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Immersive and Interactive Experience Design in Virtual Reality Films and Games

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Abstract:
Movies and games are often chosen as a way for people to entertain themselves. The immersive and interactive experience they bring is very important to people. The extensive use of VR in creation is also because it can effectively deepen these two feelings. Regarding the immersive and interactive experience of VR movies and VR games, this article specifically analyzes the sound design, shooting methods, narrative ideas, and viewing methods in VR movie production, and discusses the Multiplayer interaction and social functions, Role-playing and dynamic storytelling in VR games, as well as the immersive experience and interactivity that related gaming devices can provide. This article analyzes the artistic design of VR movies and VR games, explores the construction of immersive experience and interactivity in both, and hopes to have more novel entertainment experiences. At the same time, it promotes the production of VR movies and VR games to better serve the player experience.

Keywords: Virtual reality, Games, Films, Immersive and interactive

1. Introduction

Smartphones, tablets, and computers—commonly used smart devices in daily life—incorporate three core subsystems: an RF system for signal transmission and reception, a logic system for data processing, and a power system for energy supply. They further enable human-machine interaction via touch-based interfaces and haptic feedback systems. The current interaction mechanisms and their resultant immersion are inadequate to fulfill the evolving player's demand for enhanced immersive experiences and interaction within film and gaming contexts. Driven by recent advancements in VR technology, ongoing experimentation in cinematic VR production, and breakthroughs in computer game engine capabilities, the pursuit of enhanced immersive and interactive experiences in film and gaming has accelerated significantly. It is a comprehensive technology that creates a virtual 3D space using the combination of multiple digital media technology including computer graphics, tracking and positioning sensor, artificial intelligence and other information processing technology [1], leveraging specialized interaction technologies such as motion-tracked controllers and gesture recognition systems, individuals actively navigate, manipulate objects, and conduct exploratory

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operations within synthetically constructed three-dimensional environments. Through this technologically mediated engagement, users acquire integrated multisensory perceptual feedback—spanning visual, auditory, and haptic channels—engineered to generate a compelling sense of spatial presence and cognitive immersion within the virtual domain. Given the support of VR technology, enhanced immersion and interactivity have become paramount in film and gaming. Contemporary scholarship predominantly examines the technical feasibility of integrating virtual reality into conventional media frameworks yet critically neglects systematic inquiry into the constructed phenomenology of immersion and agency within VR-specific cinematic and ludic forms. This gap reflects an undertheorized understanding of how these emerging media fundamentally reconfigure sensory engagement and participatory dynamics through their distinct aesthetic and interactive architectures. This paper aims to examine the implementation mechanisms of both immersion and interactivity within VR games and cinematic VR experiences. Regarding cinematic VR, this paper will examine the design of audiovisual content and viewing paradigms to explore immersion and interactivity, illustrated with exemplary implementation cases. For VR gaming, the investigation will focus on game audiovisual design, input/output devices, and relevant game design case studies concerning the construction of immersion and interactivity.

2. Immersion and Interactivity in Virtual Reality Film Production

2.1 Film Content Design

The 1895 documentary film The Arrival of a Train (Figure 1) depicted a locomotive entering Paris's La Ciutat Station. When the train appeared to surge toward the audience from the screen, first-time cinemagoers reportedly fled in panic. This visceral response exemplifies how cinematic stimulation has evolved from 2D to 3D technologies, from the Lumière brothers' realism to Georges Méliès' fantastical narratives, from silent film to 7.1-channel surround sound systems, and most recently through the proliferation of short video formats. These technological advancements have progressively elevated audiences' viewing literacy while simultaneously increasing their sensory thresholds for audiovisual stimulation.

Fig. 1 The Arrival of a Train [2]

To deliver distinctive viewing experiences, contemporary approaches could integrate VR technology with these established sensory modalities, strategically constructing immersive interactivity based on viewers' perceptual sensitivity thresholds. Such innovation would align with historical patterns of technological evolution while addressing modern audience expectations for heightened engagement.

2.1.1 Spatial sound design in immersive virtual cinema

Sound constitutes a fundamental element in the cinematic construction of illusion. In VR audiovisual production, sound—akin to visual effects—is fundamentally player-centric, spatially enveloping the user and dynamically responsive to viewpoint variations. Sound design bifurcates into technical and artistic dimensions. Technically, VR film sound production is typically categorized into preliminary sound acquisition (field recording) and post-production editing/mixing. Artistically, sound design primarily targets immersive reality reconstruction to achieve virtual authenticity, while secondarily endeavors to forge unprecedented auditory realms—existing solely in imagination or even transcending conventional auditory paradigms.

VR film sound employs three techniques: binaural (artificial heads), Ambisonic soundfield synthesis, and surround arrays capturing horizontal/height data [3]. Ambisonics provides spherical 3D recording with superior loudspeaker adaptability, where higher-order systems increase channel counts/data capacity for omnidirectional capture and viewpoint switching. Post-production utilizes Kolor Eyes/SpookSyncVR for spherical monitoring, multibus workstations (Nuendo/ProTools/Reaper) with Dolby Atmos tools for spatial localization, and HRTF/head-tracking for real-time binaural rendering.

In the realm of sonic artistry**,** Kenneth Branagh's *Murder on the Orient Express* (Twentieth Century Fox)—a cinematic masterpiece directed by and starring the preeminent Shakespearean dramatist—exemplifies how Dolby Atmos enables each sound element to traverse precise spatial coordinates within the auditorium, including overhead positioning. This generates extraordinary acoustic richness and spatial stratification, immersing audiences within the train environment where they perceive avalanche hazards through auditory immersion, experience nature's formidable power, and ultimately transcend temporal boundaries to revisit historical settings. Such artistry demonstrates that VR film sound design must not merely replicate reality but transcend mere replication to actualize imagination. As Heidegger stated: "Much closer to us than all sensations are the things themselves. We hear the door shut in the house and never hear acoustical sensations or even mere sounds"[4] In cinematic sound design, creative Foley techniques—such as generating varied frying sounds using plastic packaging—and the mixing of images/sounds with semantically rich elements (e.g., animal vocalizations, water, wind, thunder) achieve multisensory semantic layering. A representative case: two worn ballet shoes gently slapped together while Foley artists exhale through pursed lips (evoking poetic associations of free flight). Due to causal reasoning mechanisms, the resulting fluttering wings are perceived not as isolated auditory objects but as emergent properties of the shoe-slapping and breath sounds. When sounds dissociate from cognitively familiar sources, they transcend simulation to actively delineate imagination, generating unexpected sonic phenomena. As Walter Murch reports from his experiences of the sound design for Apocalypse Now: When he started to combine six premixes of the "Kilgore / helicopter attack scene", each composed of some 30 tracks, "by some devilish alchemy they all melted into an unimpressive racket when they were played together" [5]. In the production of VR videos, both the creation of sound environments based on reality and the construction of sound fields beyond imagination are key to the formation of immersive experiences and interactivity.

2.1.2 The application of 360-degree panoramic cameras.

The 360-degree panoramic camera mainly utilizes the panoramic technology. It synchronously captures images through dual fisheye lenses or multiple sensors, eliminates the stitching traces through algorithms, and generates a 360° horizontal + 180° vertical spherical image, achieving full coverage without blind spots for a single device. It takes photos and images of the surrounding still objects with the camera as the center, and finally combines each fixed-angle image together. Achieve a 360-degree image display effect on the horizontal plane. This technology enables viewers to watch videos by moving their heads, thereby obtaining an all-round immersive experience.

A typical film shot with a 360-degree panoramic view is a breakthrough VR video installation work "Carney Arena" by Oscar-winning director Alessandro Gonzalez Iñárritu in 2017. It reconstructs the sensory experience of the refugee crisis through 360-degree panoramic shooting and immersive technology. The main camera used in the film is the Nokia OZO (professional 8-lens 360-degree camera) to capture the real scene environment of the desert. In addition, LiDAR and infrared motion capture systems have recorded the precise positions and movements of refugee actors in real time.

Fig.2 A still of Carney Arena [6]

The construction of immersive experiences not only involves the participation of 360-degree cameras but also related experience equipment, creating customized experience Spaces(Figure 2) and simulating the real environment in movies through some physical device structures. For example, in the physics theater of "Carney Arena"(Table 1), the audience needs to step barefoot into the temperature-controlled sandy land simulating the desert on the US-Mexico border). The depth and humidity of the sand grains change according to the plot. Meanwhile, the production team uses strong fans to create the effect of sandstorms, and underground vibration motors simulate the sound wave tremors of approaching helicopters.

Table 1. The installation structure of the „Carney Arena“ physics theater

Stage	Technical Means	Audience Perception
Detention cell wait	Real iron cage, Low-temperature environment	Sense of oppression from identity deprivation

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Desert Walk	Barefoot on sand + Cold wind	Tactile & thermal sensations awaken body memory
Refugee Encounter	360° refugee group panorama + Spatial gunshot sound effects	Powerlessness at the center of events
Helicopter Pursuit	Overhead flashing lights + Underground vibrations	Physiological fear triggers escape instinct

On this basis, in combination with the Oculus Rift CV1 and the backpack high-performance computer, players are no longer restricted by cables. With Inside-Out, the helmet camera tracking enables users to move freely within the spatial scene. Coupled with the laser fence to prevent collisions among the audience and the setting that the narrative will automatically stop when the range is exceeded, Under this set of closed immersive experience processes, the illusion of the film is formed here. When 360° panoramic technology transcends visual wonders and becomes a tool for physical narrative, virtual reality can reach the abyss of human nature. Just as Iñárritu said, “This is not an image about refugees, but the seven minutes that make you a refugee.”

2.1.3 The narrative modalities employed within virtual reality cinematography.

The narrative mode of virtual reality film photography essentially guides the audience’s attention within an unrestricted 360-degree space, respecting the audience’s autonomy and sense of presence. They use subtle narrative attention cues to guide the audience’s attention to the key story elements. The key clues include the gaze of the characters; When a character looks in a specific direction, it will naturally draw the audience’s attention, especially suitable for directing attention beyond the current field of view (FOV). Movement is a powerful attraction element, especially effective in peripheral vision. Its influence is more significant in scenarios with less motion interference. 3D spatial audio guides the audience to locate its source, and the effect is particularly remarkable when combined with visual stimuli. The background set by the story itself can affect the audience’s expectations of the plot, which enables filmmakers to create suspense by meeting or subverting the audience’s expectations. Finally, spatial perspective and scale guide attention; Prominent or nearby objects can capture the focus, while composition lines can guide the line of sight to the vanishing point. It is crucial that these clues be placed within the possible field of vision of the viewer or supplemented redundantly to ensure they are perceived, while respecting the viewer’s freedom to choose their perspective.

VR narrative is not a transplant of film language, but a neural-environment coupling system design based on visual cortical response (20-60° parafoveal sensitive area), vestibular synchronization (motion cue delay <0.8ms), and spatial auditory positioning [5]. When the boundaries of the shot disappear, the success of the narrative depends on the director’s ability to control the biological perception mechanism - this marks the transition of film art from the montage era to the neuro-cognitive era.

2.2 VR Movies Differ from the Visual Presentation Methods of Traditional Movies

The framework of the film presentation itself - the dim theater, the all-encompassing soundscapes, and the scale of the projected images - goes beyond mere projection. It transforms into an alchemical container, establishing an intimate connection between the audience and the artworks. In this meticulously planned darkness, the mechanism of the medium is integrated with inner experiences, weaving each viewer into a web of shared faith. The screen is no longer a boundary but a threshold, inviting us not only to witness but also to dwell together in the illusion it bestows upon life.

Plato’s “Cave Theory” points out that people who have long been forced to live in a false environment will take virtual presentation as reality, and they will find it difficult to accept the true truth after being free [7]. To some extent, this shows that people’s understanding of virtual environments is constantly approaching the sense of reality. With the rapid development of technology, virtual reality has moved from the plots of science fiction novels to applications in People’s Daily lives. Whether it is entertainment, games, healthcare or education, the immersive experiences provided by virtual reality are unprecedented. However, users’ demands for immersion are constantly increasing, and traditional VR devices have long been unable to meet users’ sensory experiences. At this point, the emergence of the CAVE (Cave Automatic Virtual Environment) space has brought a brand-new breakthrough to virtual reality. Combined with virtual reality technology, it has constructed a more realistic and comprehensive immersive experience for users.

The initial design concept of the CAVE space lies in breaking through the limitations of head-mounted Display (HMD) devices and providing a shared virtual reality experience. It offers a new presentation form for VR movies, provides a new viewing experience for the audience, gets rid of the constraints of devices, and achieves a more realistic virtual experience. It realizes the naked-eye VR viewing of the audience in the CAVE space by simulating the spatial relationship between the camera and the captured images in the real space in the virtual space [8] It can also share the panoramic picture with people around, no longer restricted by the viewing Angle of traditional cinemas, and saves the queuing time for HMD devices when experiencing VR movies in public exhibition areas. For instance, the Hongyi Vision Immersive CAVE System (Figure 3)has achieved revolutionary application breakthroughs in both industrial and scientific research fields. Its 0.8ms ultra-low latency tracking technology, which has been tested by the China Electronics Standardization Institute [9], and its patented projection fusion technology have successfully supported the Shanghai Planetarium's million-level cosmic-scale visualization (ΔE<1.5 color error).

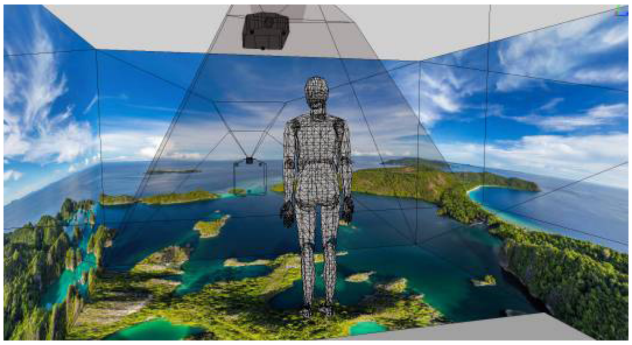

Fig.3:Hongyi Vision Immersive CAVE System [9]

In the comparison with traditional movies and VR headsets (Table 2), the CAVE System breaks the limitations of the physical screen. At the same time, it enables the audience to experience immersion without going through the medium, can move freely, and will not cause dizziness. All these are the key steps for the CAVE space to enable the audience to interact in an immersive way.

Table 2 CAVE vs Traditional Cinema vs VR Headsets

Comparison Item	Cave System	Traditional Cinema	VR Headsets
Visual Boundaries	No physical screen limits	Single fixed screen	Limited FOV (Field of View)
Social Presence	Real eye/body interaction	Indirect co-presence	Avatar-mediated isolation
Physical Freedom	Natural movement(10*10m)	Fixed seating	Confined safety zones
Motion Sickness	Minimal (vestibular visual alignment)	None	High (sensory conflict)

3. The Construction of Immersion and Interactivity within Gaming Environments.

Games are one of the tools that humans use to kill time and please themselves. There are many types of games, including stand-alone games, multiplayer games, development games, and competitive games, but they are all designed to meet people's entertainment needs in life. Based on this, immersive experience and interactive feeling are very important links, whether in terms of game content or game equipment, these two are important components.

3.1 Game Content Design

Regarding the two major themes of immersion and interaction, the game content design allows free communication between people beyond the real space and regardless of geographical distance, as well as the brief role-playing of characters that cannot be realized, regardless of their skills, appearance, or identity, and open story narrative choices. These are all important ways to keep people playing the game and interacting.

3.1.1 Multiplayer interaction and social functions

Playing single-player games for a long time often makes people feel bored. When multiple players, regardless of whether they are friends or together in real life, gather in the virtual space built by VR games, under the mutual influence of players, such as common interest topics, cultural collisions, and exploration of each other, the passage of time is replaced by the interaction of the game, and players are immersed in it.

VRchat is a game that can meet such diverse demands. It has built a highly open immersive social platform centered on user-generated content (UGC) (Figure 4). Its core experience lies in real-time multi-person interaction and rich social functions. Players can meet, communicate and cooperate with countless users in the highly customizable 3D virtual Avatar (Figure 5) in the multi-maintained virtual world. It supports cross-device access, such as VR headsets and traditional PCS, lowering the social thresh-

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old. Among them, the spatialized voice chat with internal conflicts also has distance attenuation and directionality. Full-body VR tracking enables users to interact naturally and vividly, allowing for non-verbal communication. Its ruthless appeal also lies in the free exploration of social scenarios, such as virtual parties, concerts, games, etc. Participation or organization of activities based on personal interests and expressions, meeting global users, rather than being driven by tasks or goals. This platform provides users with an important place to build virtual identities, express themselves, and experience new types of online social relationships.

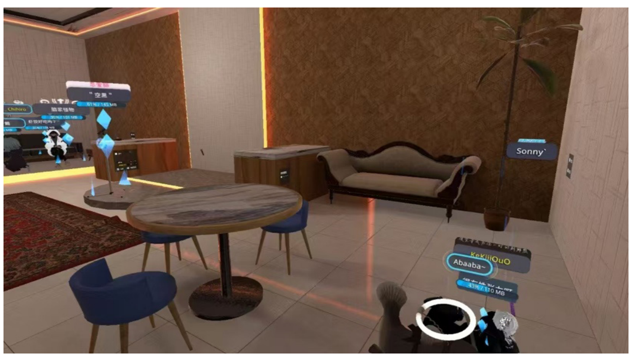

Fig.4 Highly open and immersive social platform (Picture credit : Original)

Fig 5 Players can use software such as blender and unity to create virtual images [10]

There are many games such as VRchat, such as "Rec Room", "King spray", "Cook-Out: A Sandwich Tale", etc. These games are all dedicated to shaping immersion and interaction, attempting to blur the boundary between reality and virtuality, and improving the entertainment experience of players better.

3.1.2 Role-playing and dynamic storytelling

In MMORPGs, players create a character that evolves within a digital virtual world where they can interact with thousands of other players and the game environment. Players assume the roles of fictional characters who act and evolve in virtual worlds often inspired by heroic fantasies such as J.R.R. Tolkien's saga [11], *The Lord of the Rings* [12].

Role-playing games often provide spiritual nourishment based on people's spiritual needs that cannot be met in the real world, offering an easy opportunity to realize the imagined self. In the game, players can shape themselves into an idealized character image and then communicate with other players. There are many such games. In God of War, Kratos' transformation from an avenger to a redeemer allows players to achieve the ultimate role-playing of human redemption. It is the rebellious journey of transforming into a destined person in "Black Myth: Wukong" to break through the shackles of fate, allowing players to practice the spiritual struggle against destiny. It is the epic journey of the faded one slaying the gods and seizing the throne in "Elden Ring", allowing players to experience the subversive power fantasy of mortals slaying gods. It is the pursuit of the traveler's journey across the seven kingdoms in "Genshin Impact" that enables players to undertake the mission of exploring beyond the boundaries between gods and humans - these characters all become containers for players to project their ideal self, reconstructing life narratives that are hard to reach in reality within the virtual rules.

3.2 Game Device

The immersion and interactive experience of games often require technical support. From the perspective of technical implementation, immersive experience needs to cover three levels: hardware input and output, environmental feedback, and content design. Good hardware devices can often simulate the real experience of the environment created in the game in reality. For example, the DualSense controller of PlayStation 5 can simulate God of War with a pressure sensing accuracy of 0.1mm. The stepped resistance feedback of Leviathan's Axe getting stuck in the ice layer in "Ragnarok", and the dynamic allocation of computing power by PS VR2's foveated rendering system (eye-tracking delay < 18ms) enable the foveated area of "Horizon: Call of the Mountain" to reach 4K/120fps. The built-in inertial measurement unit (IMU) of the head-mounted display, in combination with the crane-conducted vibration, synchronously transmits the tactile illusion of the steering wheel losing control during a collision in Gran Turismo 7.

In the design of games, the requirements of hardware facilities and technology are combined with content design. Only when technology can accurately convey corresponding perceptions based on emotions will players be willing to immerse themselves in experiencing the game and achieve an interactive experience.

4. Conclusion

This article explores the methods of creating immersive experience and interactive feeling in VR movies and VR games. The study found that in VR movies, based on the construction of technology and art, the three-fold illusion of sound, photography, and narrative based on reality and beyond reality, combined with special playback media, enables the formation of immersive experience and interactive feeling. In VR games, Multiplayer interaction and social functions, Role-playing and dynamic storytelling, as well as effective game hardware equipment, also successfully generate immersive experience and interactive feeling. This shows that the combination of art design and hardware is the key to the formation of these two feelings. This discovery makes up for the fact that the development of VR in contemporary society focuses on its integration with traditional media, but lacks the manufacturing of immersion and interaction. It is conducive to game makers and VR equipment manufacturing industries to have a clearer direction for the creation of immersion and interaction. However, the depth of this article‘s artistic exploration of movies and games is still too shallow, lacking a richer perspective on the manufacturing of immersive experience and interactive feeling. In the future, starting from the origin of film and game art, through its essence, more directions for the production of immersive feeling and interactive feeling will be developed.

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