisms for value creation and distribution in the art world. Virtual exhibitions are no longer merely supplementary to physical displays but are becoming integral components of cultural production and consumption ecosystems [4]. This evolution highlights the increasing importance of technological infrastructure, user engagement, and data circulation in shaping contemporary art practices.

Furthermore, the digitalization of cultural heritage and museum collections has accelerated the transition toward "digital museums" and "virtual heritage spaces." These developments not only enhance preservation and accessibility but also redefine how art historical knowledge is constructed and disseminated [1][4]. As a result, the boundaries between exhibition, archive, and education are becoming increasingly blurred, giving rise to new interdisciplinary research domains that intersect art history, media studies, and cultural economics.

1.2 Research Problem

Despite the rapid development of virtual exhibition technologies, several critical theoretical and practical issues remain insufficiently addressed.

First, the transition from physical to virtual exhibition raises fundamental questions regarding the ontology and value structure of art. Traditional aesthetic theories emphasize the materiality, authenticity, and spatial presence of artworks. However, digital reproduction and virtual presentation challenge these notions by introducing issues

such as reproducibility, simulation, and algorithmic mediation. Whether virtual exhibitions fundamentally alter the "being" of art and its value system remains a key unresolved question.

Second, the transmission of art historical knowledge in digital contexts presents new challenges. While digital technologies enable large-scale digitization and visualization of artworks, they also transform the ways in which historical narratives are constructed and interpreted. The integration of databases, knowledge graphs, and AI-based analysis tools has led to the emergence of "computational art history," raising questions about the balance between technological efficiency and humanistic interpretation [4][1].

Third, the concept of "intelligent aesthetics" has emerged alongside the development of AIGC and algorithmic systems. In this context, aesthetic experience is increasingly mediated by algorithms, data models, and human–machine interaction. This shift challenges traditional subject-centered aesthetic theories and calls for a re-examination of aesthetic paradigms in the age of artificial intelligence. Whether intelligent aesthetics constitutes a new paradigm or an extension of existing theories remains an open debate.

1.3 Research Objectives

In response to the above issues, this paper aims to provide a comprehensive review and theoretical synthesis of the transformation of art exhibition paradigms in the digital age, with a particular focus on cultural and economic perspectives.

First, the study seeks to systematically examine the evolution from physical exhibitions to virtual and hybrid exhibition models. By analyzing technological drivers, curatorial practices, and audience experiences, the paper aims to clarify the structural characteristics and development trajectories of contemporary exhibition paradigms.

Second, the research aims to investigate the mechanisms of art historical knowledge reproduction in digital environments. This includes exploring how digital tools, platforms, and data infrastructures reshape the organization, interpretation, and dissemination of art historical information.

Third, the paper aims to construct an integrated analytical framework that combines intelligent aesthetics with cultural economy. By linking technological innovation, aesthetic transformation, and economic value creation, the study seeks to provide a holistic understanding of the interplay between art, technology, and market dynamics in the digital era.

1.4 Research Methods

This study adopts a multidisciplinary research approach that integrates qualitative and quantitative methods.

First, a bibliometric analysis is conducted to identify key research trends, influential publications, and thematic structures in the field of virtual exhibitions and digital art. By utilizing academic databases and visualization tools, the study systematically maps the evolution of scholarly discourse [4].

Second, a comprehensive interdisciplinary literature review is carried out, drawing on theories and research from art history, media studies, digital humanities, and cultural economics. This approach enables a holistic understanding of the complex interactions between technology, aesthetics, and socio-economic factors.

Third, case studies of representative virtual exhibition platforms and digital art projects are analyzed to illustrate practical applications and emerging trends. These cases include virtual museums, immersive exhibition environments, and metaverse-based art spaces, which demonstrate the real-world implications of theoretical developments [5][3].

Through the combination of these methods, the study aims to bridge the gap between theoretical analysis and practical application, providing a robust foundation for future research in this interdisciplinary field.

1.5 Structure of the Paper

The remainder of this paper is organized as follows. Chapter 2 reviews the existing literature on art exhibition paradigms, digital art, and cultural economy, identifying key research gaps. Chapter 3 analyzes the transformation of exhibition paradigms from physical to virtual environments, focusing on technological, experiential, and economic dimensions. Chapter 4 examines the transmission and reconstruction of art historical knowledge in digital contexts. Chapter 5 explores the concept of intelligent aesthetics and its implications for cultural economy and value creation. Finally, Chapter 6 summarizes the main findings, discusses theoretical contributions and practical implications, and outlines directions for future research.

2 Literature Review

2.1 Art Exhibition Paradigm Evolution

The evolution of art exhibition paradigms reflects broader transformations in cultural production, spatial theory, and audience engagement. Traditionally, museums and galleries have functioned as authoritative spaces for the presentation and interpretation of art, often structured around the concept of the “White Cube.” This model emphasizes neutrality, spatial purity, and the isolation of artworks from external contexts, thereby reinforcing institutional control and curatorial authority. Within this paradigm, the exhibition space operates as a controlled environment in which meaning is constructed through spatial arrangement and curatorial narrative.

However, since the late twentieth century, this paradigm has been increasingly challenged by the rise of experiential and participatory exhibition practices. Influenced by developments in media art, installation art, and performance art, exhibitions have shifted from static displays toward immersive environments that prioritize sensory engagement and audience interaction. The emergence of “experience economy” frameworks has further reinforced this shift, positioning exhibitions as cultural events that generate emotional and cognitive experiences rather than merely presenting objects.

In recent years, digital technologies have accelerated the transformation of exhibition paradigms, giving rise to virtual exhibitions and online museums. These formats transcend the physical limitations of traditional exhibition spaces, enabling global accessibility and flexible modes of interaction. Virtual exhibitions often integrate multimedia elements, interactive interfaces, and real-time data, creating dynamic environments in which users can navigate, explore, and even co-create content. At the same time, online museum platforms have expanded the reach of cultural institutions, allowing them to engage with diverse audiences beyond geographical boundaries.

Despite these advancements, the transition from physical to virtual exhibition raises important questions regarding spatial authenticity, curatorial authority, and the role of institutions. While virtual exhibitions offer new possibilities for accessibility and innovation, they also challenge established norms of exhibition design and interpretation, necessitating a re-evaluation of the fundamental principles underlying exhibition practices.

2.2 Digital Art and Intelligent Aesthetics

The development of digital art has been closely intertwined with technological innovation, leading to the emergence of new forms of artistic expression and aesthetic experience. In particular, the advent of AIGC (Artificial Intelligence Generated Content) has introduced a paradigm shift in artistic production. Unlike traditional digital art, which relies on human-directed software tools, AIGC systems utilize machine learning models to autonomously generate visual, auditory, and textual content. This process fundamentally alters the relationship between artist, tool, and artwork, transforming creative practice into a collaborative interaction between human intention and algorithmic processes.

Within this context, the concept of algorithmic aesthetics has gained increasing attention. Algorithmic aesthetics refers to the study of aesthetic principles embedded within computational systems, including pattern recognition, generative rules, and data-driven visual structures. Rather than focusing solely on the subjective perception of beauty, this approach emphasizes the role of algorithms as active agents in shaping aesthetic outcomes. As a result, aesthetic evaluation becomes partially quantifiable and reproducible, raising new theoretical questions about creativity, originality, and authorship.

Furthermore, human–machine collaborative creation has emerged as a dominant mode in contemporary digital art. In this model, artists act as designers, curators, or supervisors of generative processes, guiding the behavior of AI systems while allowing for a degree of autonomy and unpredictability. This collaborative framework challenges traditional notions of artistic authorship, as the final output is often the result of iterative interactions between human input and machine-generated variations.

The rise of intelligent aesthetics thus reflects a broader transformation in aesthetic theory, shifting from human-centered perception toward distributed agency involving both humans and machines. This shift necessitates a rethinking of key aesthetic concepts, including creativity, intentionality, and aesthetic judgment, within the context of technological mediation.

2.3 Art History Transmission in Digital Context

The digital transformation of art history has given rise to new methodologies and research paradigms, particularly within the field of digital humanities. Digital humanities approaches apply computational tools and data-driven methods to the study of cultural and historical phenomena, enabling large-scale analysis and visualization of artistic data. In the context of art history, this has led to the development of digital archives, image databases, and interactive platforms that facilitate the preservation and dissemination of cultural heritage.

One significant development in this area is the use of visualization techniques to represent art historical data. Through network analysis, timeline mapping, and spatial visualization, researchers can identify patterns, relationships, and trends that are not easily observable through traditional methods. These tools enable a more dynamic and multidimensional understanding of art history, allowing for the exploration of connections across time, geography, and artistic movements.

In addition, the construction of structured databases has played a crucial role in organizing and standardizing art historical information. These databases often integrate metadata, high-resolution images, and contextual information, providing comprehensive resources for both researchers and the general public. As a result, art historical knowledge becomes more accessible and interoperable, supporting new forms of scholarly inquiry and public engagement.

Another emerging approach is the application of knowledge graphs in art history. Knowledge graphs model relationships between entities such as artists, artworks, periods, and styles, enabling semantic analysis and automated reasoning. This approach enhances the ability to uncover hidden connections and generate new insights, while also supporting advanced search and recommendation systems.

However, the digitalization of art history also raises critical concerns. The reliance on computational methods may lead to the reduction of complex cultural phenomena into quantifiable data, potentially overlooking interpretive nuances. Moreover, issues related to data bias, representation, and cultural diversity must be carefully considered to ensure that digital art history remains inclusive and contextually grounded.

2.4 Cultural Economy and Creative Industries

The intersection of art, technology, and economy has become increasingly prominent in the context of digital transformation. Cultural economy and creative industries provide a framework for understanding how artistic production is embedded within broader systems of value creation, distribution, and consumption. In the digital era, these systems are undergoing significant restructuring, driven by technological innovation and changing market dynamics.

One key aspect of this transformation is the reconfiguration of the cultural industry value chain. Traditional models, which emphasize production, distribution, and consumption as distinct stages, are being replaced by more integrated and networked structures. Digital platforms enable direct interaction between creators and audiences, reducing the role of intermediaries and facilitating new forms of value exchange. This

shift has led to the emergence of participatory culture, in which users actively contribute to content creation and dissemination.

The rise of NFTs (Non-Fungible Tokens) and blockchain technology has further transformed the digital art market. NFTs provide a mechanism for establishing ownership and provenance of digital artworks, addressing long-standing challenges related to authenticity and scarcity in digital environments. At the same time, they introduce new economic models based on tokenization, decentralized transactions, and programmable royalties. These developments have attracted significant attention from both artists and investors, although they also raise concerns regarding market volatility, speculation, and sustainability.

Platform economy plays a central role in shaping contemporary art dissemination. Social media platforms, online galleries, and digital marketplaces serve as key channels for artistic exposure and audience engagement. These platforms operate through algorithmic recommendation systems, which influence visibility and access to cultural content. As a result, the distribution of artistic value is increasingly mediated by platform logics, including data analytics, user behavior, and network effects.

Overall, the integration of digital technologies into cultural economy has expanded the scope of artistic practice while also introducing new challenges related to governance, equity, and cultural sustainability. Understanding these dynamics is essential for analyzing the evolving relationship between art and economy in the digital age.

2.5 Research Gaps

Although existing studies have made significant contributions to the understanding of virtual exhibitions, digital art, and cultural economy, several important gaps remain.

First, there is a lack of integrated research that simultaneously addresses exhibition paradigms, art historical transmission, and economic structures. Most studies focus on one or two of these dimensions in isolation, resulting in fragmented analyses that fail to capture the complex interactions between technology, culture, and economy. A comprehensive framework that bridges these domains is needed to provide a more holistic understanding of contemporary art ecosystems.

Second, the concept of intelligent aesthetics remains under-theorized. While numerous studies have explored AI-generated art and algorithmic creativity, there is still no unified theoretical framework that systematically defines and explains intelligent aesthetics. Key issues such as the role of algorithms in aesthetic judgment, the reconfiguration of authorship, and the implications for cultural value require further theoretical development.

Third, the economic evaluation of virtual exhibitions is still insufficiently developed. Although virtual exhibitions offer clear advantages in terms of accessibility and scalability, their economic impact is not yet fully understood. Existing research often focuses on technological aspects or user experience, with limited attention to cost structures, revenue models, and long-term sustainability. Developing robust evaluation frameworks for virtual exhibition economics is therefore an important area for future research.

In summary, addressing these gaps requires an interdisciplinary approach that integrates insights from art theory, digital technology, and economic analysis. Such an approach will contribute to a more comprehensive understanding of the transformation of art in the digital era and support the development of sustainable and innovative cultural practices.

3 Transformation of Exhibition Paradigm

3.1 From Physical Space to Digital Space

The transformation from physical exhibition spaces to digital environments represents a fundamental shift in the ontology, structure, and governance of art exhibitions. Traditional exhibitions are deeply rooted in physical space, where museums and galleries function as authoritative institutions that shape artistic meaning through spatial organization and curatorial narratives. In this context, exhibition design is closely tied to architectural constraints, spatial sequencing, and the physical presence of artworks. The authority of curators is reinforced by their control over spatial arrangement, interpretive frameworks, and audience pathways.

Within physical exhibition settings, space operates not merely as a neutral container but as an active medium of meaning production. The arrangement of artworks, lighting conditions, and visitor circulation patterns collectively construct a curated experience that guides interpretation and reinforces institutional legitimacy. This spatial authority also contributes to the symbolic value of art, as the physical presence of artworks in prestigious institutions enhances their cultural and economic significance.

In contrast, virtual exhibitions fundamentally alter these dynamics by decoupling exhibition practices from physical space. Digital environments enable exhibitions to exist as data-driven, networked systems that are not constrained by geography or material limitations. As a result, the exhibition space becomes fluid, scalable, and accessible across multiple platforms and devices.

One of the defining characteristics of virtual exhibitions is decentralization. Unlike traditional models, where institutions serve as central authorities, digital platforms facilitate distributed participation among artists, curators, and audiences. This shift reduces institutional gatekeeping and enables more diverse forms of artistic expression. At the same time, the rise of platformization introduces new forms of control, as digital infrastructures and algorithms mediate access, visibility, and interaction.

The transition from physical to digital space thus involves a reconfiguration of power relations within the art world. While traditional exhibitions emphasize institutional authority and spatial hierarchy, virtual exhibitions are shaped by platform logics, data flows, and network dynamics. This transformation highlights the need to reconsider the role of space, authority, and mediation in contemporary exhibition practices.

3.2 Virtual Exhibition Typologies

The diversification of digital technologies has led to the emergence of multiple types of virtual exhibitions, each characterized by distinct technological infrastructures, aesthetic strategies, and user experiences.

One major category is VR/AR-based immersive exhibitions. These exhibitions utilize virtual reality and augmented reality technologies to create highly immersive environments in which users can explore artworks in three-dimensional space. VR exhibitions often simulate physical galleries or construct entirely fictional environments, allowing for creative freedom in spatial design. AR exhibitions, on the other hand, overlay digital content onto physical surroundings, creating hybrid experiences that blend real and virtual elements. These immersive formats emphasize sensory engagement and spatial interaction, offering users a more embodied experience compared to traditional viewing modes.

Another important category is metaverse-based art exhibitions. The metaverse represents a persistent, shared virtual environment in which users interact through digital avatars. Within this context, art exhibitions are integrated into broader social and economic ecosystems, including virtual marketplaces, social networks, and gaming environments. Metaverse exhibitions are characterized by their emphasis on social interaction, real-time participation, and economic exchange. Users are not only spectators but also participants who can attend events, purchase digital artworks, and engage in collaborative activities. This integration of exhibition, socialization, and commerce reflects a convergence of cultural and economic functions within virtual spaces.

Online digital museums constitute a more institutionalized form of virtual exhibition. These platforms are typically developed by museums and cultural organizations to digitize and present their collections. Unlike immersive or metaverse-based exhibitions, online museums often prioritize accessibility, education, and archival functions. They provide structured interfaces for browsing collections, accessing contextual information, and engaging with educational resources. While less immersive, these platforms play a crucial role in democratizing access to cultural heritage and supporting lifelong learning.

These typologies demonstrate that virtual exhibitions are not a homogeneous phenomenon but rather a diverse set of practices shaped by different technological, institutional, and cultural factors. Understanding these distinctions is essential for analyzing the broader transformation of exhibition paradigms.

3.3 Economic Implications

The transformation of exhibition paradigms has significant economic implications, particularly within the context of digital and cultural economies. One of the most immediate effects is the reduction of costs associated with physical exhibitions. Virtual exhibitions eliminate expenses related to venue rental, transportation, insurance, and installation, making it more feasible for institutions and independent artists to organize

exhibitions. This cost efficiency lowers barriers to entry and encourages experimentation and innovation.

At the same time, virtual exhibitions expand the potential audience base by removing geographical constraints. Online platforms enable global access, allowing exhibitions to reach diverse audiences across different regions and cultural contexts. This expansion enhances the visibility and impact of artworks, while also creating opportunities for cross-cultural exchange and collaboration.

In addition, new revenue models have emerged within digital exhibition ecosystems. Subscription-based services, pay-per-view access, and virtual ticketing systems provide alternative sources of income for cultural institutions. The integration of NFTs and blockchain technology introduces mechanisms for monetizing digital artworks through tokenization and decentralized transactions. Artists can sell digital works directly to collectors, while smart contracts enable ongoing royalties from secondary sales.

Platform-based revenue models also play a crucial role. Digital platforms generate income through advertising, data monetization, and transaction fees, positioning themselves as intermediaries in the cultural economy. While these models create new opportunities for value creation, they also raise concerns regarding platform dominance, revenue distribution, and the commodification of cultural content.

Overall, the economic implications of virtual exhibitions highlight the interplay between technological innovation and market dynamics. While digital transformation offers significant opportunities for growth and diversification, it also requires careful consideration of sustainability, equity, and cultural value in the evolving art ecosystem.

4 Art History Transmission and Reconstruction

4.1 Digital Reproduction of Artworks

The digital reproduction of artworks has become a foundational practice in the transformation of art history in the digital age. Advances in high-resolution imaging, 3D scanning, and photogrammetry technologies have enabled the precise capture and reconstruction of artworks, including paintings, sculptures, and architectural heritage. These technologies allow for the creation of detailed digital surrogates that can be stored, transmitted, and displayed across various digital platforms.

One of the key implications of high-fidelity digital reproduction is the emergence of "digital substitutability." In many contexts, digital representations can partially or even functionally replace physical artworks, particularly in educational, archival, and exhibition settings. Users can access artworks remotely, zoom into microscopic details, and explore multiple layers of information that are not accessible in traditional viewing environments. This enhances the analytical and pedagogical potential of art historical study.

However, the increasing reliance on digital reproductions also raises critical questions regarding authenticity. The concept of authenticity in art has traditionally been associated with originality, material presence, and historical continuity. Digital reproductions, by contrast, are inherently reproducible and detached from their original

material context. This raises concerns about the loss of aura, the fragmentation of historical meaning, and the potential homogenization of cultural artifacts.

At the same time, digital technologies challenge and expand the notion of authenticity by introducing new forms of "experiential authenticity." For example, immersive reconstructions of historical sites or digitally restored artworks can provide meaningful experiences that complement or even surpass physical encounters in certain respects. As a result, authenticity in the digital age becomes a dynamic and multi-layered concept, encompassing both material and experiential dimensions.

4.2 Knowledge Structuring in Digital Art History

The digital transformation of art history has significantly altered the ways in which knowledge is structured, organized, and interpreted. Traditional art historical research relies on linear narratives and textual analysis, often structured around chronological periods, stylistic movements, and individual artists. In contrast, digital environments enable more complex and multidimensional forms of knowledge representation.

Art historical databases play a central role in this transformation. These databases integrate large volumes of information, including images, metadata, provenance records, and scholarly interpretations. By standardizing and interlinking data, they facilitate systematic analysis and cross-referencing, allowing researchers to explore relationships between artworks, artists, and historical contexts more efficiently.

Knowledge graphs further enhance this capability by modeling semantic relationships between entities. In a knowledge graph, artworks, artists, locations, and historical events are represented as interconnected nodes, enabling advanced querying and pattern recognition. This structure supports the discovery of previously unnoticed connections and enables new forms of art historical analysis that go beyond traditional methods.

Another important development is the emergence of cross-temporal and cross-spatial narrative structures. Digital platforms allow for the integration of diverse datasets, enabling users to explore art history across different time periods and geographical regions simultaneously. This approach challenges linear and Eurocentric narratives, promoting a more inclusive and global perspective on art history.

However, the structuring of knowledge in digital environments also introduces challenges. The reliance on standardized data formats may oversimplify complex cultural phenomena, while the design of databases and knowledge systems may reflect implicit biases. Ensuring the accuracy, diversity, and contextual richness of digital art historical knowledge remains a critical task.

4.3 AI in Art Historical Research

Artificial intelligence has increasingly been integrated into art historical research, offering new tools for analysis, classification, and interpretation. One of the most prominent applications is image recognition and style analysis. Machine learning algorithms can analyze visual features such as color, texture, composition, and

brushwork, enabling the identification of stylistic patterns and the attribution of artworks.

These technologies have proven particularly useful in tasks such as detecting forgeries, reconstructing damaged artworks, and identifying influences between artists. By processing large datasets of images, AI systems can uncover correlations and patterns that may not be immediately apparent to human researchers. This enhances the efficiency and scope of art historical analysis.

Another important application is the automated classification of artworks. AI systems can categorize artworks based on style, period, genre, or thematic content, supporting the organization and retrieval of large collections. This capability is especially valuable for digital archives and museum databases, where manual classification would be time-consuming and resource-intensive.

Despite these advantages, the use of AI in art history also raises important methodological and epistemological questions. AI systems rely on training data and predefined models, which may introduce biases and limit interpretive flexibility. Moreover, the emphasis on quantitative analysis may overlook the qualitative and contextual dimensions of art, which are central to humanistic inquiry.

Therefore, the integration of AI into art historical research should be understood as a complementary tool rather than a replacement for traditional methods. A balanced approach that combines computational analysis with critical interpretation is essential for maintaining the depth and rigor of art historical scholarship.

4.4 Cultural Heritage and Economic Value

The digital transformation of art history is closely linked to the preservation and utilization of cultural heritage, with significant implications for economic value creation. Digital technologies enable the documentation, preservation, and restoration of cultural artifacts, ensuring their longevity and accessibility for future generations. This is particularly important for fragile or endangered heritage sites, where digital reproduction can serve as a safeguard against loss or damage.

Digital cultural heritage also plays a key role in the development of cultural industries. By transforming cultural assets into digital resources, institutions and organizations can create new forms of cultural products and services. These include virtual exhibitions, digital archives, educational platforms, and interactive media experiences, all of which contribute to the diversification of cultural offerings.

The concept of cultural intellectual property (IP) has become increasingly important in this context. Digital representations of artworks and heritage sites can be developed into branded cultural products, including digital collectibles, virtual experiences, and multimedia content. This process of digital redevelopment enables the commercialization of cultural heritage while also enhancing its visibility and cultural impact.

At the same time, the economic exploitation of cultural heritage raises important ethical and governance issues. Balancing commercial interests with cultural preservation requires careful consideration of ownership, authenticity, and public access. Ensuring that economic benefits are distributed fairly and that cultural values are respected is essential for sustainable development.

In summary, the transmission and reconstruction of art history in the digital age involve a complex interplay between technology, culture, and economy. By integrating digital tools with cultural and economic strategies, it is possible to create new forms of value while preserving the richness and diversity of cultural heritage.

5 Intelligent Aesthetics and Cultural Economy

5.1 Concept of Intelligent Aesthetics

The emergence of intelligent aesthetics represents a fundamental transformation in aesthetic theory under the conditions of digital and algorithmic mediation. Traditional aesthetic frameworks are largely grounded in human-centered perception, emphasizing subjective experience, emotional response, and cultural interpretation. In this paradigm, the aesthetic subject is an autonomous human agent, and artistic value is derived from the interplay between creator intention and audience perception.

However, the integration of artificial intelligence and computational systems into artistic production and dissemination has given rise to a new form of "algorithm-driven aesthetics." In this context, aesthetic outcomes are no longer solely determined by human creativity but are increasingly shaped by data models, machine learning algorithms, and generative processes. Algorithms actively participate in the formation of visual structures, stylistic patterns, and compositional logic, thereby functioning as co-agents in the aesthetic process.

This shift necessitates a reconfiguration of the aesthetic subject. Rather than a singular human observer or creator, the aesthetic subject becomes a distributed entity composed of human and machine actors. Human–machine collaboration introduces new dynamics of creativity, where artists guide and curate algorithmic processes, while machines generate variations and explore possibilities beyond human intuition. As a result, authorship becomes hybridized, and aesthetic agency is shared across human and non-human entities.

Furthermore, intelligent aesthetics challenges traditional criteria of evaluation. Concepts such as originality, intentionality, and authenticity must be reconsidered in light of algorithmic generation and reproducibility. The aesthetic experience is increasingly mediated by interfaces, data flows, and interactive systems, leading to a more process-oriented and participatory understanding of art. This transformation positions intelligent aesthetics as a key theoretical framework for analyzing artistic practices in the digital age.

5.2 AIGC and Artistic Production

AIGC (Artificial Intelligence Generated Content) has fundamentally reshaped the logic of artistic production by introducing generative mechanisms that operate beyond conventional creative processes. Unlike traditional artistic methods, which rely on manual techniques and direct human control, AIGC systems generate content through probabilistic modeling, pattern recognition, and iterative computation. These systems

are trained on large datasets, enabling them to synthesize new visual forms based on learned patterns and stylistic features.

The creative process in AIGC-based art can be understood as a multi-stage interaction between human input and machine generation. Artists provide prompts, parameters, or datasets, which serve as initial conditions for the generative process. The AI system then produces outputs that may vary in style, composition, and meaning, often requiring further selection, refinement, and curation by the human user. This iterative process blurs the boundaries between creation and selection, emphasizing the role of decision-making and interpretation.

As a result, the role of the artist undergoes a significant transformation. Instead of being the sole creator of artworks, artists increasingly function as designers, curators, or orchestrators of generative systems. They define conceptual frameworks, guide algorithmic behavior, and curate outputs, shaping the final work through a combination of intentional control and openness to machine-generated variation. This shift reflects a broader transition from "making" to "managing" creative processes.

At the same time, AIGC raises important questions regarding authorship, ownership, and intellectual property. The collaborative nature of human–machine creation complicates traditional notions of authorship, while the use of training data introduces issues related to data ownership and ethical use. Addressing these challenges requires new theoretical and legal frameworks that can accommodate the complexities of algorithmic creativity.

5.3 Platform Economy and Art Market

The rise of digital platforms has profoundly transformed the structure and dynamics of the art market, giving rise to a platform-based cultural economy. Digital platforms serve as intermediaries that connect artists, audiences, collectors, and institutions, facilitating the production, distribution, and consumption of artistic content. These platforms operate through network effects, data analytics, and algorithmic recommendation systems, which shape the visibility and valuation of artworks.

One of the most significant developments in this context is the emergence of NFT-based art markets. NFTs (Non-Fungible Tokens) provide a technological mechanism for establishing ownership and provenance of digital artworks through blockchain systems. By introducing scarcity and traceability into digital environments, NFTs enable the monetization of digital art in ways that were previously difficult to achieve. Artists can sell their works directly to collectors, while smart contracts allow for automated royalty payments on secondary sales.

The platformization of the art market also leads to changes in value evaluation mechanisms. Traditional art markets rely on institutional validation, expert judgment, and historical significance to determine value. In contrast, digital platforms incorporate data-driven metrics such as user engagement, social media visibility, and transaction frequency. These metrics influence market dynamics, often prioritizing popularity and virality over traditional criteria of artistic merit.

While platform-based markets create new opportunities for artists and collectors, they also introduce challenges related to market volatility, speculation, and inequality.

The concentration of power within major platforms raises concerns about monopolization and the distribution of economic benefits. Moreover, the reliance on algorithmic systems may reinforce existing biases and limit diversity in artistic representation.

Understanding the role of platform economy is therefore essential for analyzing the intersection of technology, art, and market structures in the digital era.

5.4 Integrated Analytical Framework

To comprehensively understand the transformation of art in the digital age, this study proposes an integrated analytical framework that synthesizes technological, cultural, and economic dimensions. This three-layer model provides a structured approach for analyzing the complex interactions between intelligent aesthetics and cultural economy.

The first layer is the technological layer, which includes key enabling technologies such as artificial intelligence, extended reality (XR), and blockchain. These technologies provide the infrastructure for digital creation, interaction, and transaction, shaping the possibilities and limitations of artistic practices. AI drives generative processes and data analysis, XR enables immersive experiences, and blockchain supports decentralized ownership and value exchange.

The second layer is the cultural layer, which encompasses art history, aesthetic theory, and cultural narratives. This layer focuses on how digital technologies influence the production and interpretation of meaning, as well as the transmission of cultural knowledge. Intelligent aesthetics operates within this layer, redefining concepts of creativity, authorship, and aesthetic experience in the context of human–machine collaboration.

The third layer is the economic layer, which involves market structures, platform dynamics, and value creation mechanisms. This layer examines how digital transformation reshapes the cultural economy, including the emergence of new business models, revenue streams, and forms of economic interaction. Platform economy and NFT markets are key components of this layer, illustrating the integration of art and digital finance.

The interactions between these three layers are dynamic and mutually constitutive. Technological innovations influence cultural practices, which in turn shape economic structures, while market dynamics drive further technological development and cultural adaptation. By integrating these dimensions, the proposed framework provides a comprehensive lens for analyzing the evolving relationship between art, technology, and economy.

This integrated approach not only contributes to theoretical understanding but also offers practical implications for artists, institutions, and policymakers. It highlights the importance of interdisciplinary collaboration and provides a foundation for developing sustainable and innovative strategies in the digital cultural sector.

6 Conclusion and Future Directions

6.1 Key Findings

This study has systematically examined the transformation of art exhibition paradigms, the reconstruction of art historical transmission, and the emergence of intelligent aesthetics within the broader context of digital and cultural economy. Several key findings can be summarized.

First, the paradigm of art exhibitions has shifted from a space-dominated model to a data- and platform-driven model. Traditional exhibitions, centered on physical spaces and institutional authority, are increasingly being replaced or supplemented by virtual and hybrid formats. In these new environments, data infrastructures, algorithmic systems, and digital platforms play a central role in shaping exhibition design, audience engagement, and value distribution. This transformation reflects a broader shift in cultural production toward networked and decentralized systems.

Second, art history has entered a stage characterized by computability and visualization. The integration of digital technologies, including databases, knowledge graphs, and artificial intelligence, has enabled new methods for organizing, analyzing, and presenting art historical knowledge. These developments facilitate large-scale analysis and cross-disciplinary research, while also expanding public access to cultural heritage. At the same time, they redefine the epistemological foundations of art history, moving from narrative-based interpretation toward data-informed and multi-dimensional analysis.

Third, intelligent aesthetics has emerged as a new aesthetic paradigm. The integration of AI and generative technologies into artistic production has transformed the nature of creativity, authorship, and aesthetic experience. Aesthetic processes are increasingly mediated by algorithms and human–machine collaboration, leading to a distributed model of creative agency. This shift challenges traditional aesthetic theories and calls for the development of new conceptual frameworks that can account for the role of technology in shaping artistic practices.

6.2 Theoretical Contributions

This study makes several theoretical contributions to the interdisciplinary fields of art theory, digital humanities, and cultural economy.

First, it proposes an integrated analytical framework that connects virtual exhibition paradigms, art historical transmission, and intelligent aesthetics. By synthesizing these three dimensions, the study moves beyond fragmented approaches and provides a comprehensive perspective on the transformation of art in the digital age. This framework highlights the interdependence of technological, cultural, and economic factors, offering a structured model for future research.

Second, the study extends cultural economy research into the domain of digital art and virtual exhibitions. While traditional cultural economy studies have focused on physical cultural industries, this research emphasizes the role of digital platforms, data-driven systems, and emerging technologies in shaping new forms of value crea-

tion. By incorporating concepts such as platform economy, user participation, and algorithmic mediation, the study contributes to a more nuanced understanding of contemporary cultural production.

Third, the paper advances the theoretical discussion of intelligent aesthetics. By conceptualizing aesthetics as a process involving both human and machine agents, it challenges conventional human-centered frameworks and introduces a new perspective on aesthetic agency. This contribution provides a foundation for further exploration of the relationship between technology and aesthetic experience.

6.3 Limitations

Despite its contributions, this study has several limitations that should be acknowledged.

First, the analysis is constrained by the regional and contextual scope of available case studies. While the study aims to provide a global perspective, many examples are drawn from regions with advanced digital infrastructures, potentially limiting the generalizability of the findings. Future research should incorporate more diverse cultural and geographical contexts to achieve a more comprehensive understanding.

Second, the rapid pace of technological development introduces a degree of uncertainty. Technologies such as artificial intelligence, blockchain, and the metaverse are evolving quickly, and their long-term implications for art and cultural economy remain unclear. As a result, some of the conclusions presented in this study may require revision as new developments emerge.

Third, the interdisciplinary nature of the research, while a strength, also presents challenges in terms of depth and specialization. Balancing insights from art theory, technology studies, and economics may lead to trade-offs in the level of detail within each domain. Further research focusing on specific aspects of the framework could provide more in-depth analysis.

6.4 Future Research

Building on the findings and limitations of this study, several directions for future research can be identified.

First, the development of metaverse-based art ecosystems represents a promising area for further investigation. Future studies can explore how virtual environments integrate artistic production, social interaction, and economic exchange, as well as the implications for cultural identity and community formation.

Second, ethical issues related to artificial intelligence and art require deeper examination. Topics such as authorship, data usage, bias in algorithmic systems, and the protection of intellectual property are critical for the responsible development of intelligent aesthetics. Interdisciplinary research involving law, ethics, and technology studies will be essential in addressing these challenges.

Third, the mechanisms of cross-cultural digital art dissemination warrant further exploration. As digital platforms enable global circulation of artistic content, understanding how cultural differences influence interpretation, reception, and value creation

becomes increasingly important. Research in this area can contribute to more inclusive and diverse digital cultural ecosystems.

Finally, future research may focus on the development of evaluation frameworks for virtual exhibitions and digital art markets. By integrating qualitative and quantitative approaches, such frameworks can provide more accurate assessments of cultural, social, and economic impact, supporting evidence-based decision-making in the cultural sector.

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