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Integrating traditional and digital art through XR technologies: a qualitative study of artistic collaboration and audience experience

Abstract

Research background and purpose: This study examines the emerging paradigm of collaboration between traditional and digital art forms through extended reality (XR), augmented reality (AR) and virtual reality (VR) technologies. We identify critical research gaps including the need for integrated aesthetic theories, longitudinal impact studies, standardized evaluation frameworks, accessibility considerations, and sustainable production models. The primary objective of this study is to investigate how extended reality (XR) technologies, including augmented reality (AR) and virtual reality (VR), can facilitate the integration of traditional and digital art forms. Specifically, the research seeks to examine how XR technologies influence artistic creation, exhibition practices, and audience reception, while preserving the original artistic intent. Furthermore, the study aims to identify the challenges and opportunities arising from interdisciplinary collaboration between traditional artists and technologists, as well as the managerial implications for cultural institutions navigating this hybrid paradigm.

Design/methodology/approach: This research is guided by the following hypotheses: that the integration of XR technologies with traditional art forms can successfully preserve the original artistic intent while simultaneously enhancing audience engagement and expanding opportunities for artistic expression. And that effective interdisciplinary collaboration between traditional artists and technologists - grounded in user-centered design principles and mutual respect for artistic authenticity - is essential for achieving meaningful and sustainable integration of XR technologies into traditional art practices. Through qualitative analysis of expert interviews with artists, technologists, and cultural professionals, complemented by case study examination of implementations, we investigate how these technologies transform artistic creation, exhibition, and reception. Our findings suggest that successful integration depends on balancing artistic intent with technological capabilities, careful consideration of physical-virtual transitions, and user-centered design approaches.

Findings: The findings of this study support both proposed hypotheses. Through qualitative analysis of expert interviews and examination of the René Holm/Rufus XR project, the research demonstrates that XR technologies, when thoughtfully integrated, do not replace traditional artistic values but rather extend and enrich them. Participants consistently emphasized the importance of maintaining fidelity to artistic tone while embracing new experiential possibilities.

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Value added and limitations: These findings have important implications for arts management, highlighting new challenges in interdisciplinary team coordination, technical infrastructure planning, rights management in digital environments, and prototype-based project management. This research contributes to our understanding of an emerging artistic paradigm that respects tradition while embracing digital possibilities, suggesting that the future of art lies not in replacing one medium with another, but in their thoughtful integration.

Keywords: *Extended Reality (XR), digital transformation, artistic collaboration, arts management, audience engagement*

JEL Classification: M10, M11, M31

Received: 2025-07-25; **Revised:** 2026-01-12; **Accepted:** 2026-03-09

1. Introduction

The fourth and now fifth industrial revolutions have changed the way culture is produced, consumed and transmitted. Modern, developed environments combine the physical and virtual realms. The physical layer includes tangible places, people and objects. The virtual layer consists of electronic counterparts. Michal Ostrowicki (Sidey Myoo) suggests that it is the time now to overcome the dualism between the virtual and physical worlds, recognizing the hybrid nature of reality. This symbiosis reflects our experience in today's urbanized, technicized world (Lukaszewicz & Petri, 2022). However, the persistence and influence of pre-digital cultural forms is crucial offering rich insight and continuity in the midst of rapid technological advances.

The landscape of artistic creation, exhibition and reception is undergoing a profound transformation. As Walmsley (2019, p. 422) notes, "digital technologies are not only changing the way art is made, but fundamentally transforming what art can be." Among these technologies, augmented reality (XR)-which includes virtual reality (VR), augmented reality (AR) and mixed reality (MR)-offers particularly revolutionary opportunities for artistic expression and audience engagement. These technologies are creating what Grau (2003, p. 13) calls "osmotic interfaces" in which the boundaries between the artwork, the environment and the viewer are becoming increasingly permeable.

Literature shows that the integration of Extended Reality (XR) technologies significantly influences the preservation of traditional art forms by enhancing authenticity and original intent. XR technologies, facilitate immersive experiences that allow audiences to engage deeply with cultural narratives, thereby preserving the essence of traditional art forms while making them accessible to a broader audience. (Doukianou & Lalioti, 2024). This engagement not only preserves the art but also revitalizes interest among younger generations, ensuring the continuity of cultural practices (Kong et al., n.d.).

The integration of XR technology with traditional art forms represents not just a technological innovation, but an emerging artistic paradigm with significant implications for artists, audiences, institutions and the art market. This paradigm raises fundamental questions about authenticity, artistic intent, audience experience and the very ontology of the artwork itself. As Bucher (2018, p. 67) asks: “When an artwork exists simultaneously in the physical and virtual domains, where is the ‘real’ artwork?”. Prince, 1995 claims that the interaction between the creator and the viewer in digital spaces further blurs the lines of authorship and originality, as viewers can influence the final art experience. Bylieva and Krasnoschekov, 2023 raise that digital art challenges the concept of ‘originality’ by blurring the lines between original works and copies. It leads to the loss of the aura associated with material art, necessitating a new understanding and evaluation of artistic creativity in the digital age. On the other hand Latour & Lowe, 2011 wrote that digital technologies challenge traditional notions of originality by revealing the complex layers of a work of art. They allow for new interpretations and contexts, suggesting that originality is not fixed but rather composed of interrelated components shaped by reproduction processes.

While numerous studies have documented XR implementations in museum and gallery environments (He et al., 2018; Kenderdine, 2021), less attention has been paid to the collaborative processes by which traditional artists and digital artists and technologists negotiate these hybrid creations. Similarly, while the technical aspects of implementing XR are well documented, the managerial challenges associated with this interdisciplinary collaboration remain under-researched (Walmsley, 2019).

This study addresses these gaps through a qualitative analysis of expert interviews with traditional artists, technologists, and cultural professionals, supplemented by an analysis of implementation cases such as the René Holm/Rufus XR project. We examine how XR technologies are transforming artistic creation, exhibition and reception, with a focus on:

- facilitation and integration of traditional and digital art forms by usage of XR,
- the processes by which traditional artistic intent is preserved or transformed through digital augmentation,
- the challenges and opportunities that XR technologies present for audience engagement,
- managerial implications of these hybrid art forms for institutions and individuals.

By synthesizing the insights of artists directly involved in negotiating this emerging paradigm, this study contributes to both theoretical understanding and practical implementation of XR technologies in artistic contexts. The study’s findings have implications not only for artists and technologists, but also for cultural institutions, arts managers, educators and policymakers navigating the digital transformation of the arts sector.

2. Literature review

The relationship between technology and art has a long and complex history. As Grau (2003) demonstrates, each new technological development – from linear perspective to photography to digital media – has prompted both resistance and innovation within artistic communities. The current emergence of XR technologies represents the latest chapter in this ongoing dialogue, but one with potentially more transformative implications than previous technological shifts. While earlier technologies primarily affected how artists created their work, XR technologies fundamentally transform how audiences experience it. This shift from “art as object” to “art as experience” aligns with broader trends in contemporary art practice. As Bishop (2012, p. 2) argues, there has been a “social turn” in art characterized by “an artistic interest in collectivity, collaboration, and direct engagement with specific social constituencies.” While Csikszentmihalyi (1990) frames deep aesthetic involvement as a “flow” state characterized by intrinsic motivation and concentrated attention. XR technologies intentionally cultivate such states through immersion, interactivity, and sensory layering, transforming spectators into *coparticipants* (Kaushik & Amer, 2020; Grau, 2003).

Empirical evidence from museums and galleries shows that AR/VR can heighten engagement, comprehension, and even purchase intentions by affording embodied interaction with cultural narratives He, Wu and Li, (2018); Kenderdine (2021) extends this to digital heritage, arguing that entanglement and immersion in hybrid environments amplify memory formation and interpretive depth, particularly for audiences underrepresented in traditional settings. These findings support our interview data: participants consistently linked XR’s interactive affordances (e.g., controllable light, navigable spatial worlds, ambient sound) to heightened emotional resonance and curiosity, corroborating H1’s emphasis on audience engagement.

XR technologies accelerate turn by creating what Moloney terms “experiential artworks” that exist not as fixed objects but as dynamic environments contingent upon viewer interaction. However, as Fogliaroni notes, this transformation raises significant questions about artistic training, institutional support, and audience readiness that remain insufficiently addressed in both practice and research.

Extended reality encompasses a spectrum of technologies that blend physical and virtual elements to varying degrees. Kenderdine (2021) distinguishes between:

- Virtual Reality (VR): fully immersive environments that replace the physical world,
- Augmented Reality (AR): digital overlays on the physical world,
- Mixed Reality (MR): environments where physical and digital objects coexist and interact.

Each of these approaches offers distinct artistic possibilities and challenges. VR creates fully immersive experiences but isolates viewers from their physical surroundings, raising questions about sociality and contextual awareness (Bucher, 2018). AR maintains

connection to physical space but can struggle with integration and spatial coherence (He et al., 2018). MR offers perhaps the richest possibilities for artistic integration but presents the greatest technical challenges (Kenderdine, 2021). Research by He et al. (2018) documents numerous implementations of these technologies in museum and gallery settings, demonstrating their potential to enhance visitor engagement, particularly among younger audiences. However, as Panneels and Marshall (2020) observe, many of these implementations remain technologically driven rather than artistically motivated, functioning more as technical demonstrations than meaningful artistic experiences.

The translation of traditional art forms into digital contexts raises significant questions about authenticity, reproduction, and artistic intent. Debates around authenticity and originality have long structured the theory of art, and XR intensifies these questions by relocating part of the artwork's ontology into virtual space. In *The Work of Art in the Age of Mechanical Reproduction*, Benjamin argues that replication diminishes an artwork's "aura" – its singular presence in time and space (Benjamin, 1935/2008). On a first reading, XR might seem to exacerbate this problem by adding yet another layer of mediation. However, contemporary accounts suggest that XR can *reconfigure* rather than simply erode aura, creating unique, contextdependent encounters that are irreducible to simple copies (Grau, 2003; Bucher, 2018). Through immersion, interactivity, and sitespecific anchoring, XR experiences realize what Grau calls "osmotic interfaces" in which the boundary between viewer, environment, and artwork becomes permeable, thereby generating renewed singularity in experience (Grau, 2003, p. 13).

Moloney introduces the concept of "remediation aesthetics" to describe how traditional works acquire new meanings and dimensions when extended through digital technologies. This perspective suggests that digital extension represents not dilution but transformation – creating what is effectively a new work that maintains a relationship with its traditional source. Research by Milovanovic et al. (2017) on audience responses to traditional paintings extended through AR reveals that viewers often perceive these extensions not as separate from or inferior to the original but as dimensions of a unified artistic experience. This finding challenges traditional notions of artistic authenticity based solely on physical originality. The lived experiences of artists navigating collaborations between traditional and digital domains remain underrepresented in the literature, with most studies focusing on audience reception rather than creator experiences (Walmsley, 2019). The limited research available suggests significant variation in how traditional artists approach these collaborations.

Schweibenz, Werner (2018) document cases of resistance among established artists who perceive digital extensions as potential threats to their artistic intent and authority. Conversely, Milovanovic et al. (2017) describe artists who view digital technologies as opportunities to reach new audiences and explore dimensions of their work not possible in traditional media. These divergent perspectives highlight what Fogliaroni terms the "collaborative gap" – the space between artistic vision and

technological implementation that must be negotiated through interdisciplinary dialogue. How this negotiation occurs in practice, and what factors influence its success or failure, remains insufficiently explored in the literature.

Research on audience engagement with XR art experiences has focused primarily on quantitative metrics of attention and recall rather than qualitative dimensions of experience (He et al., 2018). The limited qualitative research available suggests that successful XR art experiences create what Csikszentmihalyi (1990) terms “flow states” – immersive experiences characterized by concentration, enjoyment, and intrinsic motivation. Kenderdine (2021) argues that these technologies have particular potential to engage audiences traditionally underrepresented in museum and gallery attendance, including younger visitors and those with limited experience of traditional arts settings. However, as Panneels and Marshall (2020) caution, this potential remains limited by accessibility issues related to technological literacy, physical abilities, and economic resources. A significant gap in the literature concerns longitudinal impacts of XR art experiences on subsequent engagement with traditional art forms. As Walmsley (2019, p. 429) observes, “we know little about whether these technologies serve as bridges to deeper engagement with traditional arts or as substitutes that potentially diminish interest in non-digital experiences.” The integration of traditional and digital art forms creates significant managerial challenges that extend beyond technical implementation. As Walmsley (2019) argues, these challenges demand new organizational structures, funding models, and professional competencies that many cultural institutions struggle to develop.

Research by Milovanovic et al. (2017) identifies several specific challenges facing arts managers in this context:

1. Cross-disciplinary team management requiring negotiation between artistic and technical priorities.
2. Technical infrastructure planning and maintenance beyond the expertise of traditional arts managers.
3. Rights management in digital environments with complex ownership and royalty structures.
4. Prototype-based project management requiring more flexible approaches than traditional exhibition planning.

These challenges are compounded by what Fogliaroni terms the “institutional inertia” of many cultural organizations – structures and processes designed for traditional art forms that resist adaptation to digital possibilities. This inertia manifests in funding models, staffing structures, and evaluation frameworks ill-suited to hybrid art forms. Recent literature points to several emerging directions for research at the intersection of traditional and digital art forms. Kenderdine (2021) highlights the potential of artificial intelligence to create more responsive and personalized XR art experiences, while raising important questions about authorship and agency. Moloney emphasizes the need for

more nuanced theoretical frameworks that move beyond binary oppositions between physical and virtual, traditional and digital, to conceptualize these hybrid forms on their own terms. Similarly, Bucher (2018) calls for ontological frameworks that can account for artworks existing simultaneously across multiple realities. Perhaps most urgently, Dekker (2018) identifies the crisis of preservation facing these hybrid art forms. As technologies rapidly evolve and become obsolete, significant artistic experiences risk being lost without appropriate documentation and preservation strategies – an area where research remains critically underdeveloped.

3. Methods

This study adopts a qualitative research design to explore how XR technologies facilitate the integration of traditional and digital art forms. A qualitative approach was deemed because the research objectives focus on understanding experiences, attitudes, and collaborative processes rather than quantifying outcomes. This design enables in-depth exploration of the nuanced interplay between artistic intent and technological innovation.

Data collection took place during a three-day intensive design sprint held at the Talent Garden Lithuania (April, 2025). This setting was purposefully selected as it provided a controlled yet authentic environment where artist-technologist collaborations could be observed in real-time. The sprint followed a structured format adapted from Knapp et al.'s (2016) design sprint methodology, modified to accommodate artistic processes. Each day consisted of 6-hour collaborative sessions focused on ideation (days 1), prototyping (days 2), and reflection (day 3).

From the broader cohort of 40 design sprint participants, we employed a purposive maximum variation sampling strategy (Patton, 2015) to select 7 participants for in-depth interviews.

Semi-structured interviews lasting 45–60 minutes were conducted during and immediately after collaborative sessions. The interview protocol addressed five domains:

1. Experiences and attitudes toward technological collaboration.
2. Technical challenges and solutions.
3. Artistic concepts emerging from XR integration.
4. Audience engagement strategies.
5. Managerial implications for exhibition and distribution.

All interviews were audio-recorded, transcribed verbatim, and supplemented with project documentation, including design notes and prototypes from the René Holm/Rufus XR project.

Thematic analysis followed Braun and Clarke's six-phase approach, operationalized through three coding stages:

- *open coding*: initial codes were generated inductively from transcripts,

- *axial coding*: codes were grouped into categories by identifying relationships and patterns,
- *theme development*: categories were synthesized into overarching themes aligned with research objectives.

This approach allowed us to capture diverse perspectives while maintaining focus on the research questions. Sample size determination followed saturation principles (Guest et al., 2006), with interviews continuing until thematic redundancy began to emerge. The selection criteria were systematically applied as follows:

1. Professional background diversity: 4 traditional artists (defined as those primarily working in non-digital media for >5 years) and 3 digital artists/technologists (defined as practitioners with >3 years' experience in XR development).
2. Involvement level: All selected participants had spent a minimum of 15 hours in direct collaborative work during the sprint.
3. Project engagement: 5 participants were directly involved in the René Holm/Rufus XR project, while 2 were selected from parallel projects to provide contrasting perspectives.
4. Experience range: Participants represented varying career stages (2 emerging artists with <5 years professional practice, 3 mid-career artists with 5-15 years' experience, and 2 established artists with >15 years and international exhibition records).
5. Prior collaborative history: 3 participants had previous digital-traditional art collaboration experience, while 4 were engaging in such collaboration for the first time.

This sampling approach acknowledged the inevitable selection bias inherent in studying sprint participants (who self-selected for technological openness) while maximizing the range of perspectives within this constraint.

Thematic analysis was employed to identify recurring patterns and significant insights from the interview data. The analysis process included:

- familiarization with transcripts and documentation,
- generation of initial codes,
- searching for themes across interviews,
- reviewing and refining themes,
- defining and naming themes,
- relating findings to existing literature.

Member checking was employed by sharing preliminary findings with selected participants to ensure accurate representation of their perspectives.

A significant limitation of this research is the selection bias inherent in the participant pool. As the interviewees were already participating in a design sprint focused on XR and traditional art integration, they likely represent artists who are:

- artificial setting: the sprint's time-limited, highly structured format differs from naturalistic, long-term collaborations, potentially amplifying efficiency-driven behaviors and suppressing organic conflict;
- selection bias: participants self-selected for technological openness, which likely skewed attitudes toward XR integration. Artists resistant to digital augmentation were underrepresented, limiting the diversity of perspectives;
- resource availability: access to advanced XR hardware and technical support during the sprint may have created an overly optimistic view of feasibility compared to typical institutional contexts;
- social desirability bias: the collaborative atmosphere and presence of technologists may have discouraged participants from expressing critical or negative views about XR adoption.

These factors constrain the generalizability of results and underscore the need for future research in naturalistic settings, with broader participant pools and longitudinal observation of collaboration dynamics.

All participants provided informed consent for their interviews to be recorded, transcribed, and analyzed for research purposes. In reporting findings, care was taken to represent diverse perspectives while maintaining awareness of the selection biases inherent in the participant pool. The research acknowledged potential conflicts regarding artistic ownership and credit in collaborative digital-traditional works, addressing these topics explicitly in interviews to surface ethical considerations in this emerging field.

4. Findings

Our semi-structured interviews with traditional artists revealed a spectrum of attitudes toward technological collaboration, ranging from enthusiastic engagement to cautious reservation. This spectrum aligns with previous research by (Anggraini et al., 2024; Porcher et al., 2016; Narayan et al., 2022) who identified similar patterns of technological acceptance among traditional visual artists. René Holm exemplified the more receptive end of this spectrum, stating:

“For me, I’m always open for opportunities, and I’m not fussy about, you know, oh, don’t do that to my work. I know I would have some colleagues who would say, don’t do that, this doesn’t look like my work, my artwork is my artwork.”

This openness was frequently connected to a perception of expanded audience opportunities, with Holm noting:

“I’m working with this very, very old school media, like they did a thousand years ago, oil canvas... this will give me the opportunity to join other venues, other exhibitions, or also places that, let’s say, even don’t have anything to do with classic art.”

While our sample included primarily artists receptive to collaboration – a methodological limitation we acknowledge – participants consistently referenced resistance among some traditional artists (Briggs & Blythe, 2013). This tension between preservation and innovation reflects broader debates in art theory regarding authenticity and medium specificity (Slayton, 2022). The René Holm/Rufus project documentation explicitly acknowledged this dichotomy, identifying “Artist boundaries: Remain faithful to Artist’s tone and message” as a key consideration balanced against “New ideas: Creating new ideas.”

The interviews and project documentation revealed numerous technical considerations that significantly impact artistic outcomes in XR projects, extending beyond mere implementation challenges to fundamental questions of artistic expression. This finding supports Candy (2007) assertion that technical constraints in digital art should be understood as creative parameters rather than limitations.

Project documentation explicitly identified “Hardware limitation: Choose what’s possible” as a key challenge in their process. These limitations required artistic compromises that ultimately influenced aesthetic outcomes, reinforcing Candy (2007) findings regarding the dialectical relationship between technical constraints and artistic innovation.

“The light is too much for this device... So then it can be optimized that you see the shadow from your hand, from your light, and you only see the light from another people, but without the shadows, for example.”

A recurring technical concern involved providing adequate orientation in virtual spaces:

“When we have a white room, or the empty room, we need to have some orientation points, like carpets... It’s nice to have some pictures on walls also.”

This concern reflects the challenge of creating navigable virtual spaces that maintain connection to physical reality, a concern that extends beyond pragmatic usability to questions of embodied experience in virtual environments (Li, 2025).

“When you are close to the painting, then to the wall, very close, then the VR changes to... AR, and you see the painting. Through the camera, the real painting, the experience is like looking at the photo. You go outside and You are going to the virtual reality. The external vision is fading to the black, and you are in the fullest.”

These transitions require careful technical planning, with one participant noting: *“This is like more complex setup, because you have to know where each of the paintings is to create the special points in the space.”*

The emphasis on transitions between physical and virtual reveals a nuanced understanding of the viewer’s phenomenological experience, suggesting that successful XR art experiences must address not only representation but also experiential continuity.

The social dimension of XR experiences emerged as a significant consideration, extending beyond technical implementation to questions of shared aesthetic experience. Unlike traditional gallery experiences where social interaction is largely separate from the viewing experience, XR necessitates explicit design of social interaction mechanisms:

“Too many people can also ruin the experience... And all they have avatars, because it’s very important that they are transferring to the augmented reality, and they later transferred to virtual reality.”

The need for avatar representation in shared virtual spaces was emphasized: *“It’s very important that other people, when they are in the same space, in virtual space, they need to have some kind of avatar for safety but also for sharing experience.”* This finding contrasts with Hodge’s 2015 assertion that Digital art experiences, emphasize isolation through impersonal communication while simultaneously fostering connection, illustrating how phatic interactions create a sense of sociability within networked digital culture despite their lack of substantive content.

The interviews revealed several innovative conceptual approaches to integrating traditional and digital art forms. Participants articulated a concept of “site-specific VR” that anchors virtual experiences to physical locations and objects:

Expert said: *“We have site specific art, we can call it site specific XR”*

This approach maintains connection to physical context while expanding into virtual dimensions, building on but significantly extending the established concept of site-specific art XR art retains the essence of site-specificity by anchoring virtual experiences in real-world locations, ensuring that the physical context remains integral to the artwork’s impact (Dellepiane & Matteis, 2014).

This finding suggests that XR art may not represent a complete departure from physical art experiences but rather an extension that preserves contextual relationships while adding new dimensions.

The René Holm/Rufus project documentation revealed an innovative approach using light as both metaphor and interaction mechanism:

“Empower the viewer with a virtual light source they control – a symbolic and functional tool for exploration, revealing elements of the artwork and directing emotional tension.”

This metaphorical approach transforms viewing from passive observation to active exploration: “The viewer holds a virtual light, becoming the only source of illumination – revealing hidden details, textures, and emotions within the artwork.” This finding aligns with Kaushik and Amer’s (2020) theory of “active spectatorship” in digital arts while providing a specific mechanism through which such engagement is facilitated.

A key conceptual distinction emerged between extending versus altering traditional artworks:

“Remain faithful to Holm’s tone and message, extending – not altering – the original artworks through spatial, sensory storytelling.”

This principle guided technical implementations that respected artistic intent while embracing new possibilities, suggesting a more conservative approach than the “radical remediation.”

Participants identified several strategies for enhancing audience engagement through XR technologies, addressing both demographic expansion and experiential depth. Experts consistently mentioned the potential to attract younger and more diverse audiences:

“I also see this as an opportunity to introduce art to a younger generation. Kids would love this, because this is what they grow up in, and could see the possibilities in, okay, art is not only these boring paintings in a boring museum.”

This perception aligned with the goal articulated in the René Holm/Rufus project to “evoke a visceral, emotional response from the viewer by surrounding them with the atmosphere of René Holm’s darker pieces.” While this finding appears to support (Hürst et al., 2016) claim that digital extensions can democratize art access, our small sample size and focus on successful collaborations limits the generalizability of this conclusion.

Several artists envisioned extending gallery experiences into personal spaces:

“If somehow it would be so easy to do, that if people had the VR glasses at home, and they buy the painting, then they also, you have a QR code that you copy, and then you can actually, when you have guests at home, you say, hey, do you want to go into the work? Do you want to go behind the scene?” Rene Holm

This perspective suggests potential for new models of art distribution and collection, potentially disrupting traditional gallery and museum paradigms. This aligns with emerging research on NFTs and digital art ownership while suggesting more complex relationships between physical and digital art objects than typically acknowledged in that literature.

The documentation of process emphasized engaging multiple senses to create more immersive experiences:

This multi-sensory approach was designed to create deeper emotional connections with the artwork, extending beyond visual engagement to create what Merleau-Ponty (1945/2012) described as embodied perception. Our findings suggest that successful XR art experiences deliberately engage multiple sensory modalities rather than simply translating visual elements to virtual environments.

“Use motion, ambient sound, spatial design, and layered visuals to evolve Holm’s 2D work into a dynamic 3D world that breathes, reacts, and evolves as the viewer explores.”

This multi-sensory approach was designed to create deeper emotional connections with the artwork. The project followed an iterative process including presented on Figure 1.

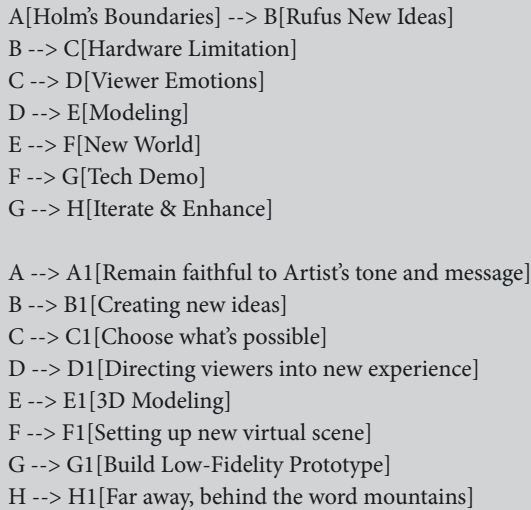
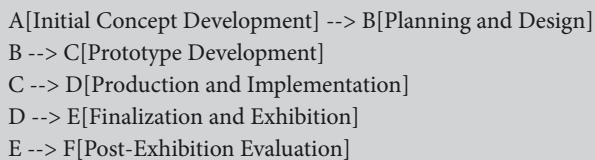


Figure 1. **Model of traditional and digital collaboration case Rene Holm/Rufus**

Source: own study

This model illustrates the collaborative process between traditional artists, digital artists, and the production team. It emphasizes the importance of maintaining the artist's original tone and message while exploring new ideas and working within hardware limitations. The process includes directing viewer emotions, creating 3D models, setting up new virtual scenes, building low-fidelity prototypes, and iterating to enhance the final product.

A more detailed model of the collaboration process reveals the complexity of these interactions presented on Figure 2.



A --> A1[Ideation and Brainstorming]

A --> A2[Research and Inspiration]

A1 --> A1a[Collaborative Meetings]

A1 --> A1b[Conceptual Framework]

A1 --> A1c[Artistic Intent]

A2 --> A2a[Art Historical Context]

A2 --> A2b[Technological Capabilities]

B --> B1[Project Scope and Objectives]

B --> B2[Technical Requirements]

B1 --> B1a[Define Objectives]

B1 --> B1b[Scope of Work]

B2 --> B2a[Hardware and Software]

B2 --> B2b[Spatial Design]

C --> C1[Low-Fidelity Prototypes]

C --> C2[Iterative Enhancements]

C1 --> C1a[Initial Prototypes]

C1 --> C1b[Feedback Loop]

C2 --> C2a[Iterative Process]

C2 --> C2b[User Testing]

D --> D1[High-Fidelity Models]

D --> D2[Interactive Elements]

D1 --> D1a[3D Modeling]

D1 --> D1b[Integration]

D2 --> D2a[User Interaction]

D2 --> D2b[Multi-Sensory Engagement]

E --> E1[Final Testing and Refinement]

E --> E2[Exhibition Setup]

E --> E3[Launch and Promotion]

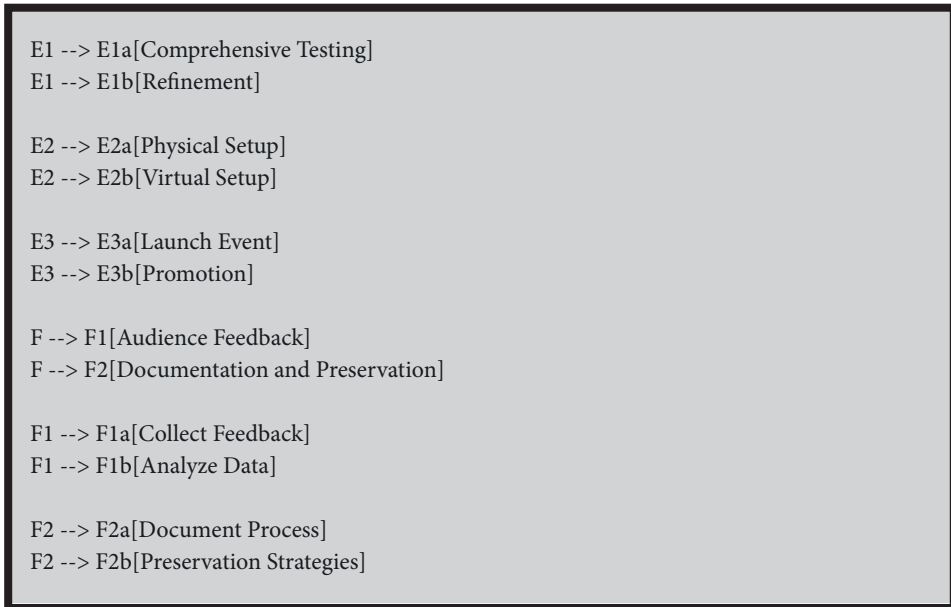


Figure 2. **Detailed model of traditional – digital collaboration**

Source: own study

This model illustrates the detailed steps involved in the collaboration between traditional artists, digital artists, and the production team. It emphasizes the importance of maintaining the artist's original tone and message while exploring new ideas and working within hardware limitations. The process includes directing viewer emotions, creating 3D models, setting up new virtual scenes, building low-fidelity prototypes, and iterating to enhance the final product. Milestones are marked with diamonds to highlight key achievements and checkpoints throughout the process.

The project utilized several AI-enhanced tools:

- “eleven labs: for voice cloning of Rene”
- “godot: game engine with neural networks support”
- “trellis ai: for processing drawings to 3D model with AI support”

This reveals an emerging production ecosystem that integrates AI to facilitate translation between traditional and digital art forms. The production process explicitly incorporated emotional response as a technical requirement: “Directing viewers into new experience.” This integration of affective considerations into technical planning represents a distinctive approach compared to purely functional digital production.

Our findings suggest several implications for traditional art institutions and exhibition practices. Experts identified the transformative potential for art distribution, potentially changing established business models:

“If you at one time have let’s say, five or ten different virtual artworks, you can just send it on an email to anywhere in the world. And if they have their own VR glasses, and can create the space, then it’s very easy to ship it around.”

This suggests potential for more democratic and widespread access to art experiences traditionally limited by physical location.

We acknowledge several significant limitations to this study. First, our small sample size (n=7) and focus on successful collaborations limits the generalizability of our findings, particularly regarding artist attitudes toward technological collaboration. Future research should include a more diverse sample of artists, including those who have rejected technological collaboration.

Second, our focus on a single case study (René Holm/Rufus) provides depth but limits breadth. Additional case studies across different artistic media and cultural contexts would provide valuable comparative insights.

Third, our methodology focused on producer perspectives rather than audience experiences. Future research should include audience studies to evaluate the effectiveness of the engagement strategies identified here.

The study identifies five key themes: (1) hybrid reality experiences as artistic extensions rather than replacements; (2) site-specific issues in implementing XR art; (3) audience expansion and deepened engagement through interactive elements; (4) different attitudes of artists toward technological collaboration; and (5) technical challenges requiring interdisciplinary solutions.

Despite the limitations, this study provides valuable insights into the emerging practices of traditional-digital art collaboration, offering both theoretical frameworks and practical models that can inform future collaborative projects and research.

5. Discussion

Authors findings suggest that XR technologies are facilitating a fundamental reimagining of how art is experienced. Traditional paintings and sculptures are no longer static objects for passive viewing but can become portals to immersive, interactive experiences. This transformation aligns with contemporary art theory that emphasizes viewer participation and the dissolution of boundaries between artwork and audience.

The virtual light source in the René / Rufus project exemplifies this shift, transforming viewing from passive observation to active exploration. As noted in the project documentation, “Light becomes both a tool and a symbol, allowing the user to explore and interact with the painting from within.” This approach creates what Grau (2003)

calls “osmotic interfaces” where the boundary between viewer and artwork becomes permeable.

A central tension in the study is the balance between preserving artistic intent and embracing new technological possibilities. The René Holm/Rufus project explicitly identified this balance as a key consideration, listing both “*René boundaries: Remain faithful to René’s tone and message*” and “*New ideas: Creating new ideas*” as parallel concerns in their process documentation.

This tension reflects broader debates in art conservation about authenticity and adaptation. However, our findings suggest that when artists themselves participate in the adaptation process, the result is not a compromise but a genuine extension of their artistic vision. As one traditional artist noted regarding the possibility of viewers “walking into” his paintings: “*I’m already thinking about, oh, could this be possible for my next exhibition in few weeks, to see the works, and then actually pick one work, and then walk into it.*”

Authors interviews revealed the potential for XR technologies to transform not only how art is experienced but also how it is exhibited and distributed. Artists described the possibility of sending virtual artworks “on an email to anywhere in the world” and using QR codes to allow collectors to access virtual extensions of physical paintings they purchase.

These emerging models challenge traditional art market structures that rely on scarcity and physical presence. They also raise important questions about how cultural institutions might evolve in response. Museums and galleries may need to reconceptualize their role as not merely housing physical objects but facilitating multidimensional experiences that span physical and virtual domains.

The collaboration between traditional and digital art forms introduces significant managerial challenges that require new approaches and skill sets. Our research identified several key areas:

1. Cross-disciplinary team management: The René Holm/Rufus project demonstrates how contemporary art production increasingly requires collaboration between traditional artists, digital artists, software developers, sound designers, and AI specialists.
2. Technical infrastructure planning: Art production managers now need expertise in hardware requirements, software licensing, network capabilities, and data storage solutions.
3. Rights management in digital environments: New questions emerge about ownership, royalties, and prevention of unauthorized reproductions in digital contexts.
4. Prototype-based project management: Digital art production follows iterative cycles of ideation, prototyping, testing, and enhancement, requiring more flexible project management approaches.

These challenges demand new skill sets including technological literacy, collaborative leadership styles, experience design thinking, and the ability to balance tradition with innovation.

6. Conclusion

This research reveals that the integration of XR technologies with traditional art forms represents not merely a technological innovation but a fundamental shift in artistic practice, exhibition, and reception. By allowing viewers to “step inside” traditional artworks, these technologies create new dimensions of experience that can deepen engagement and reach new audiences.

Our findings suggest that successful collaboration between traditional and digital art forms depends on several key factors:

1. Artist openness to technological collaboration and extension of their work.
2. Technical expertise that respects and enhances rather than overshadows artistic intent.
3. Careful consideration of physical spaces as anchors for virtual experiences.
4. User-centered design approaches that prioritize engagement and accessibility.

The managerial challenges introduced by these hybrid art forms require new skills and approaches that bridge traditional arts management with digital production methodologies. Institutions and individuals navigating this territory will need to develop cross-disciplinary fluency, embrace iterative development processes, and balance respect for artistic tradition with openness to technological innovation.

As this field continues to evolve, further research is needed to explore sustainable economic models, long-term preservation strategies, and methodologies for evaluating the impact and effectiveness of these hybrid art experiences. The conversations captured in our interviews suggest that we are only at the beginning of understanding the full potential of XR technologies to transform artistic expression and reception.

The collaboration between traditional and digital art represents not a replacement of one paradigm with another, but the emergence of a new paradigm altogether – one that honors artistic tradition while embracing the expanded possibilities of digital technologies. As one participant aptly summarized the potential of XR to transform traditional art: “It’s not only these boring paintings in a boring museum” but an opportunity to create deeply engaging experiences that can connect with contemporary audiences while preserving artistic intent.

Despite growing interest in the integration of extended reality (XR) technologies with traditional art forms, the review of the literature reveals several significant gaps that warrant further investigation: While some researchers have applied phenomenological frameworks to understand hybrid art experiences (Song & Evans, 2021), there remains a need for more comprehensive theoretical approaches. The field lacks:

1. Integrated aesthetic theories that address both traditional and digital dimensions of hybrid artworks. Current aesthetic theories predominantly address either traditional or digital art separately, with limited frameworks that comprehensively theorize their intersection (Kenderdine, 2021).
2. Ontological frameworks for understanding the nature of art objects that exist simultaneously in physical and virtual spaces. Questions about where the “actual” artwork resides – in the physical object, the digital extension, or the relationship between them – remain undertheorized (Bucher, 2018; Moloney).
3. Longitudinal impact studies on audience engagement with hybrid art forms are notably absent. While numerous studies document initial reactions to XR art experiences, few track how engagement patterns evolve over time or how they influence subsequent interactions with traditional art forms (He et al., 2018).
4. Standardized evaluation frameworks for assessing the effectiveness of XR art implementations are lacking. The field would benefit from consistent metrics that balance technological, artistic, and experiential dimensions (Rouse et al., 2022).
5. Accessibility considerations for diverse audiences remain underdeveloped. Research has insufficiently addressed how XR art experiences can be designed to accommodate varying levels of technological literacy, physical abilities, and cultural backgrounds (Panneels & Marshall, 2020).
6. Sustainable production models for hybrid art forms are underexplored. Few studies examine the economic, environmental, and institutional sustainability of maintaining XR art experiences over extended periods (Milovanovic et al., 2017).
7. Arts management literature has not sufficiently addressed the unique challenges posed by hybrid art production. While digital transformation is widely discussed in business literature, its specific application to arts management remains limited (Walmsley, 2019).
8. Educational implications for artist training remain largely unexplored. How art education should evolve to prepare artists for creating work that spans physical and virtual domains deserves greater attention (Fogliaroni).
9. AI integration with XR art experiences presents an emerging frontier with limited research. How artificial intelligence might enhance audience personalization, adapt experiences based on viewer responses, or even contribute to artistic co-creation represents a significant area for investigation (Akten & Grierson, 2020).
10. Preservation strategies for hybrid art forms remain critically underdeveloped. The challenges of preserving art experiences that depend on rapidly evolving technologies require urgent attention from conservation researchers (Dekker, 2018).

Addressing these gaps would significantly advance understanding of how XR technologies can meaningfully extend traditional art forms while preserving artistic intent, enhancing audience engagement, and creating sustainable models for future artistic practice.

Authors' contribution

M.S.-W., M.K., M.L. and R.P.: article conception, theoretical content of the article, research methods applied, conducting the research, data collection, analysis and interpretation of results, draft manuscript preparation. **L. G.:** data collection, analysis and interpretation of results, draft manuscript preparation.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors did not use Generative AI and AI-assisted technologies in the writing process

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