# The Application of VR in the Film Industry

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**Abstract.** The integration of Virtual Reality (VR) technology into the film industry has ushered in a new era of immersive and interactive storytelling that fundamentally alters the way narratives are constructed and experienced. This paper explores the transformative impact of VR on narrative structures, multisensory experiences, and the myriad challenges filmmakers face in creating engaging and coherent VR films. By enabling dynamic environmental changes and personalized narrative paths, VR films significantly enhance user engagement and foster a deeper emotional connection between the audience and the story. The paper also delves into the potential of multisensory experiences to enrich learning, therapy, and training, highlighting the promise and pitfalls of current VR technology. We conclude by emphasizing the potential of VR to revolutionize cinema, suggesting that as the technology matures, it will lead to a fundamental shift in how we interact with and experience films.

**Keywords:** Application, VR, film industry.

## 1. Introduction

Cinema, as an art form of audio-visual expression, has been continuously striving for more realistic and immersive viewing experiences since its inception. With the advancement of digital technology, the production and projection technologies of films have undergone several revolutions, from black and white to color, from silent to sound, and from 2D to 3D. However, these technological innovations have mostly been optimizations and improvements within the traditional viewing paradigm, with the audience remaining passive recipients, and the interactivity and personalization of the viewing experience being limited. The emergence of Virtual Reality (VR) technology, with its unique immersive experience and interactivity, has brought about a revolutionary change in the field of cinema [1].

At present, the research and practice of VR films are in an active phase of exploration. Internationally, some film production companies and research institutions have begun to experiment with the creation of VR films and have achieved certain results. For instance, Oculus Story Studio's releases such as "Dear Angelica" and "Henry" have garnered widespread attention from both the industry and viewers due to their unique narrative methods and immersive experiences. Additionally, some film festivals have started to establish VR film categories, providing a platform for the display and exchange of VR films.

Domestically, with the popularization of VR technology and support from relevant policies, an increasing number of filmmakers and research institutions are paying attention to VR films. Some universities and research institutions have also begun to set up courses and research projects related to VR films, cultivating talents to promote the development of VR films.

However, the development of VR films also faces a number of challenges and issues. The first is the technical challenge, including how to improve the comfort and ease of use of VR equipment, and how to solve the technical problems in the production of VR films [2]. The second is the challenge in content creation, which involves how to fully leverage the advantages of VR technology while maintaining the artistic nature of films to create works that are both attractive and profound. Furthermore, the business model and market promotion of VR films are also hot topics of current research. It is precisely because of the significant technical, artistic, and social value of VR films, as well as the existing problems and challenges in research and practice, that the motivation for this paper lies in deeply analyzing the characteristics and advantages of VR films, exploring their innovative potential in narrative structure and multisensory experiences, and facing the technical, artistic, and market challenges. The aim is to provide theoretical support and practical guidance for the development of VR films.

## 2. VR in the film industry

### 2.1. Dynamic environmental changes

VR has revolutionized the gaming industry by creating immersive, interactive environments that provide players with a greater sense of presence and engagement. One of the most important advances in VR game development is the implementation of dynamic environmental change, which refers to the ability for the virtual environment to change in real time based on player actions or predetermined in-game events. This development has made profound contributions to game mechanics, narrative depth, and player immersion.

First of all, dynamic environmental change in VR enhances gameplay by increasing interactivity and realism. Traditional games typically feature static environments that respond minimally to player actions. In contrast, VR games with dynamic environments allow players to interact with and influence their surroundings in a more realistic way. For example, weather conditions, lighting, and physical objects in the game world can change based on player decisions or progress. This fosters a sense of agency because players feel like their actions have a tangible impact on the virtual world. Games such as The Walking Dead: Saints & Sinners effectively utilize this mechanic, where environmental factors such as the day-night cycle affect zombie behavior, adding strategy and unpredictability. Moreover, dynamic environmental change contributes greatly to narrative and emotional engagement in VR games [3]. Changing environments can reflect changes in the tone or mood of a story, creating a more emotionally resonant experience for players. For example, an environment that changes from calm to chaotic can reflect a character's inner turmoil, drawing the player deeper into the narrative. This type of environmental storytelling is particularly effective in VR due to the immersive nature of the medium. Players are more likely to connect emotionally with a game when the world around them reacts dynamically to the unfolding story, as seen in Half-Life: Alyx, where environmental cues played a key role in building tension and suspense. In addition, dynamic environmental changes in VR increase immersion by making the virtual world feel more alive and responsive. In traditional games, immersion is broken when the environment remains static or unchanging regardless of how the player interacts. In VR, however, incorporating dynamic changes, such as changing weather patterns, destructible objects, or shifting landscapes, helps maintain the illusion of being in the real world. Not only does this keep players engaged, it encourages them to explore and experiment, as they can predict how the environment will respond to their actions.

In summary, dynamic environmental changes have greatly contributed to the development of VR games, increasing game interactivity, deepening narrative engagement, and improving overall immersion. As VR technology continues to advance, these environmental dynamics are likely to become more complex, further blurring the line between virtual and real-world experiences in games.

## 2.2. Personalized narrative in VR films

VR films have indeed brought innovation to storytelling, particularly in the realm of personalized narrative paths, giving viewers the ability to choose different storylines at any given moment. This interactivity stands in stark contrast to traditional linear storytelling, where audiences often passively receive a predetermined narrative progression, lacking the ability to influence the direction or ultimate outcome of the story. The dynamic nature of VR narratives enhances the viewing experience by making it more interactive and emotionally engaging, significantly increasing the potential for rewatchability [4]. Particularly noteworthy is the implementation of branching story structures in VR films, which unlocks numerous possibilities for personalized and truly immersive experiences.

Branching narration is a crucial feature within virtual reality films, characterized by a storytelling structure where the plot diverges at key decision points, dictated by user choices. This mechanism allows viewers to navigate through the story and select different paths, leading to multiple outcomes. While the concept of interactivity is not new—having been explored in video games and interactive films such as Netflix's "Bandersnatch"—VR technology elevates this interactivity to an entirely new level: providing full immersion within a 360-degree environment where audiences not only make choices but are also physically present in the story world (Figure 1). In this respect, VR films create viewing experiences that are entirely distinct from traditional cinema. Traditional films typically guide audiences through a linear narrative, achieving emotional resonance but often limiting the depth of audience engagement and the diversity of emotional experiences. In contrast, VR films place viewers in an encompassing virtual environment that compels them to engage more profoundly with the plot, enhancing their emotional connection with the characters through active participation.
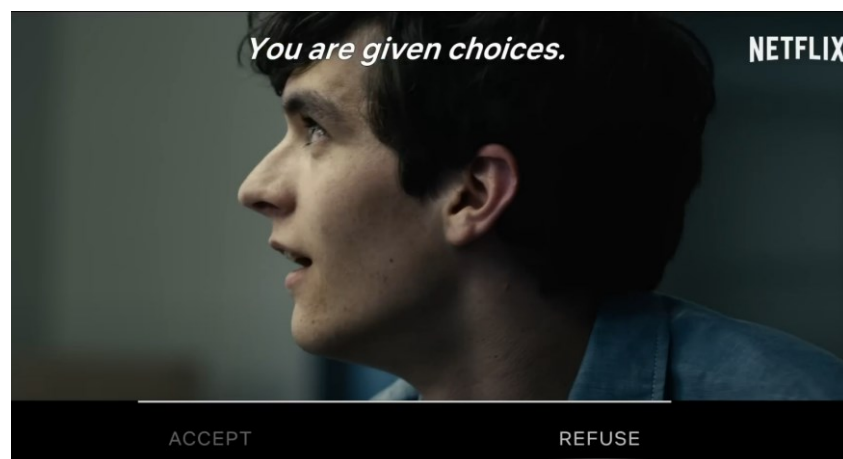


**Figure 1.** Bandersnatch [5]

By their very nature, branching narratives provide viewers with a sense of agency while simultaneously capturing their attention. In VR films, every decision becomes a pivotal moment, steering the story in one direction or another. This is exemplified in the interactive VR piece known as The Line, where viewers actively shape the character's journey through their choices and interactions within the environment. Moreover, VR films often feature multiple storylines, encouraging viewers to rewatch and explore different narrative paths, thus enhancing the film's replayability and overall value.

In contrast to traditional films, where audiences passively receive a predetermined storyline, VR films with branching narratives invite viewers to take an active role in the storytelling process. Traditional storytelling adheres to a fixed, linear arc that remains largely unchanged, even upon repeat viewings. In VR, however, each experience is unique for the viewer, as their choices lead to distinctly different outcomes. This active participation not only enhances immersion but also deepens the emotional connection between the viewer and the narrative, making the story feel more personal and engaging. This distinction is particularly evident in the way traditional films rely on cross-cutting editing to transition viewers between different scenes. In contrast, VR utilizes spatial storytelling, allowing

viewers to explore the environment at their own pace. This immersion places users in a virtual space where they can discover narrative elements that may not have been previously revealed or re-evaluate settings from various perspectives [6].

A notable example of this is Dear Angelica, a VR film created with hand-painted animation (Figure 2). In this work, viewers are transported through the protagonist's memories, experiencing the associated emotions from newly available angles. This innovative approach to storytelling not only enriches the narrative experience but also highlights the unique capabilities of VR as a medium, enabling a more profound exploration of character and emotion than traditional film can offer.



**Figure 2.** Dear Angelica [6]

*2.3. User experience with multisensory*

VR technology is rapidly transforming the film industry, bringing profound changes to viewing experiences and narrative methods. Compared to traditional films, VR movies offer a unique immersive experience and interactivity, providing audiences with a new way to engage. However, this emerging technology not only holds attractive innovative potential but also faces various challenges and limitations. Below, we will explore how the multi-sensory experience of VR films addresses the shortcomings of traditional cinema, as well as the relationship between the two and future development trends [7]. One significant advantage of VR films is the immersive environment they provide. Traditional films often follow linear storytelling, with audiences taking a relatively passive role and unable to truly be part of the story. VR technology allows viewers to choose their perspective freely, making them feel as if they are in the scene. For instance, when watching an adventure-themed VR movie, viewers can "participate" in the story and genuinely experience the character's journey. This first-person narrative method greatly enhances audience engagement and fosters a stronger emotional connection.

VR films can also incorporate a broader range of sensory experiences, further intensifying audience participation. Haptic feedback technology has already been widely adopted in some VR devices, allowing viewers to experience vibrations, pressure, and other physical sensations while watching scenes, making the viewing experience feel more real. Some experimental projects have even integrated olfactory elements into film, using scent generators to transmit scents from the scenes to viewers, allowing them to smell the aromas of forests, oceans, or cities during viewing. This combination of multi-sensory feedback provides a more complete experience for audiences, breaking free from the limitations of traditional films in sensory stimulation. Despite the advantages of VR films in immersion and interactivity, this does not imply that they can entirely replace traditional cinema. Traditional films have established an irreplaceable status through their artistic qualities and narrative depth [8]. Many classic films effectively convey complex emotions and themes through meticulously planned shot

editing, sound design, and actor performances. This approach possesses higher coherence and can effectively capture the emotional engagement of audiences. In contrast, due to the open narrative structure of VR films, viewers may lose a unified understanding of the storyline due to varying perspectives, leading to a dispersed narrative experience.

Moreover, the limitations of equipment present a notable barrier, as the viewing threshold for VR films is relatively high. Despite continuous technological advancements and improvements in the quality and functionality of VR devices, the high costs and complex user experience remain significant obstacles to the popularization of VR cinema. Many audiences may not have the opportunity to experience this emerging technology, thereby limiting the development and dissemination of VR films. The adaptability and acceptance of audiences also warrant attention. Not all viewers appreciate or adapt to this entirely new immersive experience. Some people may feel dizziness, anxiety, or even physical discomfort while watching VR movies. The intense realism brought by VR films can potentially lead to overstimulation, adversely affecting audience emotional experiences. Therefore, creators need to carefully consider these factors when producing VR films to ensure audiences can enjoy an enjoyable and healthy viewing experience.

The multi-sensory experience of VR films is pushing the boundaries of film art, redefining our understanding and experience of stories. While traditional films possess unique strengths in narrative, VR offers immense potential in terms of audience engagement and immersion. The advancement of technology will blur the lines between VR and traditional cinema, presenting audiences with a richer, more creative film future. In light of this trend, there is hope for the arrival of a new cinematic era that is both immersive and artistically rich.

## 3. Challenges and issues of VR in film

Despite the potential of multisensory technology in VR films, several challenges hinder its widespread adoption. One significant issue is the high cost associated with developing multisensory equipment and software, which limits accessibility for both creators and consumers. This financial barrier prevents many filmmakers from utilizing these advanced technologies, stifling innovation in the industry.

Another challenge is the poor compatibility between different devices and platforms, which creates potential obstacles for users. If multisensory experiences cannot be seamlessly integrated across various systems, it can lead to frustration and a fragmented user experience. Additionally, the accuracy of sensory simulations remains a concern. Current technologies still struggle to effectively replicate certain senses, such as smell and taste, and are not yet able to meet real-world standards. User experience design for multisensory devices also presents significant hurdles. The complexity of integrating sensory information makes it difficult to create interfaces that provide a cohesive experience across sight, sound, touch, smell, and taste [9]. Designers need interdisciplinary knowledge to craft intuitive and immersive experiences, yet there is a relative scarcity of professionals with the necessary expertise in this field. This lack of talent further constrains the development and application of multisensory technologies in VR film making.

Despite these challenges, the future of multisensory technology in film remains promising. As technology continues to advance and costs gradually decrease, it is expected that multisensory devices will become more widely used across various sectors, including film. To achieve this goal, collaboration among governments, enterprises, research institutions, and educational organizations is essential. By working together to promote the innovation and popularization of relevant technologies, we can unlock the vast potential offered by multisensory experiences in the cinematic landscape.

## 4. Conclusion

As the VR technology continues to advance, the film industry stands at a pivotal juncture. This paper has delved into how VR technology transforms the narrative structures and multisensory experiences in cinema, analyzing the technical and creative challenges faced by filmmakers in creating engaging and coherent VR films. The discussion on dynamic environmental changes and personalized narrative paths reveals how VR films enhance user engagement and emotional connection, while also highlighting the

technical hurdles and creative barriers that need to be overcome to achieve these immersive experiences. The emergence of VR films signifies a shift from the audience being passive recipients to active participants in the storytelling process. The use of personalized narrative paths and branching story structures offers an unprecedented level of interactivity and emotional investment, significantly increasing the rewatchability and overall value of films. Moreover, the integration of multisensory experiences, such as haptic feedback and olfactory simulation, further blurs the line between the virtual and the real, providing audiences with a richer and more authentic cinematic experience.

However, the development of VR films is not without challenges. The high cost of technology, issues with device compatibility, the accuracy of sensory simulation, and user experience design are all current problems that need to be addressed. These challenges not only limit the widespread adoption of VR films but also impact their application in broader fields. Despite these challenges, the future of VR films remains promising. As technology matures and costs decrease, it is anticipated that VR films will play a more significant role in various sectors, including education, therapy, and training. The joint efforts of governments, enterprises, research institutions, and educational organizations will further promote the innovation and popularization of VR film technology.

In summary, VR films, as an emerging art form, offer not only a new way of experiencing cinema but also redefine our interactive relationship with films. With the continuous development of technology, there is reason to believe that VR films will usher in a new era of film art, leading us into a future of cinema that is more immersive, personalized, and emotionally resonant.

## Authors Contribution
All the authors contributed equally and their names were listed in alphabetical order.

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