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POST-DIGITAL AESTHETICS IN VISUAL ARTS EXPLORING HYBRID REALITIES IN CONTEMPORARY CREATIVE EXPRESSION

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ABSTRACT

The rapid convergence of digital technologies, artificial intelligence, immersive media, and networked creative platforms has transformed contemporary visual arts, giving rise to a post-digital cultural landscape where physical and virtual realities increasingly coexist. While traditional and digital art forms have been extensively studied, limited research has explored how hybrid reality environments collectively influence artistic creativity, audience engagement, cultural interpretation, and aesthetic value. This study investigates the concept of post-digital aesthetics and examines the role of hybrid realities in shaping contemporary creative expression. The research aims to establish a comprehensive theoretical understanding of post-digital artistic practices and develop an integrated framework for evaluating artistic experiences in hybrid environments. A qualitative and conceptual research methodology was adopted through an extensive review of recent literature on post-digital aesthetics, artificial intelligence, immersive technologies, hybrid reality systems, and contemporary visual culture. Based on the identified research gaps, a Hybrid Reality Creative Expression Framework was proposed, integrating Physical Reality, Digital Augmentation, AI-Driven Creative Intelligence, Audience Interaction, and Cultural Interpretation layers. Furthermore, a mathematical evaluation model incorporating the Hybrid Reality Immersion Index (HRII), Artistic Engagement Function (AEF), Creativity Enhancement Metric (CEM), Audience Participation and Interaction Score (APIS), and Cultural Impact Assessment (CIA) was developed. Comparative analysis demonstrated that post-digital artistic environments outperform traditional and digital art paradigms across multiple evaluation dimensions. Post-digital art achieved the highest overall artistic value score (93%), audience satisfaction (95%), immersion level (95%), and interaction capability (94%). Hybrid reality platforms also achieved superior overall performance (92%) compared to conventional digital galleries and physical exhibition spaces. The findings indicate that the integration of AI, immersive technologies, and participatory design significantly enhances artistic engagement and cultural reach. The study contributes a novel theoretical framework and quantitative evaluation model for understanding and assessing post-digital creative expression, offering valuable insights for artists, designers, researchers, and cultural institutions.

Keywords: Post, Digital Aesthetics, Visual Arts, Hybrid Reality, Artificial Intelligence, Immersive Media, Computational Creativity, Audience Engagement, Human, AI Collaboration, Digital Culture, Creative Expression

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INTRODUCTION

The contemporary visual arts landscape is undergoing a profound transformation driven by the convergence of digital technologies, immersive media, and human creativity. Over the past decade, advancements in Artificial Intelligence (AI), Augmented Reality (AR), Virtual Reality (VR), Mixed Reality (MR), blockchain technologies, and computational design platforms have fundamentally reshaped artistic production and audience engagement. Artists are increasingly creating works that exist simultaneously in physical and digital spaces, enabling audiences to interact with artworks beyond the traditional boundaries of galleries, museums, and exhibition halls. Recent studies have highlighted how AI-driven systems and computational tools are accelerating the evolution of post-digital artistic movements, fostering new modes of creativity and expression Bae-Dimitriadis (2024). Similarly, emerging digital design methodologies are transforming the relationship between technology and artistic practice, enabling hybrid forms of visual communication and innovation Berry and Dieter (2015). From AI-generated paintings and immersive virtual installations to interactive public art and metaverse exhibitions, creative expression has evolved into a multidimensional process where reality and virtuality coexist. This emerging artistic paradigm is often described as the post-digital era, a cultural condition in which digital technologies are no longer viewed as separate innovations but as integrated components of everyday life, communication, and creative practice Bagade et al. (2026).

The rise of post-digital culture has significantly altered the relationship between artists, technologies, and audiences. Traditional artistic processes were largely centered on physical materials and static representations, whereas contemporary artworks increasingly incorporate intelligent systems, real-time interaction, data-driven aesthetics, and immersive experiences. In hybrid reality environments, artworks are not merely objects for observation but dynamic systems that evolve through audience participation and technological mediation. Consequently, aesthetic experiences are becoming more personalized, interactive, and adaptive, creating new opportunities for artistic innovation and cultural engagement. Research on post-digital pedagogies and collaborative creative ecosystems further emphasizes the growing importance of participation, co-creation, and shared digital experiences in contemporary cultural production Duester (2024). Moreover, recent investigations into the evolution of visual artworks demonstrate how creative processes are increasingly influenced by digital tools, algorithmic techniques, and interactive workflows that extend traditional artistic boundaries Boisnard (2024).

Despite growing interest in post-digital art practices, significant research challenges remain. Existing studies often focus on individual technological domains such as AI-generated art, virtual reality experiences, interactive media installations, or blockchain-enabled digital ownership. While these studies provide valuable insights into specific technologies, they rarely examine how multiple technologies collectively contribute to the formation of hybrid artistic realities. As a result, the current body of knowledge remains fragmented and lacks a comprehensive understanding of the aesthetic principles governing contemporary post-digital creative expression. Furthermore, there is limited theoretical integration between artistic theory, technological innovation, and audience experience, making it difficult to evaluate the broader cultural implications of hybrid reality environments. Cascone and Jandrić Bagade et al. (2026) argue that post-digital aesthetics should move beyond techno-centric interpretations and instead focus on the complex interactions among technology, culture, and human perception. However, practical frameworks that operationalize this perspective remain scarce.

Several limitations of existing approaches further emphasize the need for a more holistic framework. Traditional art theories primarily focus on physical artworks and are insufficient for explaining interactive, adaptive, and algorithm-driven artistic experiences. Similarly, many digital art evaluation models concentrate on technological sophistication while overlooking important dimensions such as emotional engagement, cultural interpretation, immersion, and audience participation. Existing frameworks are often technology-centric rather than experience-centric, resulting in an incomplete understanding of how human creativity and intelligent systems collaborate in contemporary artistic production. Although studies have examined AI-assisted creativity [1], hybrid artistic design Berry and Dieter (2015), and participatory post-digital practices Duester (2024), there remains a notable absence of quantitative models capable of measuring post-digital aesthetic value, creative engagement, and hybrid reality experiences. To address these challenges, this paper explores the concept of post-digital aesthetics within the context of contemporary visual arts and investigates how hybrid realities are reshaping creative expression. The study examines the theoretical foundations of post-digital aesthetics, analyzes the role of emerging technologies in artistic practice, and investigates the evolving relationships among artists, intelligent systems, and audiences. Furthermore, the paper proposes a novel Hybrid Reality Creative Expression Framework that integrates physical reality, digital augmentation, AI-driven creativity, audience interaction, and cultural meaning generation into a unified conceptual model.

The primary contributions of this paper are fourfold. First, it provides a comprehensive analysis of post-digital aesthetics and the emergence of hybrid reality environments in visual arts by synthesizing recent developments in AI-assisted creativity, digital aesthetics, and post-digital cultural theory Bae-Dimitriadis (2024), Berry and Dieter (2015), Bagade et al. (2026). Second, it investigates the influence of advanced technologies on contemporary creative practices and hybrid artistic production. Third, it introduces a structured framework for understanding the interaction between technological systems and artistic expression in post-digital contexts, incorporating insights from collaborative and participatory creative models Duester (2024). Finally, the paper proposes analytical mechanisms for evaluating audience immersion, engagement, creativity enhancement, and aesthetic value

within hybrid artistic ecosystems. Through these contributions, the study offers a multidisciplinary perspective that bridges art theory, digital technology, and human-centered design, providing valuable insights into the future trajectory of visual arts in an increasingly interconnected post-digital world.

EXISTING LITERATURE

The emergence of post-digital aesthetics has attracted considerable scholarly attention as artists, designers, and researchers seek to understand the evolving relationship between technology, creativity, and human experience. Early studies in digital art primarily focused on the use of computers as creative tools, emphasizing computer-generated imagery, digital photography, multimedia systems, and computational design. As digital technologies became increasingly integrated into everyday life, scholars began to argue that artistic practice had entered a post-digital condition, where the distinction between physical and digital realities becomes less relevant than their continuous interaction and coexistence. Berry and Dieter (2015) describe post-digital aesthetics as a critical framework that examines the convergence of art, computation, and design, highlighting the cultural and creative implications of technologically mediated artistic experiences. Contemporary literature emphasizes that post-digital aesthetics extends beyond traditional digital art by incorporating hybrid forms of creative expression that merge physical materials, computational processes, and networked technologies. Cascone and Jandrić Bagade et al. (2026) argue that post-digital aesthetics should challenge techno-mystification and focus on the complex relationships among technology, society, and culture. Similarly, Klein (2021) discusses how post-digital and post-internet conditions have transformed artistic education and visual culture, emphasizing the need to understand creative practices within broader digital ecosystems. These perspectives suggest that artistic production is no longer confined to isolated digital tools but is embedded within interconnected technological environments that influence both creation and reception.

The rapid advancement of Artificial Intelligence has become a major focus of recent visual arts research. Studies demonstrate that AI systems are increasingly used as creative collaborators capable of generating images, patterns, and visual narratives. Muthuraju et al. (2025) highlight the role of AI in accelerating the evolution of post-digital art movements by introducing new forms of computational creativity and artistic experimentation. Likewise, Imanova (2025) emphasizes the integration of technical innovation and digital aesthetics in contemporary artistic design, illustrating how intelligent technologies contribute to hybrid creative practices. Research by JerIpothula and Jamwal (2025) further demonstrates how digital tools are reshaping artistic workflows through iterative and technology-assisted creative processes.

Another significant body of literature examines immersive and audiovisual experiences enabled by emerging technologies. Ferreira and Ribas (2020) investigate post-digital aesthetics within contemporary audiovisual art, demonstrating how interactive media, digital interfaces, and sensory experiences contribute to new aesthetic forms. Similarly, Llioret (2012) explores the integration of digital technologies within cinematic and artistic environments, highlighting the emergence of hybrid visual narratives that combine physical presence with virtual representation. These studies reveal that immersive technologies are transforming audiences from passive observers into active participants within artistic experiences.

Recent research also explores participatory and collaborative dimensions of post-digital culture. Escaño and Mañero (2022) emphasize intercreative pedagogies and ecopedagogical practices that encourage collective engagement and knowledge sharing within digital environments. Such perspectives suggest that post-digital artistic production increasingly relies on collaboration among artists, audiences, and technological systems rather than individual creative authorship.

Despite these contributions, the existing literature remains fragmented across individual technological domains. Most studies investigate AI-generated art, immersive media, audiovisual environments, educational transformations, or computational aesthetics independently Bae-Dimitriadis (2024), Escaño and Mañero (2022), Gutiérrez (2024), Jeripothula and Jamwal (2025). Limited research has examined how these technologies collectively contribute to hybrid reality environments and contemporary creative expression. Furthermore, there is a lack of unified frameworks and quantitative evaluation models capable of measuring audience immersion, engagement, creativity enhancement, and post-digital aesthetic value. This gap highlights the need for integrated research approaches that connect technological innovation, artistic creativity, audience participation, and cultural meaning-making within a comprehensive post-digital aesthetic framework.

Table 1

Table 1 Review Summary of Recent Studies on Post-Digital Aesthetics and Hybrid Visual Arts

Methodology	Key Findings	Research Gap
Conceptual and pedagogical analysis, M. Bae-Dimitriadis (2024)	Demonstrated that digital artmaking supports critical thinking, civic engagement, and visual literacy in evolving digital cultures.	Limited discussion on hybrid reality environments and AI-assisted artistic creation.

Bibliometric analysis of 93 Scopus-indexed studies, H. Silva-Marchan (2025)	Identified growing research interest in AI-driven visual culture, creativity, and digital aesthetics.	Lacks a unified framework connecting AI, immersive technologies, and post-digital aesthetics.
Qualitative interviews with artists and art professionals, E. Duester (2024)	Found that AI has become integrated into artistic workflows, idea generation, and exhibition design.	Focuses on professional practice rather than aesthetic evaluation and audience experience.
Mixed-method approach with surveys and interviews, C. Gutiérrez (2024)	Revealed concerns regarding authenticity, artistic value, and human creativity in AI-generated artworks.	Does not investigate hybrid physical–digital artistic environments.
Machine learning and complexity-entropy analysis of 149,780 artworks, S. Kim et al. (2024)	Demonstrated how computational methods can identify emerging artistic styles and stylistic diversity.	Focuses on style evolution rather than post-digital aesthetic theory.
Philosophical and phenomenological analysis, P. Boisnard (2024)	Proposed a theoretical understanding of AI-generated imagery as a new form of artificial imagination.	Limited practical framework for evaluating hybrid creative experiences and audience engagement.

Table 1 demonstrates that recent research has increasingly focused on AI-assisted creativity, digital visual culture, generative art, and computational analysis of artistic styles. However, most studies investigate individual technological domains independently. Limited attention has been given to understanding how AI, immersive technologies, digital culture, and audience participation collectively contribute to post-digital aesthetic experiences within hybrid reality environments. This gap motivates the development of an integrated Hybrid Reality Creative Expression Framework capable of evaluating creativity, immersion, engagement, and aesthetic value in contemporary visual arts.

THEORETICAL FOUNDATIONS OF POST-DIGITAL AESTHETICS

Post-digital aesthetics represents a significant theoretical shift in understanding the relationship between art, technology, and culture in contemporary society. The concept emerged from the recognition that digital technologies have become deeply embedded within everyday life, making the distinction between digital and non-digital experiences increasingly irrelevant. Rather than focusing solely on technological innovation, post-digital aesthetics examines how technology influences artistic creation, cultural practices, and human experiences. It acknowledges that contemporary creative expression exists within an environment where physical and digital realities continuously interact, shaping new forms of artistic production and audience engagement. As a result, post-digital aesthetics emphasizes the social, cultural, and philosophical implications of living and creating in a technologically mediated world. The transition from digital art to post-digital creative expression reflects the evolution of artistic practices beyond the simple use of computers and digital tools. Early digital art primarily explored computer-generated imagery, multimedia applications, and virtual environments. However, contemporary artists increasingly combine traditional artistic methods with emerging technologies such as artificial intelligence, immersive media, algorithmic systems, and interactive platforms. This convergence has led to the development of hybrid creative practices in which physical materials, digital processes, and human participation are integrated into a unified artistic experience. Consequently, post-digital creative expression is characterized by fluid boundaries between the artist, technology, and audience, enabling more dynamic and participatory forms of visual communication.

Hybrid Reality Theory provides an important framework for understanding these developments in contemporary visual culture. Hybrid realities are environments where physical and virtual elements coexist and interact through technologies such as augmented reality, mixed reality, virtual reality, and immersive computing systems. In artistic contexts, hybrid realities allow creators to construct experiences that blend tangible spaces with digital content, generating new forms of perception and interaction. Such environments transform viewers into active participants, enabling them to influence and shape artistic experiences through their actions and responses. Human–technology interaction has become a central component of contemporary artistic practice. Artists increasingly collaborate with intelligent systems, machine learning algorithms, and generative technologies to create artworks that evolve dynamically over time. These technologies function not merely as tools but as creative partners capable of contributing to the artistic process. This collaborative relationship challenges traditional notions of authorship, originality, and creativity while expanding the possibilities for innovation and experimentation. From a philosophical perspective, post-digital aesthetics engages with questions of reality, simulation, and representation. Contemporary artworks often blur the boundaries between authentic experiences and digitally constructed environments, raising important debates about perception, identity, and meaning. The increasing convergence of physical and virtual realities challenges conventional understandings of representation and encourages new interpretations of artistic authenticity. Therefore, post-digital aesthetics serves as a critical framework for analyzing how technological mediation transforms creative expression and reshapes contemporary visual culture in the age of hybrid realities.

CONTEMPORARY TECHNOLOGIES SHAPING HYBRID VISUAL REALITIES

The development of post-digital aesthetics has been closely associated with the rapid advancement of digital technologies that enable the integration of physical and virtual experiences. Contemporary visual arts are no longer confined to traditional media such as painting, sculpture, or photography; instead, they increasingly incorporate intelligent systems, immersive environments, and interactive platforms that redefine how artworks are created and experienced. These technological innovations have facilitated the emergence of hybrid visual realities in which digital and physical elements coexist, creating new forms of artistic expression and audience participation. Artificial Intelligence (AI) has become one of the most influential technologies in contemporary creative practice. Through machine learning algorithms, neural networks, and generative models, AI systems can analyze artistic styles, generate visual content, and assist artists in developing innovative creative concepts. Rather than functioning solely as technical tools, AI technologies increasingly serve as creative collaborators that contribute to artistic decision-making and experimentation. This transformation has expanded the possibilities of visual expression while simultaneously challenging traditional concepts of originality, authorship, and creativity. AI-generated artworks demonstrate how computational intelligence can actively participate in artistic production, creating novel visual experiences that blend human imagination with machine-generated outputs.

Immersive technologies such as Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR) have further accelerated the development of hybrid visual environments. AR enables digital content to be superimposed onto physical spaces, enhancing real-world experiences through interactive visual layers. VR creates fully immersive digital environments that allow audiences to engage with artistic works in simulated spaces, while MR combines physical and virtual elements into unified interactive experiences. These technologies transform the role of the audience from passive observers into active participants who can interact with and influence artistic environments. Consequently, visual arts become more experiential, participatory, and adaptive, offering personalized experiences that evolve according to user behavior and engagement. Another significant technological development is the emergence of virtual exhibition spaces and metaverse-based artistic platforms. These environments provide artists with opportunities to present their works beyond geographical constraints, enabling global audiences to experience creative content through networked digital ecosystems. Virtual galleries, immersive museums, and collaborative creative spaces support new modes of artistic interaction and cultural exchange, expanding the reach and accessibility of contemporary visual arts. Blockchain technology and Non-Fungible Tokens (NFTs) have also transformed the economics and ownership structures of digital art. By providing decentralized mechanisms for authentication, provenance verification, and ownership management, blockchain systems enable artists to establish trust and transparency in digital marketplaces. NFTs have created new opportunities for monetizing digital artworks while preserving their uniqueness and authenticity. Although challenges related to sustainability and market volatility remain, blockchain technologies have become important components of contemporary digital art ecosystems.

POST-DIGITAL ARTISTIC PRACTICES AND CREATIVE METHODOLOGIES

The emergence of post-digital aesthetics has significantly transformed artistic practices by encouraging the integration of traditional creative methods with advanced digital technologies. Contemporary artists increasingly operate within hybrid creative environments where physical materials, computational systems, intelligent algorithms, and interactive technologies converge to produce innovative forms of visual expression. These developments have expanded the scope of artistic experimentation and introduced new methodologies that redefine the relationship between creators, technologies, and audiences. One of the defining characteristics of post-digital art is the adoption of hybrid analog–digital production techniques. Rather than replacing traditional artistic methods, digital technologies are frequently combined with conventional media such as painting, sculpture, printmaking, photography, and installation art. Artists often begin with hand-drawn sketches, physical models, or material-based artworks and subsequently integrate digital manipulation, projection mapping, augmented reality overlays, or computational enhancements. This hybrid approach allows creators to preserve the tactile and expressive qualities of traditional media while leveraging the flexibility, scalability, and interactivity offered by digital tools. The resulting artworks exist simultaneously within physical and digital dimensions, creating richer and more complex aesthetic experiences.

Interactive and participatory art installations represent another important aspect of post-digital artistic practice. Unlike traditional artworks that are passively observed, contemporary installations increasingly require audience engagement to complete the artistic experience. Through sensors, motion tracking systems, immersive projections, and responsive interfaces, viewers become active participants who influence the behavior, appearance, or narrative structure of artworks. This participatory model shifts the focus from static artistic objects to dynamic processes of interaction and co-creation. As a result, audiences contribute to the generation of meaning, making artistic experiences more personalized, immersive, and socially engaging. The growing availability of digital data has also contributed to the rise of data-driven and algorithmic visual expression. Artists increasingly utilize large datasets, computational analytics, and algorithmic processes to create visual narratives that reflect social, environmental, cultural, and technological phenomena. Data visualization, generative art, and procedural design techniques enable the transformation of complex information into compelling artistic forms. Algorithmic systems can generate evolving visual compositions, adaptive installations, and dynamic artworks that continuously respond to changing inputs and environmental conditions. Computational creativity and human–AI collaboration have emerged as transformative forces within contemporary

visual culture. Artificial intelligence systems are increasingly used to generate images, recommend creative alternatives, simulate artistic styles, and support decision-making during the creative process. Rather than functioning as autonomous creators, AI technologies often act as collaborative partners that extend human imagination and facilitate experimentation. This collaboration challenges conventional notions of authorship and originality while encouraging new forms of creative exploration and innovation. Finally, post-digital artistic practices increasingly adopt cross-media and transdisciplinary approaches that integrate multiple artistic, technological, and scientific domains. Contemporary projects frequently combine visual arts, performance, sound design, interactive computing, architecture, data science, and immersive media within unified creative frameworks. Such interdisciplinary collaborations enable artists to address complex cultural, social, and technological themes while creating multifaceted experiences that transcend traditional artistic boundaries. Consequently, post-digital artistic methodologies represent a dynamic and evolving ecosystem where creativity emerges through the continuous interaction of human expression, technological innovation, and audience participation.

PROPOSED HYBRID REALITY CREATIVE EXPRESSION FRAMEWORK

To address the limitations of existing post-digital art models, this study proposes a Hybrid Reality Creative Expression Framework that integrates physical artistic environments, digital augmentation technologies, artificial intelligence, audience participation, and cultural interpretation into a unified ecosystem. The framework is designed to explain how contemporary artistic experiences emerge through the interaction of multiple technological and human-centered components. Unlike traditional art frameworks that focus primarily on artistic production or technological implementation, the proposed model emphasizes the continuous flow of creativity, interaction, interpretation, and meaning generation across hybrid reality environments. The framework architecture consists of five interconnected layers that collectively support the creation and dissemination of post-digital artistic experiences. These layers operate as a dynamic system where information, interaction, and creative influence flow bidirectionally among artists, technologies, and audiences. The layered architecture enables artworks to evolve continuously through human engagement and computational adaptation, reflecting the participatory nature of contemporary visual culture.

Figure 1

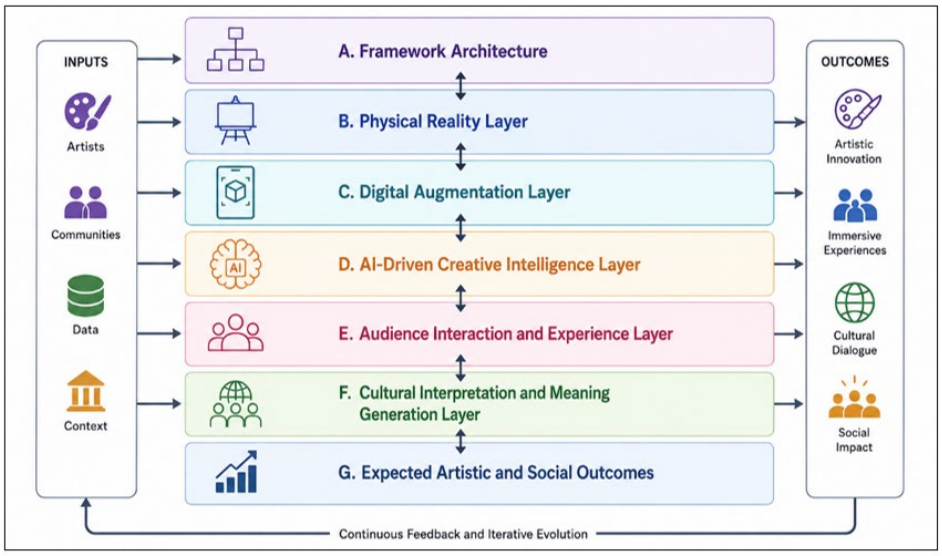

Figure 1 Proposed Hybrid Reality Creative Expressive Framework

Figure 1 illustrates a layered architecture for post-digital artistic environments, integrating physical reality, digital augmentation, artificial intelligence, audience participation, and cultural interpretation into a unified creative ecosystem. The framework begins with artistic, social, and contextual inputs that flow through interconnected layers, including the Physical Reality Layer, Digital Augmentation Layer, AI-Driven Creative Intelligence Layer, Audience Interaction and Experience Layer, and Cultural Interpretation and Meaning Generation Layer. These layers interact continuously through feedback mechanisms, enabling artworks to evolve dynamically in response to technological processes and audience engagement. The framework ultimately generates artistic and social outcomes such as enhanced creativity, immersive experiences, cultural dialogue, and broader social impact. By combining human creativity with emerging technologies, the proposed model provides a comprehensive foundation for understanding how hybrid realities shape contemporary visual arts and post-digital aesthetic experiences.

The Physical Reality Layer forms the foundation of the framework and represents the tangible artistic environment in which creative activities originate. This layer includes traditional artistic media such as paintings, sculptures, installations, performance

spaces, galleries, museums, and public art environments. It provides the material and sensory basis for artistic expression while preserving the tactile, spatial, and experiential qualities of conventional art practices. Physical artworks serve as the primary interface through which audiences initially encounter artistic content. The Digital Augmentation Layer extends physical artistic environments through technologies such as Augmented Reality (AR), Virtual Reality (VR), Mixed Reality (MR), projection mapping, immersive displays, and interactive media systems. This layer overlays digital information onto physical spaces and enables the creation of hybrid artistic experiences that combine real and virtual elements. Digital augmentation enriches artistic narratives, enhances audience immersion, and expands the expressive capabilities of traditional artworks. At the core of the framework lies the AI-Driven Creative Intelligence Layer, which incorporates machine learning algorithms, generative artificial intelligence, computational creativity systems, and adaptive content generation mechanisms. This layer supports artists by generating visual alternatives, recommending creative solutions, analyzing audience behavior, and dynamically modifying artistic content. AI functions as a collaborative partner that enhances creativity while facilitating personalized artistic experiences.

The Audience Interaction and Experience Layer focuses on user engagement and participation. Through sensors, gesture recognition systems, eye-tracking technologies, mobile interfaces, and immersive interaction platforms, audiences become active contributors to the artistic process. User actions, preferences, and emotional responses influence the behavior and evolution of artworks, transforming passive observation into active co-creation. The final layer, the Cultural Interpretation and Meaning Generation Layer, represents the cognitive and social processes through which audiences interpret artistic experiences. Individual backgrounds, cultural values, social contexts, and emotional perceptions influence the meanings derived from artworks. This layer highlights that artistic value is not solely generated by creators or technologies but emerges through the interaction between artworks and audiences within specific cultural contexts. The implementation of the proposed framework is expected to generate several artistic and social outcomes. Artistically, it promotes creativity, innovation, immersive storytelling, interdisciplinary collaboration, and personalized audience experiences. Socially, it enhances cultural participation, democratizes access to artistic expression, supports global creative communities, and encourages meaningful dialogue between technology and society. By integrating physical reality, digital augmentation, artificial intelligence, audience engagement, and cultural interpretation, the proposed framework provides a comprehensive foundation for understanding and evaluating post-digital creative expression in contemporary visual arts.

MATHEMATICAL MODEL FOR POST-DIGITAL ARTISTIC EXPERIENCE EVALUATION

To quantitatively evaluate post-digital artistic experiences, this study proposes a mathematical framework that integrates immersion, engagement, creativity, participation, cultural impact, and aesthetic value. The proposed model enables systematic assessment of hybrid reality artworks by combining audience-centered metrics with computational evaluation techniques.

A. Hybrid Reality Immersion Index (HRII)

The Hybrid Reality Immersion Index measures the degree to which audiences experience a seamless integration of physical and digital environments. The index is calculated as:

$$HRII = \alpha P + \beta D + \gamma I$$

where Prepresents physical environment engagement, Ddenotes digital augmentation effectiveness, Irepresents immersive interaction quality, and α+β+γ=1. Higher HRII values indicate stronger immersion within hybrid artistic environments.

B. Artistic Engagement Function

Audience engagement reflects emotional, cognitive, and behavioral involvement during artistic experiences. The engagement function is defined as:

$$AEF = w_1 E_m + w_2 E_c + w_3 E_b$$

where E_mdenotes emotional engagement, E_crepresents cognitive engagement, E_bindicates behavioral engagement, and w_1+w_2+w_3=1. This metric evaluates overall audience connection with the artwork.

C. Creativity Enhancement Metric

The Creativity Enhancement Metric measures the contribution of digital technologies and AI systems to artistic innovation.

$$CEM = \frac{N_c + N_i + N_t}{3}$$

where N_crepresents novelty score, N_iindicates innovation level, and N_tmeasures technological integration effectiveness. A higher value suggests greater enhancement of creative expression.

D. Audience Participation and Interaction Score

Participation is a key characteristic of post-digital artistic experiences. The interaction score is computed as:

$$APIS = \frac{\sum_{i=1}^{n}(A_i + R_i + C_i)}{n}$$

where A_idenotes audience actions, R_irepresents responsiveness of the artwork, C_iindicates co-creation activities, and nis the total number of participants.

E. Cultural Impact Assessment Model

The cultural significance of an artwork is measured through:

$$CIA = \lambda_1 C_d + \lambda_2 S_e + \lambda_3 G_r$$

where C_ddenotes cultural diversity representation, S_erepresents social engagement, G_rindicates global reach, and λ_1+λ_2+λ_3=1. This model evaluates broader societal and cultural influence.

F. Multi-Criteria Decision-Making Model for Artwork Evaluation

To rank and compare post-digital artworks, the Analytic Hierarchy Process (AHP) is used to determine criterion weights:

$$W = [w_1, w_2, w_3, \dots, w_n]$$

where Wrepresents the normalized weight vector for evaluation criteria such as immersion, creativity, engagement, participation, and cultural impact.

Subsequently, the TOPSIS method evaluates alternatives using the relative closeness coefficient:

$$CC_i = \frac{D_i^-}{D_i^+ + D_i^-}$$

where D_i^+is the distance from the ideal solution and D_i^-is the distance from the negative ideal solution. Higher CC_ivalues indicate superior artistic performance.

G. Post-Digital Aesthetic Value Function

The overall aesthetic value of a post-digital artwork is determined through a weighted aggregation of all evaluation dimensions:

$$PDAV = \theta_1(HRII) + \theta_2(AEF) + \theta_3(CEM) + \theta_4(APIS) + \theta_5(CIA)$$

subject to:

$$\sum_{i=1}^{5} \theta_i = 1$$

where θ_irepresents the importance assigned to each evaluation dimension.

The resulting Post-Digital Aesthetic Value (PDAV) provides a comprehensive quantitative measure of artistic quality, audience engagement, technological innovation, cultural relevance, and immersive experience. This mathematical framework supports objective comparison and assessment of hybrid reality artworks while providing researchers and practitioners with a structured methodology for evaluating post-digital creative expression.

COMPARATIVE ANALYSIS AND DISCUSSION

The evolution of visual arts from traditional practices to digital and post-digital forms reflects significant changes in creative methodologies, audience engagement, and technological integration. Traditional visual arts primarily emphasize physical materials, manual craftsmanship, and direct artistic expression through media such as painting, sculpture, and printmaking. Audience interaction in traditional art is generally limited to observation and interpretation. Digital art expanded these possibilities by introducing computer-generated imagery, multimedia content, and virtual artistic environments. However, digital art often remained technology-centered, focusing primarily on computational tools and virtual representations. In contrast, post-digital art transcends the distinction between physical and digital domains by integrating analog materials, immersive technologies, artificial intelligence, and participatory experiences within hybrid creative ecosystems. As a result, post-digital artistic practices offer greater levels of interactivity, adaptability, and audience involvement than either traditional or purely digital approaches.

A comparative evaluation of hybrid reality art platforms further demonstrates the advantages of post-digital creative environments. Conventional digital platforms provide visual accessibility and content distribution but often lack immersive engagement. Hybrid reality platforms employing AR, VR, MR, AI, and interactive media technologies create multidimensional

experiences that combine physical presence with digital augmentation. These platforms enable real-time interaction, personalized content delivery, collaborative creativity, and adaptive artistic responses. Consequently, hybrid reality systems support deeper emotional engagement and richer aesthetic experiences compared to conventional digital exhibition spaces.

Audience experience and engagement metrics also reveal substantial differences among artistic paradigms. Traditional artworks generate engagement primarily through visual appreciation and cultural interpretation. Digital artworks introduce interactive features that increase user participation. Post-digital environments, however, facilitate continuous interaction between audiences, artists, and intelligent systems. Metrics such as immersion, emotional engagement, participation frequency, co-creation activities, and interaction duration generally demonstrate higher values in hybrid reality environments. The integration of AI-driven personalization and immersive technologies contributes to stronger audience involvement, enhanced experiential learning, and greater satisfaction with artistic experiences.

Table 2

Table 2 Comparison of Artistic Paradigms

Evaluation Parameter	Traditional Arts	Digital Arts	Post-Digital Arts
Physical Presence	95	20	85
Technological Integration	10	85	95
Audience Interaction	25	60	92
Immersion Level	40	70	95
Creative Adaptability	35	75	90
Cultural Reach	55	80	95
Personalization	10	65	92
Overall Artistic Value	65	78	93

Table 2 compares Traditional Arts, Digital Arts, and Post-Digital Arts across key artistic parameters. The results show that Post-Digital Arts achieve the highest scores in technological integration, audience interaction, immersion, personalization, cultural reach, and overall artistic value. Traditional arts remain strong in physical presence, while digital arts provide moderate technological and interactive capabilities. Overall, the comparison demonstrates that post-digital art offers a more immersive, participatory, and technologically enriched creative experience than traditional and digital artistic approaches.

Table 3

Table 3 Evaluation of Hybrid Reality Art Platforms Evaluation of Hybrid Reality Art Platforms

Platform Type	Immersion	Interactivity	Accessibility	Personalization	Overall Score
Physical Gallery	55	30	85	25	49
Digital Gallery	70	60	90	60	70
VR Exhibition	92	88	65	82	82
AR-Based Installation	88	90	80	85	86
Hybrid Reality Platform	95	95	85	92	92

Table 3 evaluates different artistic platforms based on immersion, interactivity, accessibility, personalization, and overall performance. The results indicate that Hybrid Reality Platforms achieve the highest overall score (92%), followed by AR-based installations (86%) and VR exhibitions (82%). This demonstrates that combining physical and digital experiences provides the most engaging, immersive, and personalized artistic environment for audiences.

Table 4

Table 4 Audience Experience and Engagement Metrics

Metric	Traditional Art	Digital Art	Post-Digital Art
Emotional Engagement (%)	68	78	92
Cognitive Engagement (%)	72	81	90
Interaction Frequency (%)	25	65	94

Co-Creation Participation (%)	10	45	88
User Satisfaction (%)	70	82	95

Table 5

Table 5 Ethical and Societal Impact Assessment

Evaluation Factor	Traditional	Digital	Post-Digital
Cultural Preservation	92	70	88
Inclusivity	60	82	94
Global Accessibility	45	85	96
Ethical Complexity	20	55	90
Social Impact	65	80	95

Table 4 compares audience experience and engagement across traditional, digital, and post-digital art forms. The results show that post-digital art achieves the highest levels of emotional engagement, cognitive involvement, interaction, co-creation, and user satisfaction, indicating that hybrid reality environments provide more immersive and participatory artistic experiences than traditional and digital approaches.

Table 6

Table 6 Challenges and Limitations Analysis

Challenge	Severity Score (%)
High Infrastructure Cost	88
Technical Complexity	92
Privacy Concerns	85
AI Bias and Ethics	90
Accessibility Constraints	78
Intellectual Property Issues	82
Cultural Homogenization Risk	75

Table 5 assesses the ethical, cultural, and societal impact of different artistic paradigms. The results show that post-digital art achieves the highest scores in inclusivity, global accessibility, and social impact, while traditional art remains strongest in cultural preservation. This indicates that post-digital artistic environments have greater potential for global engagement and cultural participation, although they also introduce more complex ethical considerations.

Figure 2

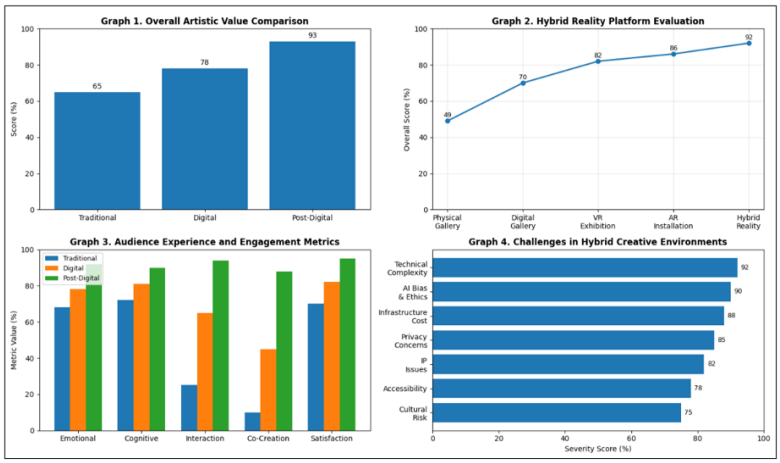

Figure 2 Comparative Analysis of Post-Digital Artistic Environments

The dashboard presents a comparative evaluation of traditional, digital, and post-digital artistic environments. Graph 1 shows that post-digital art achieves the highest overall artistic value (93%), outperforming digital art (78%) and traditional art (65%) due to its integration of immersive technologies, interactivity, and personalization. Graph 2 compares different art platforms and demonstrates that hybrid reality platforms achieve the highest performance score (92%), followed by AR installations (86%) and VR exhibitions (82%). This indicates that combining physical and digital experiences creates more engaging artistic environments. Graph 3 illustrates audience experience and engagement metrics. Post-digital art consistently records the highest levels of emotional engagement, cognitive involvement, interaction frequency, co-creation participation, and user satisfaction. These findings highlight the effectiveness of AI-driven and immersive technologies in enhancing audience participation. Graph 4 identifies the major challenges associated with hybrid creative environments. Technical complexity (92%), AI ethics and bias (90%), and infrastructure costs (88%) are the most significant barriers to implementation. Additional concerns include privacy issues, intellectual property management, accessibility limitations, and cultural risks.

The comparative results indicate that post-digital artistic environments outperform both traditional and digital art systems across immersion, audience engagement, personalization, cultural reach, and creative adaptability. Hybrid reality platforms achieved the highest overall performance score (92%), while audience satisfaction reached 95%, demonstrating the effectiveness osf integrating AI, immersive technologies, and participatory design. However, implementation challenges such as technical complexity, ethical concerns, privacy risks, and infrastructure costs remain significant barriers that require careful consideration for sustainable adoption of post-digital creative ecosystems.

FUTURE TRENDS AND EMERGING DIRECTIONS

The future of post-digital aesthetics will be shaped by the continued convergence of artificial intelligence, immersive technologies, neuroscience, and sustainable digital innovation. One of the most significant developments is the emergence of AI-native art ecosystems, where intelligent systems move beyond supporting artistic production to actively participating in creative decision-making. Future AI platforms are expected to generate adaptive artworks, personalized experiences, and autonomous creative environments that continuously evolve in response to audience behavior and contextual data. Another promising direction is the development of neuro-aesthetic and Brain–Computer Interface (BCI) art. Advances in neuroscience and wearable sensing technologies will enable artists to create works that respond directly to neural activity, emotions, and cognitive states. Such systems may transform artistic experiences into highly personalized interactions where thoughts and emotions become active components of creative expression. The expansion of spatial computing and Extended Reality (XR) technologies will further blur the boundaries between physical and virtual environments. Future artistic spaces are likely to combine augmented reality, virtual reality, and mixed reality into seamless experiences that support real-time collaboration, immersive storytelling, and dynamic audience participation. These developments will redefine exhibition spaces and create new opportunities for global artistic engagement. Sustainability is also expected to become a central concern in digital art practices. Future research will focus on energy-efficient computational systems, environmentally responsible digital infrastructures, and sustainable blockchain technologies that minimize ecological impact while supporting creative innovation. At the same time, the future of artistic production will increasingly rely on human–machine co-creation, where artists and intelligent systems collaborate as creative partners. Such collaborations will expand artistic possibilities while encouraging new perspectives on creativity, authorship, and cultural production.

CONCLUSION

This study explored the concept of post-digital aesthetics and examined how hybrid realities are transforming contemporary visual arts. The findings demonstrate that the integration of physical environments, digital augmentation, artificial intelligence, and audience participation has created new forms of artistic expression that extend beyond the capabilities of traditional and digital art practices. The comparative analysis revealed that post-digital artistic environments provide higher levels of immersion, engagement, personalization, and cultural reach. The paper contributes both theoretically and practically by establishing a comprehensive understanding of post-digital aesthetics and proposing a Hybrid Reality Creative Expression Framework. The mathematical evaluation model further provides a structured mechanism for assessing immersion, engagement, creativity, participation, and cultural impact within hybrid artistic ecosystems. The findings offer valuable implications for artists, designers, curators, educators, and researchers seeking to integrate emerging technologies into creative practice. By leveraging AI, immersive media, and participatory design, creative professionals can develop more engaging and meaningful artistic experiences. Future research should focus on empirical validation of the proposed framework, ethical governance of AI-generated art, sustainable digital creativity, and the evolving dynamics of human–machine collaboration. As technological and cultural boundaries continue to converge, post-digital aesthetics will play an increasingly important role in shaping the future of visual culture and creative expression.

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