

Opera Heritage Aura Regained Through VR Immersion as Compensatory Translation

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Abstract: Opera heritage, once defined by Walter Benjamin's concept of "aura", the irreplaceable sensory and cultural essence of live performance, has faced erosion amid digitization's flattening of embodied experience. This paper introduces "compensatory translation" as a theoretical framework to examine how Virtual Reality (VR) revives opera's aura by offsetting the limitations of traditional digital formats. Through case studies of immersive VR productions such as White Snake Projects' Alice in the Pandemic and regional opera digitization initiatives, this research analyzes how VR reconstructs spatial presence, contextualizes cultural narratives, and empowers audience agency. By integrating qualitative analysis of technical design with user experience data, the study demonstrates that compensatory translation enables VR to reimagine opera heritage not as a static artifact, but as a dynamically immersive cultural practice. Findings highlight VR's potential to democratize access to opera while preserving its authentic aura, offering actionable pathways for digital heritage conservation.

Keywords: Opera Heritage, VR Immersion, Compensatory Translation, Aura Reconstruction, Digital Cultural Preservation.

1. Introduction

In the 21st century, the digitization of cultural heritage has emerged as a double-edged sword. On one hand, it has shattered geographical and economic barriers, making once-elite art forms like opera accessible to global audiences through streaming platforms, recorded broadcasts, and digital archives. On the other, this mass dissemination has sparked a growing concern among scholars, artists, and cultural custodians: as live performances are reduced to pixelated images and compressed audio, do we risk diluting the very essence that defines opera's cultural and aesthetic value? Walter Benjamin provides a critical lens through which to examine this tension. Benjamin argued that mechanical reproduction strips art of its "aura": the unique, irreplaceable presence that arises from a work's specific time, place, and embodied context. For opera, this aura is woven into the collective breath of a live audience, the subtle vocal inflections of a singer responding to the energy of the room, and the immersive spatiality of a grand opera house.

In the digital realm, these elements are often flattened into a passive, one-way viewing experience, leaving audiences disconnected from the cultural and sensory depth that makes opera a transformative art form. This paper addresses this crisis of aura by proposing "compensatory translation" as a theoretical framework for reimagining opera heritage in the digital age. Compensatory translation refers to the process by which emerging technologies like Virtual Reality (VR) offset the limitations of traditional digital formats, not by replicating live performance, but by translating its core sensory and cultural elements into a new, immersive medium. Unlike pre-recorded videos or streaming services, which present opera as a static, pre-determined object, VR has the potential to reconstruct the spatial presence, contextual narrative, and audience agency that are central to opera's aura. By creating virtual environments that respond to user interaction, VR can transform audiences from passive viewers into active participants, allowing them to explore the cultural and historical contexts of opera productions, engage with

performers in simulated real-time, and experience the spatial dynamics of a performance in ways that transcend the physical limitations of a traditional theater. To illustrate the potential of compensatory translation, this research examines two distinct case studies: White Snake Projects' Alice in the Pandemic, a groundbreaking VR opera that reimagines Lewis Carroll's classic tale through the lens of the COVID-19 pandemic, and regional opera digitization initiatives in China, which use VR to preserve and revitalize endangered local opera forms. These case studies demonstrate how VR can be used to contextualize cultural narratives, making opera's historical and social relevance accessible to contemporary audiences, while also empowering audience agency by allowing users to navigate virtual performance spaces and interact with digital representations of performers and cultural artifacts. By integrating qualitative analysis of technical design with user experience data, this study argues that compensatory translation enables VR to reimagine opera heritage not as a static artifact to be preserved, but as a dynamically immersive cultural practice that evolves with the needs and expectations of 21st-century audiences.

Ultimately, this research seeks to contribute to a growing body of scholarship on digital heritage conservation by challenging the notion that digitization inevitably leads to the erosion of cultural aura. Instead, it argues that emerging technologies like VR offer a new pathway for democratizing access to opera while preserving its authentic cultural and sensory essence. In an era where cultural heritage is increasingly threatened by globalization, climate change, and technological disruption, this study offers actionable insights for cultural institutions, artists, and technologists seeking to harness the power of digital tools to ensure that opera, and other embodied art forms, continue to thrive as living, breathing cultural practices.

2. Literature Review

2.1. Introduction to the Literature Review

This chapter undertakes a systematic review of existing

scholarship across three interconnected domains: Walter Benjamin's foundational concept of "aura," media transformation theories encompassing translation and remediation, and empirical research on virtual reality (VR) experiences. By synthesizing these disparate yet complementary bodies of literature, this review aims to establish a robust theoretical framework that underpins the subsequent analysis of VR's role in reviving the auratic qualities of opera heritage.

The exploration begins with Benjamin's (2009) seminal work on the aura of artworks, examining how mechanical reproduction disrupts the unique presence and authenticity of cultural artifacts [3]. This is followed by an analysis of media transformation theories, particularly Jakobson's (1959) intersemiotic translation [6] and Bolter and Grusin's (2000) remediation [4], which provide critical insights into how opera, as a complex semiotic system, adapts to new media environments. Finally, the review turns to VR research, focusing on the concepts of immersion [12] and presence [8] (Slater & Wilbur, 1997; Murray, 1997) and their implications for cultural heritage preservation [7].

By mapping the intersections of these theoretical and empirical strands, this chapter identifies significant gaps in current scholarship, particularly the lack of a unified framework for understanding how VR can address the specific auratic losses incurred in the transmission of opera. This sets the stage for the introduction of the "compensatory translation" concept, which is proposed as a novel lens through which to analyze VR's potential to restore opera's aura in the digital age.

2.2. Walter Benjamin and the Concept of Aura

2.2.1. Benjamin's Original Formulation

Walter Benjamin's essay *The Work of Art in the Age of Mechanical Reproduction* (2009) remains one of the most influential texts in media and cultural theory. In this work, Benjamin introduces the concept of "aura" to describe the unique quality of an original artwork—its "presence in time and space, its unique existence at the place where it happens to be". For Benjamin, aura is intimately linked to the artwork's authenticity, its history of ownership and exhibition, and its embeddedness in tradition and ritual.

Benjamin argues that mechanical reproduction technologies -- photography, film, and audio recording -- fundamentally alter the status of art by destroying its aura. When an artwork can be reproduced and viewed anywhere, it loses its connection to its original location and context. The reproduced object becomes detached from the domain of tradition, and its "cult value" (rooted in ritual and mystery) is replaced by "exhibition value" (rooted in mass consumption and accessibility). As Benjamin puts it, "that which withers in the age of mechanical reproduction is the aura of the work of art".

2.2.2. Applying Aura to Performance Art

While Benjamin focused primarily on visual arts and film, subsequent scholars have extended his concept to live performance. Phelan (1993) argues that performance has a unique ontology that distinguishes it from recorded media: live performance "becomes itself through disappearance" [9]. Unlike a painting or a film, which persists over time, a performance exists only in the moment of its enactment and cannot be perfectly preserved or reproduced. This ephemerality, Phelan suggests, is central to performance's power and its aura.

Auslander (2022) offers a contrasting perspective, arguing that "liveness" itself is a historically contingent concept that has been shaped by the development of recording technologies [1]. He contends that live performance and mediated performance are not oppositional but mutually defining -- the idea of "liveness" only became meaningful after the invention of recordings that could be contrasted with it. For Auslander, the relationship between live and mediated performance is complex and constantly evolving.

2.2.3. Opera and Aura

Applying these insights to opera, the concept of aura can be understood as encompassing multiple dimensions. Operatic aura is not solely a property of the work itself but emerges from the intersection of several elements: the physical theatre with its unique architecture and acoustics, the living bodies of performers generating unamplified sound, the collective presence of an audience sharing a temporal and spatial experience, and the irreversibility of each performance. Traditional recordings, as subsequent sections will show, inevitably sacrifice some of these dimensions.

2.3. Media Transformation: From Translation to Remediation

2.3.1. Jakobson's Intersemiotic Translation

To understand how opera changes when transferred to different media, Roman Jakobson's typology of translation provides a valuable starting point. Jakobson distinguishes three types of translation: (1) intralingual translation (rewording within the same language); (2) interlingual translation (between different languages); and (3) intersemiotic translation (between different sign systems).

Intersemiotic translation, or "transmutation," involves the interpretation of verbal signs through non-verbal sign systems. Extending this concept, the transformation of a live opera, which combines verbal text, music, visual spectacle, and bodily performance, into a recorded or digital format can be understood as a form of intersemiotic translation. In such translation, certain elements are inevitably lost, while others may be gained or transformed. This framework highlights that media change is never neutral but always involves selection, adaptation, and transformation.

2.3.2. Bolter and Grusin's Remediation

Building on similar insights, Bolter and Grusin (2000) propose the concept of "remediation" to describe how new media refashion older media forms. They argue that new media never entirely break with the past but rather incorporate and reshape existing media. Remediation operates through two competing logics:

(1) *Immediacy* (or transparent immediacy): The attempt to make the medium disappear so that the user feels directly present in the content. Virtual reality, with its immersive headset and 360-degree environments, represents an extreme attempt at immediacy.

(2) *Hypermediacy*: The fascination with the medium itself, where the interface is made visible and multiple representations are presented simultaneously. A website with multiple windows or a music video that constantly draws attention to its editing exemplifies hypermediacy.

Bolter and Grusin argue that these two logics are not mutually exclusive but often coexist. Even the most immersive VR experience still requires users to wear a headset and navigate interfaces, creating moments of hypermediacy within the broader project of immediacy.

2.3.3. Applying Remediation to Opera

For opera, remediation theory offers a powerful lens. A live opera performance remediates earlier theatrical and musical traditions. A filmed opera remediates the live performance by translating it into cinema's language of editing, camera angles, and close-ups. An HD broadcast remediates both live performance and cinema, adding the immediacy of "liveness" while remaining mediated by screens. Each remediation transforms the operatic experience in specific ways, privileging certain elements while sacrificing others.

2.4. Understanding Virtual Reality: Immersion and Presence

2.4.1. Defining Immersion and Presence

As VR has emerged as a significant medium for cultural applications, scholars have developed conceptual frameworks for understanding its distinctive qualities. Murray, in her pioneering work *Hamlet on the Holodeck*, identifies immersion as one of the core affordances of digital environments. She describes immersion as the sensation of being "surrounded by a completely other reality" that "takes over all our attention, our whole perceptual apparatus". For Murray, immersion is not merely technological but psychological—it requires the user's active participation and suspension of disbelief.

Slater and Wilbur (1997) introduce a crucial distinction between "immersion" and "presence." They define immersion as the technical capabilities of the VR system, the extent to which it can deliver inclusive, extensive, surrounding, and vivid illusions of reality. Presence, in contrast, refers to the user's subjective psychological response -- the sensation of "being there" in the virtual environment.

Slater (2009) further refines this framework by distinguishing two components of presence: ① Place Illusion: The sensation of being in a real place, even though one knows one is not. This depends on the VR system's ability to respond consistently to the user's movements and actions. ② Plausibility: The sensation that the events occurring in the virtual environment are really happening. This depends on the scenario's coherence and its responsiveness to the user [11].

2.4.2. VR and Cultural Heritage

The application of VR to cultural heritage has attracted increasing scholarly attention. Mercimek examines VR's potential for music education and cultural transmission, suggesting that immersive environments can enhance engagement and provide access to experiences that would otherwise be unavailable. However, most existing research focuses on heritage sites, museums, and educational applications, with limited attention to Western performing arts such as opera.

2.4.3. Opera in VR: Emerging Scholarship

While still limited, a small body of scholarship has begun to examine VR opera specifically. Some studies explore the technical challenges of capturing operatic performance for VR, while others consider the aesthetic implications of translating opera to immersive media. However, these studies tend to be descriptive rather than theoretical, documenting specific projects without developing broader frameworks for understanding VR's relationship to operatic aura.

2.5. Identifying the Research Gap

The literature reviewed above demonstrates significant

contributions across three domains. Benjaminian scholarship provides a rich vocabulary for discussing what is lost when artworks are reproduced and mediated. Media transformation theories: Jakobson's intersemiotic translation and Bolter and Grusin's remediation offer tools for analyzing how content changes across different media forms. VR research supplies concepts for understanding immersion, presence, and the possibilities of digital heritage.

However, several gaps emerge from this review:

First, while Benjamin's aura concept has been extensively applied to visual arts and film, its application to opera remains underdeveloped. Opera's complex combination of music, text, spectacle, and live performance presents unique challenges for understanding aura that existing scholarship has not fully addressed.

Second, although remediation theory illuminates how media transform content, it has not been systematically applied to the specific case of opera's migration across media from live performance to recording, to film, to HD broadcast, and now to VR.

Third, while VR scholarship has explored presence and immersion in various contexts, there is no unified framework for understanding how VR's affordances might specifically address the auratic losses incurred in traditional opera mediation. The concept of "compensatory translation", proposed in this thesis as an original contribution, seeks to fill this gap by theorizing VR as a medium that can consciously compensate for the deficits of earlier media.

Fourth, existing studies of VR and cultural heritage tend to be empirical and project-specific, lacking theoretical depth. They document what has been done without providing frameworks for understanding what VR can and cannot do for heritage preservation.

3. Deconstructing the Operatic Aura and Its Mediated Deficits

3.1. A Proposed Model of Operatic Aura

Building on the theoretical foundations established in Chapter 2, this section proposes a model for understanding the constitutive dimensions of operatic aura. While Benjamin's (2009) original formulation provides the conceptual starting point, opera's unique characteristics as live performance demand a more specific analytical framework.

Drawing on performance studies, operatic aura can be understood as emerging from four interrelated dimensions:

(1) Spatial Aura: The spatial dimension encompasses the unique physical environment of opera, the specific architecture of the opera house, its acoustic properties, and the spatial relationship between stage and audience. The "here" of live opera is not merely a location but a carefully constructed acoustic and visual space that cannot be replicated elsewhere.

(2) Temporal Aura: The temporal dimension refers to the irreversibility and uniqueness of each live performance. As Phelan (1996) argues, performance "becomes itself through disappearance"; its ontology is fundamentally tied to its ephemerality. Unlike a recording that can be replayed, a live performance exists only in its moment of enactment.

(3) Social Aura: The social dimension encompasses the communal nature of opera, the co-presence of performers and audience sharing the same temporal and spatial frame. This collective experience constitutes a form of ritual that

distinguishes live performance from individualized media consumption.

(4) Bodily Aura: The bodily dimension concerns the physical presence of living performers. The unamplified voice emanating from a visible, breathing body, the witness of physical effort and risk; this bodily co-presence creates what Benjamin would recognize as the “cult value” of the performer.

These four dimensions are mutually reinforcing. Together, they constitute the complex phenomenon this thesis terms “operatic aura.”

3.2. Traditional Media as “Reductive Translations”

Having established this model, this section examines how traditional media translate, and inevitably reduce, this multi-dimensional experience.

(1) The Audio Recording: The audio recording represents the most radical reduction. By capturing only the sonic dimension, it entirely eliminates spatial, social, and bodily aura. The listener encounters disembodied voices in an acoustic space bearing no relationship to the original performance. As Seeger (1986) notes, recordings preserve sonic content but sacrifice the performative context that gives it meaning[10].

(2) The Filmed Opera: Film restores the visual dimension but imposes its own reductions. Unlike the live spectator who freely chooses where to look, the film viewer is subject to the director’s gaze -- camera angles and editing determine what can be seen. The voice becomes synchronized with a two-dimensional image rather than emanating from a real, three-dimensional body. Furthermore, film eliminates temporal uniqueness; it is fixed, repeatable, and always already past (Wurtzler, 1992)[13].

(3) Live in HD Broadcasts: HD broadcasts represent a hybrid form, preserving temporal simultaneity but sacrificing spatial co-presence. Viewers watch as the performance happens but are spatially removed from performers and from each other. As Auslander (2022) argues, “liveness” is not a fixed quality but a construct that evolves with technology -- HD broadcasts represent not a corruption of authentic liveness but an evolution in how liveness is constructed.

3.3. Defining the “Auratic Deficit”

“Auratic deficit” refers to the gap between the multi-dimensional experience of live opera and what any given medium can transmit. Each medium performs a selective translation that privileges certain dimensions while sacrificing others. The deficit is not a measure of failure but an inherent characteristic of intersemiotic translation.

Drawing on the four-dimensional model, the auratic deficit of traditional media can be mapped as Table 1.

Table 1. Auratic Deficits of Traditional Media

Medium	Spatial	Temporal	Social	Bodily
Audio Recording	Lost	Lost	Lost	Lost
Filmed Opera	Reduced	Lost	Lost	Reduced
HD Broadcast	Lost	Preserved	Reduced	Reduced

Understanding these deficits serves two purposes. First, it clarifies why traditional media cannot fully satisfy the desire for authentic operatic experience. As Connor (1996) observes, “the proliferation of reproductions actually intensifies the

desire for origin.”[5] Second, mapping these deficits establishes criteria for evaluating whether new media, particularly VR, can genuinely compensate for what has been lost. A medium claiming to restore operatic aura must demonstrate its capacity to address the spatial, temporal, social, and bodily dimensions that traditional media sacrifice.

Mediation is not merely a story of loss. Each medium also creates new possibilities, audio recordings enable intimate study, films offer impossible perspectives, HD broadcasts reach global audiences. The concept of “auratic deficit” does not deny these gains but provides a framework for understanding what is distinctive about live experience. This sets the stage for Chapter 4’s exploration of VR as “compensatory translation.”

This chapter has deconstructed operatic aura into four dimensions, spatial, temporal, social, and bodily, and analyzed how traditional media perform “reductive translations” that sacrifice these dimensions. The concept of “auratic deficit” has been introduced as a tool for mapping these losses and establishing criteria for evaluating new media’s compensatory potential.

4. VR as Compensatory Translation: A Theoretical Framework

4.1. Introduction of “Compensatory Translation”

4.1.1. Defining the Concept

Building on the analysis of auratic deficits in Chapter 3, this chapter introduces “compensatory translation” as the central theoretical contribution of this thesis. The term refers to a remediation strategy that consciously leverages new technology’s unique affordances to address the specific losses incurred by previous media forms. Unlike traditional media, which perform what Chapter 3 termed “reductive translation”, inevitably sacrificing certain dimensions of operatic aura, VR offers the possibility of compensatory translation: using its distinctive capabilities to restore, at least partially, what earlier media could not transmit.

This concept draws on Jakobson’s intersemiotic translation and Bolter and Grusin’s remediation, but extends them by introducing a normative dimension. Compensatory translation is not merely descriptive of what happens when media change; it proposes criteria for evaluating whether a new medium can genuinely address the limitations of its predecessors.

4.1.2. Theoretical Foundations

Three theoretical insights from Chapter 2 underpin this framework:

(1) First, Benjamin’s (2009) aura concept establishes that what is lost in reproduction is not merely detail but the artwork’s “presence in time and space.” Compensatory translation must therefore address not just content but context and presence.

(2) Second, Bolter and Grusin’s (2000) logic of immediacy suggests that VR’s project of making the medium disappear aligns with the goal of restoring the spectator’s sense of “being there” in the operatic event.

(3) Third, Slater’s (2009) distinction between place illusion and plausibility provides criteria for evaluating whether VR’s compensation is genuinely experienced or merely technological.

4.1.3. Compensatory vs. Reductive Translation

The key distinction can be summarized as Table 2.

Table 2. Key Distinction between Reductive Translation and Compensatory Translation

Reductive Translation	Prioritizes certain dimensions while sacrificing others; accepts loss as inevitable
Compensatory Translation	Consciously uses medium-specific affordances to address the losses of previous media; aims for a more holistic, albeit transformed, experience

This framework does not claim that VR can perfectly replicate live opera. Rather, it proposes that VR's unique capabilities may allow it to compensate for specific deficits in ways that audio, film, and HD broadcasts cannot.

4.2. Mapping VR Affordances onto Auratic Deficits

This section systematically examines how VR's key affordances map onto the four dimensions of operatic aura identified in Chapter 3.

4.2.1. Spatial Compensation: Regaining the Theatre

Table 3. Compensating for Spatial Deficit

Auratic Deficit	VR Compensation	Theoretical Basis
Loss of physical space	360-degree immersive environments	Slater's "place illusion"
Loss of acoustic presence	Spatial audio technology	Bolter & Grusin's "immediacy"

VR's most fundamental affordance is its ability to create a convincing sense of being in a place. Through head-tracked, stereoscopic displays and spatial audio, VR can reconstruct the opera house environment; not as a flat image but as a surrounding space. The user can look around freely, experiencing the scale of the theatre and the spatial relationships between stage, orchestra, and audience.

This directly addresses the spatial deficit of audio recordings which have no visual space and HD broadcasts which present space as a two-dimensional image. While the space is simulated rather than physically present, VR's immersive qualities can generate what Slater (2009) calls "place illusion", the sensation of being in a real place despite knowing one is not.

4.2.2. Bodily Compensation: Regaining the Gaze

Table 4. Compensating for Bodily Deficit

Auratic Deficit	VR Compensation	Theoretical Basis
Loss of freedom of gaze	First-person perspective; user-controlled viewing	Murray's "agency"
Loss of bodily co-presence	Sense of embodied presence in virtual space	Slater's "embodiment"

In live opera, the spectator freely chooses where to look, following a singer, examining an instrument, observing reactions. Film destroys this freedom by imposing a director's gaze. VR restores it: the user decides where to look, when, and for how long.

This restoration is not merely visual but embodied. VR creates a sense of having a body in the virtual space, a phenomenon Slater and Wilbur (1997) term "presence."

While the user cannot physically interact with performers, the ability to move one's head and shift one's gaze creates a bodily relationship to the performance that film cannot provide.

This partially compensates for the bodily deficit of traditional media. The user does not share physical space with living performers, but experiences a simulated co-presence that more closely approximates live spectatorship than the fixed frame of cinema.

4.2.3. Temporal Compensation: Simulating Liveness

Table 5. Compensating for Temporal Deficit

Auratic Deficit	VR Compensation	Theoretical Basis
Loss of "here and now"	Real-time rendering; responsive environment	Slater's "plausibility"

The temporal deficit is the most challenging to address. Live opera's temporal aura derives from its irreversibility and risk - the knowledge that this moment will never recur exactly. Recorded media, including film, eliminate this dimension entirely.

VR offers partial compensation through what Slater (2009) calls "plausibility", the sensation that events are really happening. In a well-designed VR experience, the environment responds to the user's movements in real-time, creating a sense of immediate presence. If the experience is live-streamed rather than pre-recorded, it can also preserve temporal simultaneity with the actual performance.

However, even live-streamed VR remains mediated. The user knows the performers are not physically present. VR can simulate liveness more effectively than film, but cannot fully restore the temporal aura of live performance, a limitation addressed in section 4.3.

4.3. The Limits of Compensatory Translation

4.3.1. The Social Deficit: The Problem of Individualized Experience

The most significant limitation concerns social aura. Live opera is fundamentally communal, an audience shares the experience, reacting together, creating a collective energy that shapes the performance. VR, as currently configured, is radically individual. A single user wears a headset, isolated from others, experiencing the performance alone.

Multi-user VR environments exist and could theoretically simulate co-presence with other audience members as avatars. However, even the most sophisticated social VR cannot replicate the unpredictable, unmediated presence of hundreds of strangers breathing, coughing, and applauding together. The social deficit may be the one most resistant to technological compensation.

4.3.2. The Question of Authenticity: Real or Simulated?

VR compensates by simulation; it creates a convincing virtual environment rather than transporting the user to a real one. This raises questions about authenticity. Is experiencing a simulated opera house equivalent to experiencing the real one? Does VR preserve opera heritage or create a substitute?

Baudrillard's (1994) concept of the "hyperreal" offers a critical lens[2]. He argues that in postmodern culture, simulations become more appealing than the real, eventually replacing it. Applied to VR opera, this suggests a risk: future audiences might prefer the clean, controllable, perfect VR version to the messy, unpredictable, expensive reality of live performance. Compensatory translation could become replacement rather than preservation.

4.3.3. The Performer's Ghost

Finally, VR struggles to capture the bodily aura of living performers. In live opera, the performer's physical presence is central, the effort, the sweat, the direct address. In VR, the performer may be a recording, a volumetric capture, or an avatar. The user knows, at some level, that no one is actually there.

This does not invalidate VR opera but transforms it. The relationship shifts from genuine co-presence to what might be called "simulated encounter." Whether this transformation enriches or diminishes operatic heritage remains an open question.

5. Critical Discussion

5.1. The Paradox of Individualized Ritual

Chinese opera's cultural value stems not only from its artistic expression but also from its role as a collective ritual. In traditional theaters, the synchronized reactions of the audience, close physical interactions, and collectively created atmosphere form the core of opera's "social aura." This aura is rooted in Benjamin's concept of the "here and now," as well as the fleeting yet intense collective consciousness forged among strangers through shared responses to the performance. However, VR technology delivers an inherently individualized immersive experience. Users entering virtual spaces alone become completely isolated from the physical environment and others in the real world, creating a fundamental contradiction with opera's collective ritual nature.

VR breaks down spatial barriers, allowing audiences who cannot attend in person to experience opera. Yet it dissolves the sense of "collective presence" inherent in live performances. In traditional theaters, the audience's applause, sighs, and even whispered comments are integral parts of the performance. These immediate and unpredictable interactions endow each show with a unique aura. In VR experiences, however, users' reactions are isolated and fail to resonate with others either virtually or in reality. This individualized immersion risks reducing opera from a "collective ritual" to a "personal consumer product."

Some VR opera projects attempt to simulate collectivity through technology, such as creating virtual audience models in virtual theaters or adding real-time interactive bullet comments. Nevertheless, this simulated "collectivity" is fundamentally different from the physical co-presence of real theaters. Virtual audience reactions are preset algorithms, and bullet comment interactions are delayed textual exchanges that cannot replicate the direct embodied emotional connection between people in live performances. Even technologically simulated collectivity remains an "imagined community" rather than a "community of experience." This paradox reveals VR's limitations in reconstructing opera's "social aura": it can replicate spatial presence but struggles to recreate emotional resonance between individuals.

5.2. The Question of Authenticity

This study proposes the theory of "compensatory translation," suggesting that VR can use technological means to compensate for the shortcomings of traditional media in conveying opera's aura. However, this theory assumes that "virtual aura" and "real aura" hold equal cultural value. From Benjamin's concept of "aura," the authenticity of virtual experiences is questionable.

Benjamin emphasized that the core of aura lies in "unique presence," the physical existence of an artwork in a specific time and space. The aura of traditional opera performances is embodied in this "irreplaceable uniqueness." Each performance is irreproducible, shaped by the actors' states, audience reactions, and even subtle environmental changes. In contrast, VR opera experiences are infinitely replicable. Every time users enter a virtual theater, they encounter identical digital content. Whether such "indistinguishable reproductions" can embody Benjamin's concept of "aura" requires further examination. While VR meticulously restores the "perceptual authenticity" of sight and sound, it does so at the cost of "existential authenticity," the physical co-presence and one-time nature of the event.

From the user experience perspective, there is a disconnect between VR's "perceptual authenticity" and "ontological authenticity." VR creates a sense of "physical presence" through 360-degree imaging and spatial audio, giving users the illusion of "being in the theater." Yet the experience is fundamentally virtual. Users are fully aware they are engaging with digital content, not real actors and physical space. This contradiction of "knowing it is artificial yet perceiving it as real" may impact users' perceptions of opera's cultural authenticity. Once accustomed to virtual opera experiences, audiences may gradually lose their pursuit of the "real aura" of live performances. In this sense, VR resembles a delicate piece of amber: it preserves the form of opera but risks freezing its soul.

5.3. The Performer's Presence

Opera's aura heavily relies on the performer's "physical presence." The actor's breath, gaze, subtle bodily tremors, and the texture of their live singing voice are all vital components of opera's artistic charm. However, VR technology faces insurmountable limitations in conveying the performer's "bodily aura."

Currently, VR opera content is primarily produced in two ways: 360-degree filming of live performances, or generating virtual actors through motion capture and CG technology. 360-degree filming can preserve the actor's real image and performance, but fixed camera angles and post-production editing erase the sense of direct physical interaction between actors and audience in live shows. Virtual actors created via motion capture allow for more flexible perspective switching, yet they cannot fully replicate the actor's physical texture and emotional nuances. Motion capture only reproduces the trajectory of limb movements, failing to capture the actor's emotional depth and improvisational moments during performances. This is particularly true for opera's subtle "eye techniques" and the visceral impact of "living, breathing performance"-elements current digital technology struggles to recreate authentically.

The "mediating nature" of VR technology creates an invisible barrier between the audience and performer. In traditional theaters, audiences can directly see the actor's sweat and hear their breath. This "embodied intimacy" is a crucial source of opera's aura. In VR, however, audiences view digitally processed images and listen to technically optimized audio. This technologically mediated experience can make the performer's body feel "distant and unfamiliar," weakening the essential attribute of opera as a "direct dialogue between people."

From the perspective of performing arts, performances in VR environments differ fundamentally from live shows.

During live performances, actors adjust their acting based on audience reactions. This “real-time interaction” is part of the performance’s aura. But in VR content production, actors either perform facing an empty green screen or ignore the audience behind the camera during live recordings. This “performance without an audience” may significantly diminish the actor’s expressive power, thereby affecting the transmission of opera’s aura.

6. Conclusion

This study has explored the potential of Virtual Reality (VR) to revive the aura of opera heritage through the theoretical framework of “compensatory translation.” By deconstructing operatic aura into spatial, temporal, social, and bodily dimensions, the research has identified the auratic deficits inherent in traditional digital media and examined how VR’s unique affordances can address these limitations. Through the analysis of case studies and theoretical synthesis, this research demonstrates that VR, as a compensatory translation medium, offers a novel pathway to reconstruct spatial presence, restore audience agency, and contextualize cultural narratives, thereby reimagining opera heritage as a dynamically immersive cultural practice. The findings highlight that VR’s capacity to generate place illusion and embodied presence enables it to partially compensate for the spatial and bodily deficits of traditional media. By offering user-controlled viewing perspectives and immersive environments, VR transforms passive spectatorship into active engagement, allowing audiences to experience opera in ways that transcend the physical constraints of traditional theaters. Critical discussions reveal inherent limitations in VR’s ability to fully replicate the social and temporal dimensions of live opera.

The individualized nature of VR experiences challenges the collective ritual aspect of opera’s social aura, while the reproducibility of virtual content raises questions regarding the authenticity of the auratic experience as defined by Benjamin’s emphasis on unique presence and irreplaceability. Additionally, the mediation of performer presence through digital technology introduces barriers to the transmission of the embodied intimacy and real-time interaction that are integral to live performance. Despite these limitations, this research contributes to the field of digital heritage conservation by providing a theoretical framework for understanding how emerging technologies can be harnessed to preserve and revitalize embodied art forms. The concept of compensatory translation offers a nuanced perspective that acknowledges both the losses and gains inherent in media transformation, moving beyond the binary view of digitization as either preservation or erosion of cultural aura. By demonstrating VR’s potential to democratize access to opera while preserving its authentic cultural and sensory essence, this study provides actionable insights for cultural institutions, artists, and technologists. Future research should

focus on addressing the identified limitations, particularly in enhancing social interaction within virtual opera environments and exploring innovative methods to convey the embodied presence of performers. Ultimately, VR emerges not as a replacement for live opera, but as a complementary medium that can extend its reach, engage new audiences, and ensure its vitality as a living cultural practice in the digital age.

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