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A Study on K-POP Video Content Using Metaverse Virtual Technology

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Abstract

The meta-universe, as an innovative medium of digital technology that integrates the virtual and real worlds, is revolutionizing the traditional K-POP industry by leveraging advanced technologies such as artificial intelligence (AI), virtual reality (VR), augmented reality (AR), and motion capture. This transformation is gradually reshaping the entire entertainment sector. As K-POP continues its global expansion, the industry is actively exploring the application of virtual technologies, presenting viewers with a more diverse range of entertainment content. This thesis reviews the development history of virtual technology in K-POP, analyzes the practical applications of VR, AR, AI, and motion capture within the industry, and examines how these technologies enhance artist-fan interactions and immersion. The study demonstrates that the incorporation of virtual technology not only overcomes the limitations of traditional entertainment modes but also provides new directions for the future development of the K-POP industry.

Keywords: *K-POP, virtual technology, metaverse, AR, VR, AI technology, motion capture*

1. Introduction

The metaverse is a groundbreaking medium that blends the virtual and real worlds through digital technology. With the advancement of various virtual technologies such as AI, 5G holography, VR, and AR, the concept of the metaverse is gradually gaining public attention, not only challenging the clear boundaries between the virtual and real worlds, but also breaking the conventional wisdom. In the context of the metaverse, virtual idols in the K-Pop industry, relying on the development of digital technology, have continued to explore and innovate in their field to present a more diverse and multifaceted image to the public.

2. Research Background

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The rapid development of virtual technology has brought revolutionary changes to the entertainment field, which has introduced unprecedented innovation and diversity, changed the transforming traditional forms of entertainment, and led to the transformation and upgrading of the entire entertainment industry. In this context, K-POP, a cultural phenomenon that has attracted with significant global attention, has begun to explore the application of virtual technology. The interaction between K-POP artists and their fans is evolving beyond traditional music performances to become an all-encompassing entertainment experience. Virtual technology is providing new forms of expression and business models for the K-POP industry.

In October 2021, SM Entertainment's President, Lee Soo-Man, addressed the combination of technology and idols at the 1st WCIF World Culture Industry Conference in Seoul. He stated, “In the course of the new information revolution, the form of idol experience is constantly changing, and the application of new technology will lead to the iteration of idol experience, with virtual idols and holographic performances being an important direction.” K-POP virtual idols have benefited from various technologies, transitioning from two to three dimensional representations, and their expressions have become increasingly vivid and natural.

3. Research Content

3.1. Development History of Virtual Technology in K-POP

With the continuous advancement of virtual technology, its application in the K-POP industry has expanded significantly. Initially used primarily for marketing through imagery, virtual technology in K-POP has evolved to encompass comprehensive AI applications. Moreover, as technology continues to innovate, its application in K-POP is diversifying and deepening.

Table 1. Main Parameters

Virtualization History	Characteristics	Representational Image
Phase I	Characters use 3D graphics and songs are recorded by real people.	Adam
Phase II	A virtual image is created based on game characters, and a virtual image is created by combining cultural IP with technology.	K/AD
Phase III	A K-POP group with both real and virtual members.	Aespa

From the era of Adam utilizing 3D imagery, to the K/AD era's integration of intellectual property, and further to aespa's groundbreaking exploration crossing between the 2D and 3D realms, the flexible utilization of virtual technology has propelled the development of K-POP. This not only enriches the industry's forms and content but also expands audience perception and engagement, providing new directions for the future advancement of the K-POP industry.

3.2 The Use of Virtual Technology in the Field of K-POP

Augmented Reality and Virtual Reality Technology. Born in response to the global pandemic of 2020, Beyond LIVE emerged as a pioneering solution to the challenges facing K-POP operations such as concerts. With traditional means of K-POP operations disrupted by the pandemic, South Korea's SM Entertainment, in collaboration with NAVER, introduced Beyond LIVE, an online pay-per-performance concert service, to fans. Commencing with SM's SuperM group on April 26, 2020, subsequent idol group combinations from SM Entertainment have taken turns performing through Beyond LIVE. Diverging from traditional offline concerts, Beyond LIVE maximizes the utilization of digital technology to provide audiences with a unique visual

experience. Fig. 1 showcases Super Junior member Choi Siwon appearing as "Gianton Siwon" in the group's performance, an AR scene realized by SK Telecom using 106 cameras to capture Choi's movements and employing 3D models alongside cutting-edge facial recognition technology.

Beyond LIVE leverages AR, VR, and other technologies to simulate real-world experiences for audiences. This immersive approach enhances the audience's perception of screen space by adding details and a sense of hierarchy, thereby breaking the spatial constraints of traditional concerts. Consequently, Beyond LIVE enhances the audience's sense of participation and immersion across all aspects, heralding a new era for digital performance culture.

Figure 1. *Gianton Siwon* in the Beyong LIVE

Artificial Intelligence Technology. AI technology serves as a scientific and technological mechanism designed to simulate and expand human intelligence. Simply put, AI replicates the information processing of human consciousness and thinking. Amidst the rapid development of AI, this technology has not only found applications in various facets of production and daily life but also has made significant inroads into the entertainment industry. Fig. 2 in the case of the K-POP group aespa, which debuted in November 2020, AI technology was employed to create four virtual AI members, known as ae-members, based on four real members. These ae-members, empowered by AI technology, possess individual autonomy and form friendships with the entertainers, facilitating communication through digital mediums. Through AI technology, ae-members can simulate the expressions, language, and behaviors of the real members, enabling face-to-face interaction and exchange with the artists. These ae-members actively participate in aespa group activities, ranging from music video shoots to concert performances.

The presence of ae-members has not only garnered increased attention and credibility for aespa's content but also has amplified the group's influence. Furthermore, the influence of these virtual ae-members has facilitated rapid market penetration of the idol group's content and has transcended existing fan circles.

Figure 2. *Aespa*

Motion Capture Technology. Dynamic capture technology was initially applied in the film and television industry, where the actor's performance data was obtained through a dynamic capture system, and then processed by 3D programmers and animators into animation suitable for the character, and ultimately generated images. However, since there are bound to be differences between the actors and the virtual characters, it is particularly important to modify the data at a later stage to ensure that the performance fits the character. The K-POP virtual boy band PLAVE, shown in Fig 3, requires real-time motion capture of the real person behind them during the performance, skipping data processing and post-production, so the motion capture technology used in PLAVE makes the following major improvements over traditional motion capture technology.

Figure 3. *PLAVE*

A real-time interference avoidance solution has been developed to ensure that collisions are avoided without distorting the dance kinematics, thus allowing unrestricted movement for the actor, as depicted in Fig 4-a. Self-positioning (Ref-pose calibration) addresses errors caused by marker position changes, as shown in Fig 4-b, ensuring accurate reactions of the character to the actor's pose. The traditional solutions of either Inverse Kinematics (IK) or Forward Kinematics (FK) localization, have been enhanced, introducing Dynamic IK. As illustrated in Fig 4-c, Dynamic IK automatically switches to IK when the actor attempts to grasp objects with significant pressure, ensuring accurate pose representation even during daily live broadcasts or dance performances. Moreover, Foot IK extra offset resolves issues such as feet penetrating the floor or overlapping during complex leg movements, as demonstrated in Fig 4-d. This ensures that the feet naturally align with the floor even during intricate dance routines. These technological advancements have enabled PLAVE members to actively engage in the program, particularly showcasing their talents in dancing. For fans, despite PLAVE being visual avatars, the experience of interacting and performing with the show is indistinguishable from that of real idols.

Figure 4. PLAVE Motion Capture Technology

3.3. The Advantages of Virtual Technology in K-POP

Increase in Intercommunication. The construction of interaction is inherently tied to the subjective intentions of the actors. The advent of social media and virtual technology has not only revolutionized traditional modes of interpersonal communication but, is has also transformed the operational landscape of the entertainment industry. The interaction between idols and fans now transcends the confines of traditional offline fan meetings, concerts, or video viewings. Instead, the application of virtual technology has successfully shattered the limitations of time and space, offering myriad possibilities for interaction between fans and idols.

In the case of the South Korean group Billlie K-POP, they utilized the meta-universe platform ifland, shown in Fig. 5, to hold a fan meeting with the theme The Fan Live. This meetup allowed fans and K-POP idols to interact with each other through virtual images in the form of entertainment in the meta-universe space. Fans immersed themselves in a diverse content experience, exploring Billlie's photos, music videos, and even interacting with a holographic statue of the idol created using capture technology. This interaction transcended the 2D screen, allowing fans to engage with their idols in a 3D world. Similarly, BLACKPINK employed avatars for fan signing sessions in Fig 6, demonstrating the various forms of communication facilitated by virtual technology. These successful examples highlight the multifaceted communication channels between K-POP idols and fans, enriching fans' experiences and presenting new opportunities for the entertainment industry's development.

Figure 5. The Space Created by Ifland

Figure 6. Screenshot of BLACKPINK Online Fan Signing

Enhancement of Immersion. Fans often project their dreams and aspirations onto idols, while idols portray a positive and flawless image across various media platforms. These dynamics foster idol worship among fans, driving them to avidly follow idol news. With the integration of virtual technology into traditional entertainment formats, combining auditory and visual experiences, fans are treated to an unprecedented freshness. The incorporation of virtual technology introduces the idol's virtual image and facilitates virtual interactions with fans. This not only realizes visual effects and sensory enjoyment that are challenging to achieve in traditional K-POP interactive experiences but also significantly enhances fans' immersion in the

process of idol fandom. This heightened sense of immersion fosters a more intimate interaction between fans and idols, enriching the fan's star-chasing experience both qualitatively and quantitatively.

4. Conclusion

Virtual technology is profoundly reshaping the landscape and trajectory of the K-POP industry. The comprehensive utilization of virtual technology not only introduces new business models and performance formats to K-POP but also amplifies fans' sense of participation and immersion. Virtual technologies such as VR and AR have played pivotal roles in the emergence and evolution of virtual idols in K-POP, transcending the constraints of traditional entertainment and offering audiences a more diverse and enriching entertainment experience. Platforms like Beyond LIVE and ifland have established specific virtual spaces, fostering more frequent and in-depth interactions between virtual idols and fans. The application of these technologies has not only introduced new forms of expression to the K-Pop industry and brought a completely new experience to audiences, but has also provided new directions for the future development of K-Pop.

As virtual technology continues to advance, we anticipate that K-POP, and indeed the entire entertainment industry, will accelerate towards digitalization and intelligence. This trend will drive continuous innovation and transformation within the K-POP industry, offering audiences an ever-expanding array of diversified entertainment experiences.

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