A Preliminary Analysis of the Integration and Development of Virtual Reality Technology and Cultural Industries (Postprint)

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Abstract

In the early 20th century, when virtual reality technology first emerged into public consciousness, it gradually evolved into a scientific discipline through an entirely novel technological approach. The emergence of any novel entity invariably occurs amidst a chaotic interplay of numerous uncontrollable factors; as virtual reality technology matured to a certain degree, it began to intersect and merge with the cultural industry. This paper concentrates on investigating the applications of virtual reality technology across various strata of the cultural industry to analyze the mutual interactions between virtual reality technology and the cultural industry, and, confronted with the current impasse, seeks to stimulate profound contemplation regarding the future development of virtual reality technology within the cultural industry domain, encouraging us to courageously embrace challenges and break through the predicament.

Full Text

Preamble

A Brief Analysis of the Integration and Development of Virtual Reality Technology and Cultural Industry

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Abstract: When virtual reality technology first emerged in the early 20th century, it gradually formed a scientific field as an entirely new technological approach. The birth of any novel entity invariably involves a chaotic interplay of uncontrollable factors. As VR technology matured, it began to intersect and merge with the cultural industry. This paper focuses on examining VR technology' s applications across different levels of the cultural industry to analyze the mutual interaction between VR technology and cultural industries. Amid the current impasse, this study aims to awaken deeper contemplation about the

future development of VR technology in the cultural sector, encouraging us to meet challenges bravely and break through existing dilemmas.

Keywords: Virtual Reality Technology; Cultural Industry; Technological Breakthrough; Technology Integration; "VR+"

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Virtual Reality (VR) technology simulates human visual, auditory, and tactile sensory functions through scientific means, creating an immersive state that virtualizes the interaction between humans and their environment. It can autonomously expand virtual environments according to human imagination, creating a multi-dimensional information space. As technological innovation and breakthroughs continue, business models transform, audience groups expand, cultural consumption upgrades, and cultural industry chains extend, VR is becoming a focal point for cultural industries both domestically and internationally.

1.1 Foreign Development: Vertical Growth, Positive Momentum

VR technology is currently in an exploratory development stage with continuously expanding application fields. Its development in foreign markets is gaining momentum, characterized by intense competition and cooperation. Research has primarily focused on hardware device development and upgrades, which then extend to related industrial chains in the cultural sector. For instance, media organizations such as *The New York Times* have experimented with VR technology for news reporting, integrating more life scenarios into their coverage.

Among the VR-related fields announced abroad, these projects utilize virtual environments for therapeutic rehabilitation of psychological disorders like anxiety, recreate art appreciation scenes or competitive sports events in virtual reality, simulate experiences of ancient times or space flight, provide VR platforms for education in arts, science, mathematics, and other disciplines, and offer VR tools for the reproduction of cultural artworks. These initiatives have enabled VR technology to achieve significant application and practice across different cultural levels.

1.2 Domestic Development: Technological Breakthroughs and Industry Integration

In recent years, China' s VR technology has continuously achieved key breakthroughs, with market application scale expanding and extending extensively into the cultural industry domain. This aligns with specific applications within the cultural boom, as VR can provide people with different perceptions and experiences in cultural industries. By the end of 2019, the commercial deployment of 5G by China' s three major telecom operators, coupled with the support of "gigabit fiber + WiFi6," resolved bandwidth and latency issues for VR while providing superior pipelines. In the view of many, the VR industry has consequently welcomed a new round of development opportunities. VR is currently positioned as a strategically emerging industry for 超前发展 (advanced development).

VR has entered the 2.0 era, offering substantial development space in both hardware and content, with various cultural industry sectors representing fields where VR can fully demonstrate its capabilities. Current domestic VR technology research and development involves cultural products such as film, television, and art, as well as cultural services and value-added aspects including cultural relic exhibitions, virtual reconstruction of damaged artifacts, and cultural tourism. To seize the commanding heights of the global VR strategy, China has actively strengthened its deployment, with various regions responding to the call by investing in VR research and development. Through talent and financial development, these regions promote the aggregation of VR technology resources and drive the development of related local industries through innovation in the VR technology sector, injecting new technological vitality into regional cultural development.

1.3.1 Reflecting Upgraded Cultural Consumption

Currently, people pursue a shift from basic living standards to spiritual civilization construction, making cultural needs increasingly important. Cultural consumption has become a crucial pathway to enhancing national happiness indices. This high-level consumption upgrade has led to the widespread application of VR technology in cultural industries. Psychological factors such as curiosity about VR technology as a novelty, lifestyle enrichment, and other external influences have prompted VR technology to gain more audiences and broader markets.

1.3.2 The Product of Technology-Culture Integration

The integration of culture and technology has become a new trend in cultural industry development. Relying solely on the independent development of one industry or heavy equipment such as aircraft and high-speed rail construction can no longer secure an advantageous position in today' s international competition

based on comprehensive strength founded on science and technology. Consequently, the trend of integrated culture-technology development has emerged. Building on current VR technology breakthroughs, applying it to the cultural industry to form industrial chains and thereby increase added value undoubtedly plays a significant role in economic and social development.

1.3.3 Reverse Driving Cultural Industry Upgrading

VR technology innovation has gradually integrated into daily life. Through innovation, it changes the external manifestation or content of cultural products, providing new directions for cultural industry development, thereby reshaping cultural industry chains and promoting their upgrading.

2. VR Industry Integration: Opening Up Multi-Dimensional Development Sectors

2.1 Cultural Products Industry: Seeking New Development Opportunities

The cultural products industry, representing the core layer of the cultural industry, accommodates most achievements of VR technology integration, such as integration with books, newspapers, electronic publications, film and television works, and animation. Heilongjiang Province has launched projects enabling tourists to experience the natural and cultural beauty of the province without leaving home. Currently, traditional newspaper industries face significant impact. In the digital information era, VR technology can enhance the development of online publications, pushing them forward substantially. VR technology can more realistically simulate news event locations and scenarios for users, allowing them to feel immersed in the news setting and providing a genuine sense of contact, achieving true cross-spatiotemporal news presentation.

Currently, "VR+Animation" has become a new industry trend. Transforming animation content into VR through re-rendering allows users to experience a closer sense of space, no longer viewing drawings on a screen but traveling into the animation space itself, providing anime enthusiasts with a new realm. The new expansion of "VR+Film and Television" was demonstrated at the World VR Industry Conference, which integrated film elements with technology. This expansion was put into practice at the Nanchang International VR Film Exhibition, which highlighted VR technology. Leveraging its cutting-edge, immersive, and feasible characteristics, the exhibition cleverly combined VR with film works, showcasing VR films such as *Sky Roaming*, *Everest: Life and Death*, and *Mars Passenger*. Compared to screen viewing, this immersive and interactive film experience provides greater inspiration and serves a certain social education function.

2.2 Cultural Services Industry: Aligning with VR' s Immersive Experience

The cultural services industry occupies the peripheral layer of the cultural industry, including art performances, advertising, exhibition services, and other aspects. When VR technology is applied to art performances, performers can use VR to immerse themselves in performance scenes during drama and dance rehearsals, obtaining on-site feelings in advance during the rehearsal stage for better practice results. From the audience' s perspective, people watching VR art display videos can adjust viewing angles arbitrarily, maintaining initiative and autonomy during appreciation, such as enjoying sculptures or stage plays from all perspectives.

The Shanxi Cultural Industry Fair Transaction Center has created a "never-ending" exhibition by leveraging VR technology to build a comprehensive online virtual exhibition hall for the Shanxi Cultural Fair. People can experience the fair site anytime and anywhere using mobile devices, seeing every corner of the venue with an immersive feeling. With its unique Yellow River culture, Shanxi can use VR technology to more authentically display these typical cultural elements, providing people with different cultural experiences.

2.3 Cultural Value-Added Industry: A Hundred Flowers Blooming, Constructing New Channels

The cultural value-added industry represents the related layer of the cultural industry and is a level that VR technology currently focuses on developing. By establishing resource platforms and concentrating high-quality industrial resources, VR technology integrates with and upgrades high-quality culture, extending and cross-linking the production chains of quality cultural activities, products, and derivatives. This forms new circulation links, derives new cultural commodity markets based on VR technology, and increases the added value of original cultural content. Specific applications include cultural tourism and traditional culture protection.

VR panoramic images originate from real scene photography. When viewing mobile phone panoramas, people can drag the screen to achieve arbitrary zooming, moving forward and backward, and changing perspectives. During epidemic prevention and control, this approach reduced travel risks while allowing unrestricted viewing of scenery. The stay-at-home lifestyle fostered the "homebody" group' s "anti-epidemic" life. Furthermore, combining VR technology with cultural heritage protection enables virtual restoration of traditional artifacts, multi-directional display and promotion of cultural heritage, and protection of cultural monuments, thereby enhancing the value of traditional culture and demonstrating its enduring vitality.

With the rapid development of 5G technology, combining 5G with VR in museums, along with big data and cloud computing technologies, provides collection enthusiasts with venues to display their artifacts. Based on artifact display,

these platforms excavate historical culture for users, creating a new type of comprehensive big data service platform for collected artifacts.

The Palace Museum' s *A Thousand Li of Rivers and Mountains* scroll uses VR technology to provide a panoramic immersive experience. The Dunhuang Research Institute's "When Murals Meet the 24 Solar Terms" displays cultural relic images through VR. This perfect connection between ancient murals and modern technology better showcases traditional cultural connotations and enhances understanding of Dunhuang murals. At the Xuanwu "Innovation" Technology Exhibition, a corporate representative from Nanjing Future Vision VR Industry Technology Research Institute demonstrated artistic restoration scenes of the Tianlongshan Grottoes through their products.

3. VR Industry Operation: Diverse Markets and Multiple Levels Coexisting

For producers, to deliver created products to consumers, they must research consumer demand and preferences for creative products, conduct feasible market analysis, establish effective platforms, and achieve two-way empowerment. For operators, cultural market research is crucial—identifying consumer markets, investigating consumer acceptance and attraction to VR technology in cultural markets, and designing culturally attractive product positioning to expand cultural industry influence. This enables true practice and application, integration with different cultural products, and enhanced cultural derivation and vitality.

In VR technology applications within cultural industries, diverse cultural markets exist. This technology not only enters cultural product markets such as books, newspapers, art, and cultural relics but also cultural service markets like performances, entertainment, exhibitions, and tourism. It also exists in cultural resource markets, converting natural and human resources into virtual reality existence modes. Different cultural industry levels cleverly integrate VR with culture.

Moreover, VR applications present a coexistence of online and offline scenarios. Offline promotion can occur in experience stores and social cinemas, enabling immersive film viewing or virtual advertising and studio technologies for television. Online, 360° panoramic technology allows remote visits through mobile terminals. Sanshui District in Guangdong launched a VR online meteorological bureau visit activity, enabling citizens to "walk into" the Sanshui Meteorological Bureau via mobile phones. Such online activities place cultural content containing meteorological knowledge into VR-created platforms, providing not only new technical experiences but also enhancing public cultural awareness and influence.

4. New Thinking on VR Integration: Challenges in a Media Society

4.1 VR Industry Dilemma: The Game Between Reality and Virtuality

The VR industry today faces several difficult-to-breakthrough dilemmas. First, the industry is immature with insufficient content. VR industry development in network terminals, content production, and industrial chain completeness remains in an immature stage. Despite seemingly unstoppable momentum, development is actually fraught with difficulties. As early as 2011, the "Digital Dunhuang" project was completed, applying VR and interactive technologies. However, user VR experiences have not yet achieved truly immersive feelings, and technological development requires improvement. The scarcity of interactive content resources between VR technology and cultural industries, along with unresolved interaction methods, results in insufficient content richness.

Second, lack of innovation and serious homogenization. Talent shortages lead to low creative integration between VR technology and cultural industries, with homogeneous and simplistic content forms. High-quality original cultural industry content awaits activation.

Third, limited audience and insufficient market investment. Public awareness of VR technology applications remains inadequate, and prices exceed basic consumption levels, limiting audience and market acceptance. This restricts broader expansion of VR technology applications. Current market investment trends favor manufacturing, with insufficient attention and recognition for VR, resulting in limited investment scale and no formation of large enterprises capable of leading VR technology development.

4.2.1 Breaking Technical Barriers and Market-Oriented Development

New developments inevitably progress from weak technology, immature industries, and insufficient content to strength, maturity, and richness. This process requires future-oriented vision. Based on gradual technological improvement, VR technology should integrate with different cultural industry projects to maximize feasibility, reduce usage costs, and conduct market-oriented development. Adapting to market demand extends value chains and broadens different fields. Upgrading and transforming the cultural industry gradually enriches its content, establishes brand awareness, and builds well-known VR technology brands to enhance product visibility. The goal is to create more market-compliant cultural derivatives, using new technology to open new development pathways for the cultural industry.

Examples include experiencing news locations under traditional reporting methods, creating online cultural habitats based on traditional museums, conducting restoration and reproduction of broken traditional cultural artifacts, and innovating new mobile panoramic experiences under physical tourism models. All these enable VR technology to bring creative experiences to people while satis-

fying cultural needs.

4.2.2 Content is King, Creativity First

VR technology possesses unique advantages in its integration with the cultural industry: novel, rich, and captivating content that utilizes human senses for genuine feelings. Leveraging this advantage can drive the transfer of digital product content to virtual reality content, satisfying people's needs for upgraded cultural consumption. First, we must tell Chinese stories well by combining VR with traditional culture. Expanding VR derivatives into traditional culture not only makes traditional culture more charming but also broadens VR technology' s coverage.

Additionally, we should note that VR technology conveniently enables home-based experiences. This presents an opportunity with the ACG (Anime, Comic, Game) community, which shows great enthusiasm for animation. Their longing and affection for anime characters can serve as a breakthrough point for VR technology content development. The current fermentation of the "niche fan economy" has become a popular trend, and this community' s social methods can expand outdoors through virtual means, experiencing exhibition scenes while staying at home. The inherent virtuality of ACG content also makes this technology easier to link with development.

4.2.3 Multi-Party Assistance from Talent, Media, and Government to Drive Development

Talent is essential in the integration process of technology and culture. Technological upgrades, creative development, and industrial promotion all depend on talent. We should actively implement talent introduction programs, combining efforts with universities and enterprises to achieve talent cultivation and incentive mechanisms.

Furthermore, we can develop "VR+Broadcasting and Television," advancing traditional TV channels toward VR program effects and conducting real-time VR recording of news events, variety shows, and live ceremonies. "VR+Media" enables both traditional and new media companies to produce VR live broadcasts, VR advertisements, and VR film production, connecting with contemporary H5 panoramic players for viewing.

Government support also plays a significant role in the "VR+Culture" combination. Through policy support, establishing public service platforms, and increasing investment in cultural industry VR technology projects, the government can broaden financing channels for the industry and obtain financial support.

The application and integration of VR technology in cultural industries have become an inevitable trend. "Technology+Culture" remains in a dynamic innovation process that will gradually drive industrial upgrading. Of course, this

process is bumpy, requiring us to break free from dilemmas and use creativity to open new directions for VR technology in the cultural industry domain.

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Note: Figure translations are in progress. See original paper for figures.