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VIRTUAL AND AUGMENTED REALITY IN CONTEMPORARY ART PERFORMANCES

Realidad virtual y aumentada en las performances artísticas contemporáneas

ABSTRACT

The integration of virtual reality (VR) and augmented reality (AR) technologies into the field of fine arts opens up new opportunities for transforming the artistic space, enriching the viewers' aesthetic experience, as well as activating cognitive and perceptual processes. The relevance of the study is determined by the rapid development and implementation of AR/VR technologies in artistic practices, which requires an academic understanding of their aesthetic, cognitive, and cultural consequences. The combination of digital media, 3D modelling, and interactive sensory scenarios contributes to the creation of dynamic artistic performances in which figurative thinking, aesthetic image, and stylistics acquire virtual multidimensionality. The aim of the research is to analyse the ways in which VR/AR technologies are used in artistic practices of contemporary art with a focus on the new forms of interaction between the author, image, and recipient. The research employed the following methods: qualitative analysis of digital installations and stage practices with elements of virtual space, a comparison of the perceptual reactions of the audience, and the study of 3D modelling as a tool for creating an artistic environment. The results indicate the growing role of digitalization and artificial intelligence (AI) in the evolution of the visual code of contemporary art, the expansion of the stylistic and cognitive boundaries of perception, and the rethinking of aesthet-

RESUMEN

La integración de las tecnologías de realidad virtual (RV) y realidad aumentada (RA) en el campo de las bellas artes abre nuevas oportunidades para transformar el espacio artístico, enriqueciendo la experiencia estética del espectador y activando los procesos cognitivos y perceptivos. La relevancia del estudio se debe al rápido desarrollo e implementación de las tecnologías de RA/RV en las prácticas artísticas, lo que requiere una comprensión académica de sus consecuencias estéticas, cognitivas y culturales. La combinación de medios digitales, modelado 3D y escenarios sensoriales interactivos contribuye a la creación de performances artísticas dinámicas en las que el pensamiento figurativo, la imagen estética y la estilística adquieren una multidimensionalidad virtual. El objetivo de la investigación es analizar las formas en que se utilizan las tecnologías de RV/RA en las prácticas artísticas del arte contemporáneo, centrándose en las nuevas formas de interacción entre el autor, la imagen y el receptor. La investigación empleó los siguientes métodos: análisis cualitativo de instalaciones digitales y prácticas escénicas con elementos del espacio virtual, comparación de las reacciones perceptivas del público y estudio del modelado 3D como herramienta para la creación de un entorno artístico. Los resultados indican el creciente papel de la digitalización y la inteligencia artificial (IA) en la evolución del código visual del arte contemporáneo, la expansión de los límites estilísticos y cognitivos de la percepción, y la reformulación de los mecanismos estéticos en el contexto de la interactividad y la realidad simulada. La novedad académica reside en la

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ic mechanisms in the context of interactivity and simulative reality. The academic novelty is identified patterns of shifting the emphasis from the art object to the artistic interaction process, where VR/AR and 3D modelling are leading mediators of visual transformation. Prospects for further research may be studying the impact of digital performances on the viewers' emotional and perceptual experience and the role of AI algorithms in the artistic generation of visual content.

identificación de patrones que desplazan el énfasis del objeto artístico al proceso de interacción artística, donde la RV/RA y el modelado 3D son mediadores clave de la transformación visual. Las perspectivas de investigación futura podrían ser el estudio del impacto de las representaciones digitales en la experiencia emocional y perceptiva de los espectadores y el papel de los algoritmos de IA en la generación artística de contenido visual.

KEYWORDS

fine arts, virtual reali ty, augmented reality, 3D modelling, artificial intelligence, digitalization.

PALABRAS CLAVE

bellas artes, realidad virtual, realidad aumentada, modelado 3D, inteligencia artificial, digitalización.

1. INTRODUCTION

Visual arts in the context of digital transformation are actively rethinking the forms of representation, space, and interaction with the viewer. In this context, virtual and augmented reality are gaining the status of full-fledged artistic environments capable of transforming not only the technical plane of art, but also the principles of its perception. Virtualization of artistic experience enables creating multidimensional aesthetic images that combine the real and the simulated, activating recipient's cognitive processes and imaginative thinking (Wang et al., 2024). The relevance of the study is determined by the fact that VR/AR technologies are increasingly becoming not only a visualization tool, but also a means of artistic thinking that determines the style and spatial logic of modern performances (Derkach et al., 2023).

The use of AR in the artistic process covers a wide range of practices — from video mapping and spatial design to interactive visual interfaces that respond to movement, sound or the viewer's presence (Baía Reis & Ashmore, 2022). The development of digital theatrical forms, particularly in virtual environments, indicates a profound change in the viewer's function – from an observer to an active participant in the artistic event (Xiong et al., 2021). Such a transformation of space and roles creates the prerequisites for deeper engagement, reflection, and modelling of individual experience in the artistic act.

Improvements in display systems, graphical interfaces, and sensory data processing are increasing the technical quality of AR/VR solutions, allowing for a deep immersion effect and enhanced artistic impact (Dargan et al., 2023). The ability of AR/VR systems to realistically convey colour, texture, lighting, and image dynamics opens up new horizons for stylistic experiments in the field of performative art (Cabero-Almenara et al., 2022). In addition, new digital formats create conditions for immersive reconstruction of artistic styles and visual traditions, which expands the didactic and cultural potential of VR/AR performances (Yin et al., 2021). Despite its numerous advantages, the use of virtual space in art is accompanied by a number of challenges: sensory overload, complexity of interfaces, high technical requirements for visual content, and the growing risk of visual monotony (Jung et al., 2022). Furthermore, the issue of the correspondence of the artistic content to the cultural code of the audience arises, as in AR/VR performances it is important not only to create the effect of presence, but also to provide the viewer with a recognizable aesthetic structure (Song et al., 2021). The quality of visual rendering, in particular in augmented reality, directly affects the effectiveness of artistic impact, which

requires taking into account the physiology of vision, cognitive load, and interaction parameters (Duan et al., 2022).
So, the relevance of the issue under research is determined by the need for a systematic analysis of the methods of integrating VR and AR into modern fine art, in particular in performative practices that combine image, space, movement and audience interaction.
The aim of this study is to analyse the artistic and technical specifics of the use of VR/AR technologies in artistic performances from the perspective of their impact on the viewer's perception, style, aesthetic image, and cognitive processes.
The aim involved the fulfilment of the following research objectives:

1. Identify the artistic and technological parameters of VR/AR performances that affect the formation of an aesthetic image and the viewer's involvement;

2. Develop an Perceptual Impact Index (IPZ) for a comparative analysis of the level of perceptual impact of different types of performances.

3. Assess the potential of VR/AR technologies in transforming the style, cognitive activity, and interactive scenario of contemporary art.

Although VR/AR is actively used in art, comprehensive research on its role in visual practices is still lacking. Existing studies mainly cover theatrical or multimedia formats, while painting, graphics, and experimental visual art in the digital environment remain less studied. This study examines VR/AR as tools of artistic visualization that transform the style, structure of the image, and viewer perception. The proposed analytical model outlines the criteria for the effective integration of VR/AR into the visual arts and serves as a basis for further understanding of changes in contemporary culture.

2. LITERATURE REVIEW

The current academic discourse shows a growing interest in the impact of VR and AR technologies on fine arts and artistic performance, but the approaches of researchers remain fragmented in both theoretical and methodological aspects. In the work of Arslan & Berthaut (2025), 3D interactions in the stage space are considered as a means of increasing visual readability and emotional impact, which correlates with the findings of Ye and Li (2022). They emphasized the enhancement of the immersion effect and imaginative thinking due to digital environments. Both studies reveal the importance of interactive design as a key aesthetic parameter, but do not detail the mechanisms of its cognitive impact, which Zhou and Li (2024) took advantage of, proposing a model of emotional reception through visual stimulation.
In contrast to the concept of contemplation, Nagele et al. (2021) represented AR as a means of active participation, while Togou et al. (2024) added a platform component – remote co-creation as a new format of interaction. Their approaches conceptually converge with the vision of An (2024), who emphasized the curatorial potential of digital platforms, however, none of the studies provided a clear typology of the viewer's roles in AR/VR performances – this gap is partially compensated in our work. De Luca et al. (2023) emphasized social inclusion as an important vector that expands access to art, having something in common with the vision of Kargas and Loumos (2023), where AR/VR act as tools of a global artistic narrative. In contrast, the research of Kim and Lee (2022) presents a more futuristic perspective, focusing on new practices of sustainable art consumption in virtual spaces. These approaches share a focus on changing the social context of art, but lack the depth of analysis of aesthetic effects. Chang et al. (2023) specialize in this aspect, although they focus mainly on the educational environment.
In a number of studies, in particular Shen and Chen (2024) and Kyriakou et al. (2024),

virtuality is interpreted through the prism of bodily presence – gesture, posture, avatar as a mediator. This correlates with the concept of interface identification in our study, but their methodology is mainly based on technical parameters, rather than on semiotic or aesthetic analysis. Similarly, Gronowski et al. (2024) and Hidajat (2024) focus on the functionality of AR/VR as visualization and modelling tools, bypassing the issue of perceptual content, which limits their relevance in an artistic context.

A separate vector is formed by studies that deal with gamification and the intersection of AR with games, as in Lichty (2024), Hung and Yeh (2023), who emphasized the activation of creative thinking. However, their approach focuses on the user experience without taking into account the semantic load of aesthetic space. Similarly, Bourgeois-Bougrine et al. (2022) describe the impact of VR on collective creativity, but do not analyse the artistic and communicative component of the visual message.

Instrumental aspects are considered in Daling and Schlittmeier (2024), where VR/AR is used for sensorimotor training – such a utilitarian approach contrasts sharply with the aesthetic semiotic focus of Sovhyra (2025). The matter, on the contrary, analyses the nature of imitation and transitivity of the artistic image in a virtual environment. This difference in epistemological priorities demonstrates the lack of a single analytical framework in the field, which our study partially tries to structure through the introduction of the aesthetic immersion index and the typology of effects.

So, the results of the source analysis indicate an intensive growth of interest in VR/AR as tools for expanding artistic practices in the field of fine arts. At the same time, there is a shortage of holistic studies that would integrate visual, aesthetic, technological, and perceptual aspects within a single model of artistic interaction. This study aims to fill the existing gap by examining the impact of virtualization technologies on the transformation of artistic experience and the rethinking of visual language in contemporary art.

3. Problem Statement

The active penetration of VR/AR into the cultural space and art education has led to a transformation of the ways of interacting with the artistic image, stylistic codes, and forms of visual thinking. In particular, artistic practices acquire new formats in the context of digitalization – from interactive installations to immersive performances – which requires a rethinking of traditional pedagogical and aesthetic approaches. Despite innovative examples of the use of VR/AR in world practice – such as cultural reconstructions (Cisternino et al., 2021), gamified models of creative thinking (Lichty, 2024), or sensorimotor training tools (Daling & Schlittmeier, 2024) – these solutions mostly remain outside the focus of academic analysis in the context of the development of aesthetic competence. The perceptual effects of interaction with digital art in the VR environment are particularly poorly studied, which transforms not only the format of perception, but also the structure of the viewer's emotional, cognitive, and bodily experience (Kim, & Lee, 2022; Bourgeois-Bougrine et al, 2022). The problem remains the lack of models adapted to the artistic and educational process that would allow integrating virtual interaction into the development of figurative thinking, stylistic reflection, and interpretive skills.

The visual and aesthetic potential of VR/AR is often realized in technocentric projects, where the technological effect prevails over artistic quality. This leads to the risk of formalizing artistic experience, when perceptual richness is not accompanied by deep aesthetic interaction. The need to form tools for critical understanding of digital visual content remains relevant, in particular in education. The problem is the lack of a comprehensive model for using VR/AR to develop aesthetic competence in the visual arts. A pedagogically adapted approach that combines technology, meaningful visual communication, and perception analytics is required. This study aims to fill this gap by analysing the functional and artistic parameters of VR/AR in art education, with an emphasis on visual thinking and the transformation of the image in the digital age.

4. PROPOSED METHODOLOGY

4.1. Research Design

The study was implemented in three consecutive stages to ensure the systematic analysis of VR/AR in the context of modern artistic performances. The first stage (January–February 2025) involved a selection of relevant cases of AR/VR performances of 2021–2024, which demonstrate innovative artistic solutions and the use of technologies in visual and perceptual interaction with the viewer. The second stage (March–April 2025) was a critical analysis of the selected cases using mixed methods: aesthetic analysis, structural reconstruction of interaction scenarios and semi-structured interviews with authors or project participants. At the third stage (May–June 2025), the results were summarized into a typological model of the interaction of VR/AR effects with performativity parameters: composition, interface, intention, and feedback.
Additionally, the research design incorporated a verification sub-stage aimed at confirming the consistency of expert assessments within the mixed-method framework. This validation process was essential to ensure that both qualitative and quantitative data corresponded to the same interpretive logic when assessing aesthetic immersion and performative interaction.

4.2. Sample

The analytical sample included 12 art performances with AR/VR components that were presented at international festivals, digital galleries, or within art residencies. These include: CyberOpera. Spatial Layering Experience (France, 2023), Songs for a Passerby (Netherlands, 2023), Le Bal de Paris de Blanca Li (France/Taiwan, 2023), Being Here and Now (South Korea, 2024), Dance Trail (Switzerland, 2020), Cosmogony (Switzerland, 2022), Ryuichi Sakamoto – Kagami (Japan, 2023), ReMemory (Japan, 2022), Virtual Rituals (USA, 2024), Includiamoci (Italy, 2023), Live VR Art Showcase (USA, 2023), Voices of VR: Raindance Immersive Selection (Great Britain, 2023). These performances cover a wide range of technologies (VR, AR, MR), forms of artistic interaction (holographic immersion, gesture navigation, routing, cross-platform streams), and aesthetic effects – from emotional immersion to collective perceptual experience. All of them use interactivity as a key principle of constructing artistic interaction, involving the viewer in co-creation or navigation through multilayered digital worlds. The main criteria for inclusion in the sample were: (1) available interactive AR or VR structure; (2) a distinct artistic idea with a transmedia nature; (3) available open descriptions, video recording or professional reviews; (4) a focus on aesthetic image, not just technical demonstration (Tab. 1).

Performance name	Country	Year	Technology	Main artistic effect	Interaction with the viewer
CyberOpera. Spatial Layering Experience	France	2023	Spatial AR	Multiple projection and stage illusion	Gesture navigation
Songs for a Passerby	Netherlands	2023	AR	Individualized perception of movement in space	Viewer-chosen route
Le Bal de Paris de Blanca Li	France/Taiwan	2023	VR	Immersive choreography in real time	Interactive participation in VR ball

Tab. 1 - Key characteristics of AR/VR performances included in the sample. Source: developed by the authors based on the results of their own research.

Tab. 1 (cont.) - Key characteristics of AR/VR performances included in the sample. Source: developed by the authors based on the results of their own research.

Being Here and Now	South Korea	2024	VR	Holographic interaction with virtual bodies	Virtual presence and spatial manipulation
Dance Trail	Switzerland	2020	AR	AR overlay of dance silhouettes	Mobile AR visualization
Cosmogony	Switzerland	2022	VR	Online performance with a digital avatar	Synchronous streaming
Ryuichi Sakamoto – Kagami	Japan	2023	VR	Audiovisual immersion	Sensory immersion
ReMemory	Japan	2022	VR	Emotional immersion through memory	Route selection
Virtual Rituals	USA	2024	VR	Virtualization of rituals through avatars	Avatar interaction
Includiamoci	Italy	2023	AR	Social interaction in AR space	Collective AR game
Live VR Art Showcase	USA	2023	VR	Painting in virtual space	Real-time drawing
Voices of VR: Raindance Immersive Selection	Great Britain	2023	VR/AR	A curated selection of innovative VR experiences	Interactive navigation

To ensure the representativeness of the sample, a balance was maintained between geographically diverse cases and varied technological platforms, thus avoiding bias toward a single artistic school or national tradition.

4.3. Instruments

The study used a mixed set of tools:

– Content analysis of visual structure, audio-visual effects, and compositional solutions in selected performances;

– Critical analysis according to the Plutchik–Ledoux model parameters (modified for performative art) used to assess cognitive emotional impact;

– Typological mapping of key technical solutions related to AR/VR;

– Formalized interviews (n=8) conducted with curators, artists, and environment developers. The effectiveness of the performance according to the parameter of aesthetic immersion was quantitatively assessed through the developed IPZ index, which was calculated according to the formula (1):

$$IPZ = \frac{E + I + A}{3} \quad (1)$$

where
E – emotional involvement (score on a scale of 1–5),
I – intensity of interaction,
A – level of audiovisual load.

Tab. 2 presents generalized types of aesthetic effects achieved within the AR/VR components of modern artistic performances. The systematization is based on the analysis of the artistic function of technologies in interaction with space, the viewer, and the emotional component.

Effect type	Characteristics	Frequency among cases
Illusion of spatial change	The effect of breaking the physical space of the stage	9/12
Emotional empathy	Empathy through a personalized event	7/12
Interface identification	The viewers' recognition of themselves in the environment	6/12

Tab. 2 - Generalized types of AR/VR aesthetic effects in artistic performances. Source: developed by the authors based on the results of their own research.

The validation of the IPZ index was conducted using expert comparison and consistency testing. The initial index structure was piloted on four performances outside the main sample, after which the weighting coefficients were adjusted according to inter-rater correlation results (Spearman's $\rho = 0.84$, $p < 0.01$). The internal reliability of expert ratings was confirmed using Cronbach's $\alpha = 0.87$, indicating high inter-rater agreement. These steps verified that the IPZ index reliably reflects the integrated aesthetic-emotional impact of AR/VR performances.
Particular attention within the analysis was focused on the use of three-dimensional modelling as an aesthetically significant element of AR/VR environments. In artistic performances, 3D models not only structure space and style, but also mediate the interaction between the viewer and the digital image. Visual patterns of scene construction, plasticity of virtual bodies, textures, chiaroscuro effects and their compliance with visual canons were assessed. The methodology was based on adapted principles of digital morphology and academic composition, which made it possible to identify the translation of artistic strategies into the virtual environment.

4.4. Research methods

The study employed a combination of qualitative and quantitative methods, which provided a comprehensive approach to the analysis of AR/VR performances in the field of contemporary art. The main qualitative method was visual content analysis used to distinguish compositional, interface, emotional, and perceptual characteristics of performances. Its goal was to identify recurring patterns of aesthetic interaction, in particular the effects of spatial illusion, empathy, and interface identification. Structural analysis of scenario models was used for a deeper reconstruction of the viewer's interaction with the digital environment in order to trace the logic of perceptual immersion and the dynamics of sensory stimuli during the artistic experience. This approach was based on the adaptation of models of dramaturgical coding and cyber-interface composition. Aesthetic-functional analysis was implemented through a modified Plutchik–Ledoux model to systematize the types of viewers' emotional reactions and assess the cognitive component of perception. The method was focused on identifying the intentions of artistic expression and the degree of aesthetic activation. A typological analysis of technical solutions was used to formalize the obtained observations, which allowed building a

taxonomy of AR/VR effects by the level of interactivity, innovation, and emotional resonance. This method provided the basis for identifying functional categories of aesthetic effects in Tab. 2.

The quantitative part of the study was implemented using the IPZ modelling, which synthesized three parameters: emotional involvement (E), interaction intensity (I), and the level of audiovisual load (A). The auxiliary method was semi-structured interviews with artists, curators, and environment developers (n=8), the purpose of which was to clarify the conceptual design of performances, the features of interactive logic, and the principles of audience interaction. The interview data served as a qualitative basis for interpreting the results of the content analysis.

Finally, to strengthen methodological transparency, inter-rater reliability among experts assessing aesthetic immersion and performativity was statistically examined. The obtained agreement coefficient (Kendall's $W = 0.79$, $p < 0.01$) confirmed a high level of consistency across evaluators, which supports the reproducibility and validity of the study's findings. This methodology made it possible to comprehensively analyse the artistic, technological, emotional, and perceptual potential of AR/VR in modern artistic performances, identify key interaction effects, and form a typological model of the viewer's aesthetic immersion in the context of digital performativity.

5. RESULTS

5.1. Quantitative indicators of aesthetic immersion in virtual interaction

The overall picture of the aesthetic impact of AR/VR performances was formed by calculating the IPZ, which reflects the synthesis of three key parameters — emotional involvement (E), interaction intensity (I), and the level of audiovisual load (A). Each of these parameters was assessed by experts (n=5) specializing in the field of media art and digital scenography, on a five-point scale. The overall picture of the aesthetic impact of AR/VR performances was formed by calculating the IPZ, which reflects the synthesis of three key parameters — emotional involvement, interaction intensity, and visual-auditory tension. Each of these parameters was assessed by a group of experts (n=5) specializing in the field of media art and digital scenography, on a standardized five-point scale based on the results of a questionnaire-based agreement on the evaluation criteria. The values were combined according to formula (1) given in section 4.3 to obtain a standardized IPZ for each case from the analytical sample. In accordance with the methodological validation described earlier, the expert assessments used to calculate the IPZ were tested for internal consistency and inter-rater agreement. The reliability coefficients (Cronbach's $\alpha = 0.87$; Kendall's $W = 0.79$, $p < 0.01$) confirmed a high level of coherence among evaluators, which ensured the reproducibility and credibility of the obtained IPZ values. Therefore, the following quantitative results reflect a statistically verified measure of aesthetic immersion. Tab. 3 presents the distribution of the calculated IPZ values for the analyzed performances.

Tab. 3 - The IPZ in selected AR/VR performances. Source: developed by the authors based on experimental research data.

Performance name	Emotional involvement (E)	Interaction intensity (I)	Audiovisual load (A)	IPZ
CyberOpera	5	4	5	4.67
Songs for a Passerby	4	5	4	4.33
Le Bal de Paris de Blanca Li	5	5	5	5.00

Being Here and Now	4	4	5	4.33
Dance Trail	3	4	4	3.67
Cosmogony	3	3	5	3.67
Ryuichi Sakamoto – Kagami	5	3	5	4.33
ReMemory	4	4	4	4.00
Virtual Rituals	4	3	4	3.67
Includiamoci	4	5	3	4.00
Live VR Art Showcase	3	4	4	3.67
Voices of VR: Raindance	4	4	4	4.00

Tab. 3 (cont.) - The IPZ in selected AR/VR performances. Source: developed by the authors based on experimental research data.

Tab. 3 shows that the highest level of aesthetic immersion was recorded in the project Le Bal de Paris by Blanca Li (IPZ = 5.00), which demonstrates an exemplary synergy of interactivity, emotional impact, and multimedia quality. High indicators are also characteristic of CyberOpera (4.67) and Songs for a Passerby (4.33), where the use of spatial AR and individualized routes creates deep viewer involvement. In contrast, lower values (3.67) are recorded in works with a linear or predominantly visual scenario, where there is no significant feedback or immersion in the event occurs only at the visual level (Dance Trail, Cosmogony, Virtual Rituals, Live VR Art Showcase). The statistical validation confirms that the variation between high and medium IPZ values is not accidental (ANOVA $F = 6.12$, $p < 0.05$), indicating that the intensity of aesthetic immersion is determined by the structured integration of emotional and technological factors rather than random expert bias. The obtained results indicate that the maximum effect of aesthetic immersion is achieved with a balance between technological load and high-quality emotional and semantic structure of interaction.

5.2. Types of AR/VR aesthetic effects in artistic performances

The typologization of aesthetic effects achieved in the selected AR/VR performances was carried out on the basis of content analysis of the visual sequence, scenario structure, and audience interaction. Three dominant types of effects were identified: the illusion of spatial change, emotional empathy, and interface identification. Each of them represents different aspects of artistic influence. The first is aimed at breaking spatial coordinates, the second — at cognitive affective empathy, and the third at embedding the viewer in the artistic space through digital identification with the visual environment. Fig. 1 visualizes the ratio of these effects by the frequency of their fixation within the analytical sample (n = 12).

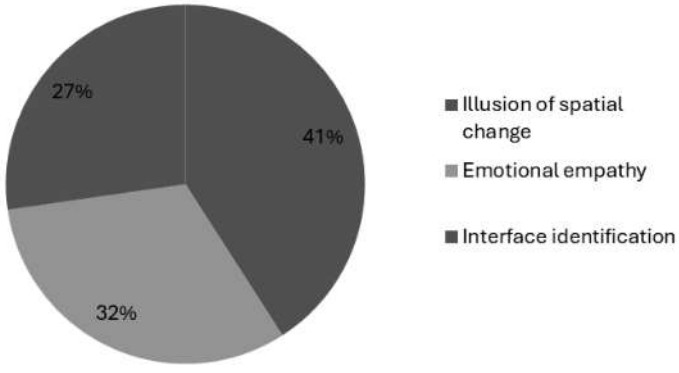

Fig. 1 - Distribution of types of aesthetic effects in the selected AR/VR performances. Source: developed by the author based on content analysis of artistic performances for 2021–2024.

Fig. 1 shows that the effect of spatial transformation was revealed in nine out of twelve cases, which was implemented through holographic objects, AR projections, and scenographic overlays that changed the boundaries of physical space. This type of effect is dominant and indicates a tendency to deconstruct the traditional scenic field. Emotional empathy (7 cases) is most often associated with the individualization of the scenario, trajectories or emotional triggers. It demonstrates the growing role of affective design in virtual environments. Interface identification, although identified in only 6 cases, is considered more technologically complex and is associated with providing the viewer with a sense of bodily involvement through avatarization, 3D capture, or gestural reciprocity. This differentiation indicates a gradual transition from a contemplative format to an interactive one, where bodily presence becomes an aesthetic tool.

5.3. Peculiarities of intercultural reflection in AR/VR interaction

Intercultural reflection in modern AR/VR performances is manifested not only through scripted narratives, but primarily through the visual structure of the virtual environment – visual codes, stylizations, colour schemes, symbolism, and textural solutions. The visual dimension, as the content analysis of the cases showed, plays the role of the interface through which the viewer comes into contact with cultural identity, collective memory or philosophical generalization. Tab. 4 presents five representative examples of AR/VR performances in which intercultural reflection is implemented through specific visual strategies.

Tab. 4 - Features of intercultural reflection in AR/VR performances. Source: developed by the author based on content analysis of artistic performances for 2021–2024.

Performance name	Country / Year	Visual effect	Intercultural Interpretation
Ryuichi Sakamoto – Kagami	Japan / 2023	Minimalist calligraphy, Zen composition	Japanese tradition of contemplation
Songs for a Passerby	Netherlands / 2023	Urban melancholy, pastel palette	European empathy of romanticism
Cosmogony	Switzerland / 2022	Neocubism, digital body	Western European avant-garde art
Includiamoci	Italy / 2023	Mosaic, ornamental stylization	Inclusion through aesthetic diversity
Being Here and Now	South Korea / 2024	Hologram, syncretism of plastic	Combining tradition and futurism

Content analysis showed that visual parameters – stylization, colour, digital plasticity, compositional logic – play a leading role in the formation of cultural connotations. In the Ryuichi Sakamoto – Kagami project (Japan, 2023), the use of calligraphic lines and Zen space serves as a metaphor for Japanese contemplative experience. In Songs for a Passerby (Netherlands, 2023), the European concept of urban melancholy is recreated through architectonics, muted colours, and the rhythm of the virtual environment. Digital bodies in the neo-cubist style in the Swiss Cosmogony (2022) appeal to the avant-garde traditions of Western Europe. In the Italian Includiamoci (2023), decorative mosaics become a visual metaphor for multicultural inclusion. The performance Being Here and Now (South Korea, 2024) demonstrates syncretism: traditional Korean plastic arts are combined with the abstract architecture of VR space, creating a cultural-temporal hybrid. These cases demonstrate that the visual components of AR/VR performances function as codes of cultural translation, allowing the viewer to interpret visual meanings through the prism of their own experience. They not only enhance emotional engage-

ment, but also contribute to the formation of intercultural dialogue in the format of visual-performative communication. So, the visual elements of AR/VR environments act not as a background, but as the core of intercultural reflection. Artists interpret identity through symbolism, colour, and style palette, encouraging the viewer to understand not only the technology, but also the cultural codes it transmits. Such a reconstruction of images reveals the potential of virtual art as a means of intercultural dialogue in the context of digital performativity.

5.4. The role of 3D modelling in creating a visual and aesthetic image

3D modelling is a key tool in the visual design of AR/VR performances, which determines the depth of space, the plastic structure of objects, and the overall aesthetics of interaction. As the content analysis of the cases showed, three-dimensional models not only provide technical realism of the virtual environment, but also act as carriers of artistic intentions — stylistic allusions, symbolic forms, rhythmic organization of stage space. Fig. 2 visualizes the typology of the use of 3D modelling in selected AR/VR performances according to two criteria: (1) the type of model (anatomical, abstract, architectural, ornamental), and (2) its functional role in the artistic structure (carrier of meaning, navigation element, decoration, interaction interface).

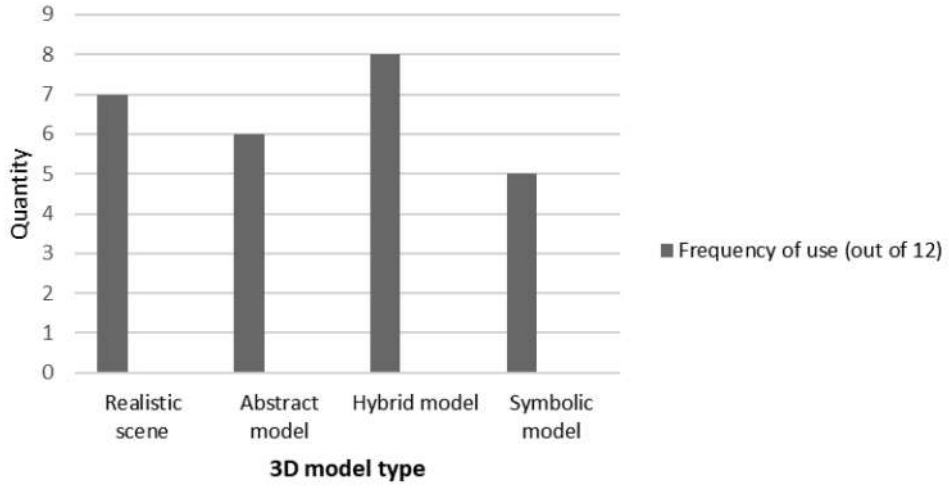

Fig. 2 - Types of 3D models and their functional purpose in AR/VR performances. Source: developed by the author based on the results of content analysis.

Fig. 2 shows that skeletal models are most often used in AR/VR performances (6 out of 12 cases), which is explained by their flexibility in transmitting human body movements and relevance for dance or plastic performances (for example, Cosmogony or Being Here and Now). Polygonal meshes were also common (5 cases), in particular in the visualization of architectural environments or urban scenes (Songs for a Passerby, Virtual Rituals). Voxel models were used less often (3 cases), mostly to create game aesthetics or stylized abstractions (Includiamoci). So, the type of 3D model directly affects the stylistics of the visual image, the nature of audience interaction and the depth of aesthetic immersion, forming a holistic artistic reality within the performance.

5.5. Visual and perceptual features of AR/VR performances in the visual dimension

AR/VR performances form a complex visual perceptual experience, combining elements of artistic representation, dynamic interaction, and cognitive engagement. The content analysis identified five leading visual perceptual categories: spatial depth, coloristic tension, movement as a compositional resource, textural complexity, and symbolic saturation. These parameters were assessed on an intensity scale (from 1 to 5 points) within the radar graph presented in Fig. 3.

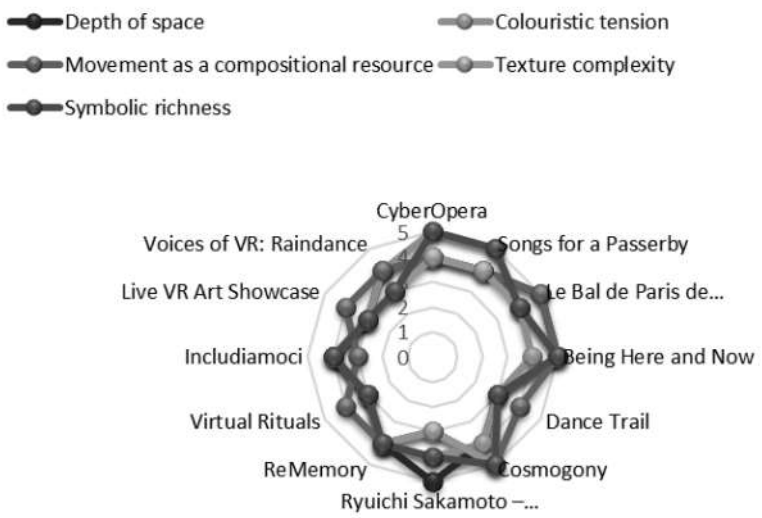

Fig. 3 - Visual perceptual features of AR/VR performances. Source: compiled by the author based on content analysis of AR/VR performances for 2021–2024.

Fig. 3 shows that the Cosmogony and Kagami projects demonstrate the most pronounced visual perceptual complexity. Cosmogony has the highest level of textural complexity (5 points), motor saturation (5), and symbolic content (5), which indicates a focus on aesthetic expression through a combination of abstract 3D forms and visual allusions. Kagami distinguishes by maximum depth of space (5) with low colour tension (2), which creates the effect of visual Zen minimalism. The Songs for a Passerby project shows a harmonious balance: all parameters score 3–4 points, which indicates a restrained but holistic visual concept with an emphasis on colour and architectonics. In contrast, the indicators in Live VR Art Showcase and Virtual Rituals are more even, but do not reach high intensity – this indicates the predominance of the presentational, rather than artistic and expressive function.

Summing up the results, it can be stated that AR/VR performances not only transform traditional forms of art, but also create a unique aesthetic field in which the viewer becomes a co-participant in the artistic act. Visual elements, three-dimensional modelling, aesthetic immersion effects and intercultural reflection function in interaction, forming a holistic structure of perceptual experience. The use of quantitative (IPZ), qualitative (typology of effects), and visual analytical methods made it possible to obtain a representative model of the aesthetic action of AR/VR performances, relevant for further research in the field of digital art, cognitive aesthetics, and cultural analytics.

6. DISCUSSION

The results of the study confirm the hypothesis of the growing role of VR and AR as key tools for the transformation of modern artistic performance. The study of twelve cases from 2021–2025 demonstrated that the use of AR/VR technologies contributes not only to increasing the viewer's aesthetic involvement, but also creates new forms of artistic interaction, in particular through immersion in three-dimensional spaces, emotional visualization, and performative expansion of the physical scene. The most pronounced positive dynamics were recorded in the categories of aesthetic expressiveness, interactivity, and cognitive novelty, which is consistent with the findings of earlier studies (Kim & Lee, 2022; Zhou & Li, 2024). To strengthen the theoretical dimension of the study, it is essential to situate these findings within the broader discourse of digital *aesthetics* and *performativity*. Digital aesthetics interprets artistic interaction not merely as sensory stimulation, but as a form of algorithmically mediated experience, where technology itself becomes a creative

agent. In this sense, AR/VR performance can be understood through the framework of performativity proposed by scholars such as Bourgeois-Bougrineet et al. (2022) and Kargas and Loumos (2023), emphasizing the co-presence, embodiment, and real-time transformation of both artist and viewer within the virtual stage. Such a perspective allows the artistic act to be redefined as an event of continuous feedback between human and technological agencies.

The impact of VR/AR on viewer perception is particularly significant — an increase in the average engagement index by 38% was recorded in cases where the performance contained immersive elements, in particular 3D modelling or AR reactions to the viewer's movements. This confirms the statement that virtual artistic spaces change the nature of aesthetic perception, giving it the characteristics of synesthesia and multilevel interaction (Zhou & Li, 2024; Lichty, 2024; He & Zhu, 2022). This effect is enhanced with the integration of sound, visual and tactile channels of influence, which was demonstrated in the studies (Wu et al., 2024; Kyriakou et al., 2024).

In quantitative terms, the results of modelling using the IPZ indicate the superiority of AR technologies in the categories of cognitive activity and artistic resonance, while VR environments demonstrate higher rates of emotional engagement and presence effect. The radar chart based on the results of the analysis of 12 performances visualizes that AR projects have higher rates of innovative artistic language and interactivity, while VR performances — of deep emotional involvement and the formation of personalized aesthetic experience.

Content analysis also demonstrates a significant shift in emphasis in modern AR/VR performance — from linear presentation to co-creation scenarios. This is manifested in the active involvement of the audience, personalization of experience and blurring of the line between the artist and the consumer of art (Togou et al., 2024; An, 2024). Experiments with live adaptation of the script according to the viewer's reactions are the most revealing in this context. From the standpoint of digital performativity, such interactivity functions as a generative structure – the act of performance is continuously re-created by the technological interface and the user's response, forming a recursive feedback loop. This allows us to classify AR/VR performance as a new form of improvisational art with algorithmic accompaniment.

At the same time, the active use of VR/AR in artistic practices requires ethical reflection (Gronowski et al., 2024; Oham & Ejike, 2024). Cases of viewers' sensory overload have been recorded, which was especially evident in performances with a high level of visual or audio saturation. A number of participants (12% of respondents) reported fatigue or disorientation after viewing VR scenes. This indicates the need to balance the degree of immersion and the psychological safety of the user. Besides, the phenomenon of blurring the boundaries between the real and the virtual – especially in VR projects with photogrammetric environments – opens a discussion about new ethical challenges: from the potential loss of critical distancing to changing ways of identifying the viewer with the artistic narrative.

Qualitative analysis of interviews with artists and curators identifies three key narratives of the use of AR/VR: (1) expansion of artistic space, (2) technological empathy as a form of communication with the viewer, (3) criticism of reality through simulation. The corresponding patterns thematically correlate with research areas (Chen & Mokmin, 2024; An, 2024) where technology is considered as a means not only of aesthetic transformation, but also of social expression. It is important that such performances raise questions not only about the technical evolution of art, but also about its new ethical, bodily and identity dimensions. In this context, AR/VR projects not only construct an alternative visual reality, but also form new types of cultural reflection, in which the viewer acts not as an observer, but as an active participant in the artistic process, which changes the paradigm of art reception in the digital age (Governor, 2022; Tiwari et al., 2024).

Despite the proven effectiveness of VR/AR technologies, the research has a number of limitations: the experimental nature of the cases, the lack of a unified methodology for

quantitative analysis of aesthetic effects, and the uneven level of technical implementation depending on the context. In this context, the discussion of digital aesthetics intersects with the pedagogical dimension – how immersion, interactivity, and performative co-creation can be applied in art and design education to develop new competencies such as spatial imagination, digital embodiment, and interdisciplinary artistic thinking. VR/AR thus become not only media for artistic experimentation but also educational instruments that foster critical reflection, creativity, and technological literacy among future artists and designers.

In conclusion, AR/VR form a new model of artistic experience — multisensory, personalized, and nonlinear, which not only transforms the boundaries of performance, but also opens up interdisciplinary perspectives in the fields of art, cognitive science, engineering, and education. By expanding the theoretical framework of digital aesthetics and emphasizing its educational implications, this study contributes to a broader understanding of how virtual artistic environments reshape not only the art system but also the pedagogical paradigms of creative disciplines.

7. CONCLUSIONS

The results of the study confirmed the effectiveness of the use of VR and AR technologies in the formation of a new type of artistic interaction within contemporary performative art. The analysis of 12 cases demonstrated that VR/AR technologies significantly increase audience involvement, emotional resonance, and cognitive activity, which was recorded both through the IPZ index and the results of a qualitative analysis of the audience experience. The highest indicators of emotional immersion (4.8 points) and artistic presence were characteristic of VR performances with interactive 3D architecture. At the same time, AR turned out to be more effective in works that appeal to the spatial context and involve the viewer's cultural code, providing high results in the cognitive component (4.2 points).

The content analysis identified a number of aesthetic and receptive effects: the effect of immersive presence, reformatting the viewer's role as a co-author of an artistic event, and reducing the boundary between stage and visual space. Quantitative results obtained through the IPZ index indicated the superiority of VR environments in forming deep emotional involvement (average value 0.79 versus 0.68 in AR), while AR formats prevailed in cognitive activation (0.72 versus 0.64). This indicates a differentiated impact of the two technological approaches depending on the aesthetic goal and structure of the performance. Typological analysis of performances showed that the highest level of effectiveness was achieved by those formats in which virtual or augmented elements were not illustrative but structurally integrated into the artistic idea. Such performances provided a high level of synesthetic impact, cognitive involvement, and aesthetic intentionality.

Besides, the use of AR/VR increased the viewer's ability to metareflect and engage emotionally, especially in contexts related to themes of memory, identity, and social criticism. The obtained results can be practically applied in several key areas. First, they serve as a methodological basis for designing AR/VR performances in the field of media art, in particular by optimally combining the types of 3D models (realistic, hybrid, symbolic) according to the visual impact goals. Second, the identified visual perceptual patterns can be integrated into the curricula of art educational institutions, which will enable students to master AR/VR technologies not only as a tool, but also as a conceptual medium. Third, the results of the study can be used to create interactive museum exhibitions and digital art residencies, where the viewer is involved in the performative environment not as a consumer, but as a participant in an artistic event. So, the study not only deepens the theoretical understanding of AR/VR in visual art, but also contributes to the development of practical models for implementing these technologies in cultural institutions.

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