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## Postprint of Research Report on the Integrated Development of “Publishing + VR/AR” in China

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### Abstract

Since the 18th National Congress of the Communist Party of China, China has achieved fruitful results in building an innovative nation, with the innovation-driven development strategy being vigorously implemented and the concept of innovative development taking root in people’s hearts. Virtual reality (VR), artificial intelligence (AI), and intelligent manufacturing have become global hotspots in technology research and development, gradually permeating consumers’ daily lives and providing techn...

### Full Text

#### Preamble

Since the 18th National Congress of the Communist Party of China, China has achieved fruitful results in building an innovative nation, with the innovation-driven development strategy being vigorously implemented and the concept of innovative development taking root in people’s hearts. Virtual reality (VR), artificial intelligence (AI), and intelligent manufacturing have become global hotspots in technology research and development, gradually permeating consumers’ daily lives and providing technical support for the innovative development of traditional industries. The year 2016 was hailed as the inaugural year of VR, witnessing explosive growth in VR and augmented reality (AR) applications across various fields. Domestic publishers responded promptly, testing the waters by leveraging their resource advantages and innovating publishing formats. VR/AR technology offers new ideas and approaches for the development of digital publishing.

Representative VR books include the “Dinosaur World Adventure” series published by Beijing Children’s Publishing House and the “Tongxile Magic Interactive Encyclopedia” series by Haitian Publishing House. As a new book format, VR/AR books have emerged from scratch and gradually become popu-

lar. Their novelty, interactivity, and experiential nature have brought readers unprecedented reading experiences, generating high market interest for a period. Numerous domestic publishers quickly followed suit. However, issues such as technical complexity, book pricing, and exhibition display have prevented their advantages in the book publishing field from being effectively highlighted. Particularly for VR/AR children's books, a comparison of the three major e-commerce platforms—Dangdang, JD.com, and Amazon—shows that most AR children's books are priced above 60 yuan, while VR children's books cost over 100 yuan. Contrary to these prices, the number of pages that actually enable VR/AR reading is very limited, giving parents a sense of poor value for money. Additionally, the display and exhibition of VR/AR children's books have become challenging, with most publishers' attempts to showcase effects through website videos proving generally ineffective, thus constraining large-scale promotion. Coupled with gradually cooling market enthusiasm, these factors present new considerations for publishers when choosing to publish such books.

## Overview of VR/AR Book Publishing

Compared with traditional books, VR/AR technology features contact-based, three-dimensional, intelligent, experiential, and interactive characteristics, making the advantages of digital reading experiences more pronounced and achieving organic integration between print books and digital content, thus becoming a new fulcrum in digital publishing development.

AR (Augmented Reality) is a technology that real-time calculates the position and angle of camera images and overlays corresponding graphics, aiming to superimpose the virtual world onto the real world on screen for interaction. AR books combine AR technology with traditional books, pairing conventional text and illustrations with visually impactful three-dimensional images. Through mobile terminals such as smartphones and iPads, they comprehensively display book content to readers, presenting flat knowledge in a three-dimensional form that is more easily accepted and communicated. Without altering any printing processes or increasing printing costs, this three-dimensional transformation of print books is achieved through technical means. Simultaneously, AR technology allows content associated with print books to be continuously updated, extending the content space and service cycle of print books.

Traditional publishers, technology producers, and private cultural companies have all experimented with AR book publishing, conducting beneficial explorations. Notable examples include the “Science Runs Out” series by CITIC Publishing Group and the “Ebook's 3D Notes: Exploration Series” by Beijing United Publishing Company.

VR (Virtual Reality) is a comprehensive integration technology centered on computer technology, involving 3D graphics, multimedia, simulation, sensing, and stereoscopic display technologies. Using computers and other devices (input/output devices), it creates a three-dimensional virtual world integrating

visual, auditory, and tactile senses. VR books combine virtual reality technology with traditional scientific and educational reading materials, allowing users to experience immersive sensations in virtual environments. They can break through spatial, temporal, and other objective limitations, bringing readers the joy of time travel and the experience of “seeing is believing.”

## Development Trends in Publishing + VR/AR

### 1. VR/AR Empowering Educational Publishing

Today’s teaching methods have greatly evolved compared to the past. Especially with the assistance of new technologies such as AR and VR, learners can more directly engage in learning. Students can “experience” the concepts and memories they are studying. For instance, through VR technology, a high school student might assume the role of Napoleon in the Battle of Borodino; for elementary students, relatively simple AR experiences can allow them to view a building and use AR to determine its height. The possibilities AR and VR bring to education are endless. Currently, it is becoming a trend for publishers to leverage VR/AR technology to publish educational books and launch educational products. For example, Qingdao City Media Co., Ltd., a subsidiary of Qingdao Publishing Group, utilizes its resource advantages to advance the development of multidisciplinary VR courseware products. Wanxin Media has built a VR digital education content omnimedia platform to reconstruct the industrial ecosystem.

### 2. Integration with Traditional Culture Opens New Paths for Publishing + VR

The essence of publishing is to disseminate knowledge and inherit civilization. The characteristics of VR technology provide new forms and carriers for the dissemination and inheritance of traditional culture. Combining publisher resources with VR technology and traditional culture represents a new business format for publishing + VR transformation.

Red Landmark (Beijing) Culture Communication Co., Ltd. has cooperated with publishing units since 2017 to develop VR+Excellent Traditional Chinese Culture projects, achieving positive results. In 2017, the “Red Landmark VR and Supporting Products in Patriotic Education” project, undertaken in collaboration with China Publishing Group’s Huawen Publishing House, was successfully selected for the 2017 reform and development project database of the former State Administration of Press, Publication, Radio, Film and Television. In 2018, the “Millennium Long River—Cultural Landmarks on the Beijing-Hangzhou Grand Canal VR” project, undertaken in partnership with Beijing People’s Education Press, was approved by the Publicity Department and Ministry of Education as a major project for the 2018 cultural industry development special fund. Also in 2018, the “Creative Inheritance Project of Excellent Traditional Chinese Culture Based on AR/VR and Other New Media Technologies,” under-

taken with China Publishing Group's Huawen Publishing House, successfully applied for inclusion in the 2018 reform and development project database of the former State Administration of Press, Publication, Radio, Film and Television. VR+Traditional Culture has played a positive role in telling Chinese stories well and inheriting Chinese civilization.

### 3. VR/AR Children's Books Occupy Half the Market

Searching for VR/AR books on e-commerce platforms such as Amazon and JD.com reveals that VR/AR children's books account for a high proportion. Children's book publishing is one of the fields where VR/AR technology and the publishing industry are most closely integrated. On the one hand, as children generally have a high acceptance of new things, VR/AR children's books enable them to experience comprehensive sensations including text, sound, video, and animation during reading, enhancing book interactivity and improving children's interest in active reading and knowledge acquisition. On the other hand, children's book publishing continues to maintain rapid growth, with huge market potential. Under the national advocacy for nationwide reading, parents increasingly emphasize comprehensive quality improvement for children and edutainment approaches. The cutting-edge technology brought by VR/AR children's books injects new vitality into children's book publishing, becoming a new hot spot pursued by parents and a new focal point for competition among publishers in the children's book market. A batch of new-form children's books combining VR/AR technology with audio-visual integration continues to emerge in the market.

At major events such as book trade fairs and the Shanghai Book Fair in recent years, publishers have prominently featured VR/AR children's books. For example, after Beijing Children's Publishing House launched "Dinosaur World Adventure," hailed as "the first enlightenment popular science reading combining virtual reality (VR) technology," it subsequently released VR readings "Eye-Opening: Journey to the West" and "Eye-Opening: Universe and Starry Sky Adventure" in 2017. Jilin Publishing Group developed the "Enter Dinosaur Paradise" series using VR technology; Shandong Education Press published "Dinosaur World" (VR set); Liaoning Science and Technology Press published "VR Super View: Alice in Wonderland"; and Beijing University of Technology Press published "Exploring the Arctic."

### 4. Content Homogeneity Breakthrough with Diverse Themes Emerging

Content homogeneity has long been a dilemma in VR/AR book development. Among approximately 200 VR/AR children's books in 2016, over 40 had titles containing "AR coloring," and more than 40 were related to dinosaur themes. Additionally, keywords such as "encyclopedia," "magic," and "AR literacy cards" frequently appeared in titles. Following trends and 同质化选题 (homogenized topics) made it difficult for parents to choose and inevitably gave

the impression of a chaotic VR/AR children's book market. However, it is worth noting that in 2016, some children's books combined unique publishing resources with novel topics, filling market gaps and receiving enthusiastic responses, thus opening new avenues for VR/AR children's book publishing. Examples include "Ancient New Songs" (children's songs + animation) by China University of Petroleum Press, "Idiom Chain" by Jiangxi People's Publishing House, "Chinese Sichuan Opera 'Face Changing': The Legend of White Snake" by Guangdong New Century Publishing House, and "Interesting Chinese Festivals" by Southwest University of Finance and Economics Press. Furthermore, the book "The Reader," edited by Dong Qing and published by People's Literature Publishing House, employs AR technology to enhance the reading experience. Using the "The Reader AR" app to scan any image in the book allows readers to watch nearly 1,000 minutes of video clips, experiencing seamless integration of video viewing, listening to readings, and reading text. Therefore, for publishers to break through in the VR/AR book field, focusing on original content and innovative topic selection has become paramount.

## 5. Market Evaluation: Mixed Responses

From publishers' evaluations of VR/AR books, in 2016, among publishers that had published VR/AR books, half reported that the novel format enriched publishing content, enhanced children's reading interest, and was welcomed by parents, resulting in positive market response. Publishers such as Haitian Publishing House, Jiangsu Phoenix Publishing House, and China Children and Youth Press continued to launch VR/AR books. The other half believed the books failed to meet market expectations, with mediocre response. Publishers attributed this to factors including topic homogeneity, increased publishing costs leading to higher book prices, parental resistance to electronic products, difficulties in downloading apps due to network limitations, inability to fully demonstrate VR/AR book features, and gradually cooling market enthusiasm, resulting in a situation where investment exceeded output.

## 6. Copyright Import Becomes a Viable Option

Regarding copyright import and export, traditional publishers face technical difficulties in directly developing VR/AR books, making copyright import a prudent choice. For example, "The Disappearing World" by Electronics Industry Press was imported from France; CITIC Publishing Group's "Science Runs Out" from the UK; Beijing University of Technology Press's "Tongxile Magic Interactive Encyclopedia" and "Exploring the Arctic" from Canada; and Nanjing University Press's AR early childhood teaching materials from South Korea and Japan. Among them, CITIC Publishing Group's "Science Runs Out" series was imported entirely from the UK in terms of both content and technology. The series won the 2015 UK Multimedia Interactive Book and THE LICENSING Awards, with sales reaching 1.5 million copies in 32 countries worldwide, establishing itself as a mature AR children's book series. Compared with high

R&D costs and unpredictable market risks, CITIC Publishing Group's choice of copyright import offered controllable costs. Additionally, Electronics Industry Press and Beijing University of Technology Press opted for pure content import while collaborating with new media technology R&D teams or private cultural companies for technical development, also achieving good market returns. Although imported VR/AR book titles are not numerous, their sales on the three major e-commerce platforms are considerable, with high consumer recognition of imported editions.

In terms of copyright export, the AR book “Interesting Chinese Festivals: AR Interactive Game Book” published by Southwest University of Finance and Economics Press became the only listed book in 2016, successfully exporting copyrights to Singapore, Malaysia, Indonesia, and other countries.

## 7. VR Publishing Projects Gradually Receive Financial Support

Regarding funding sources, among publishers that published AR/VR children's books in 2016, 10% received relevant project funding support. For example, Haitian Publishing House received Shenzhen Cultural and Creative Fund support; Nanjing University Press received support from the “Original Force” China Original Animation Publishing Support Program; Shandong Fine Arts Press, in cooperation with Shanghai Xianjian Culture Media Co., Ltd., received relevant Shanghai funding support; and Jilin Science Press received digital publishing-related funding support from Jilin Province. Furthermore, publishing projects such as the National Publishing Fund began to include VR technology integration in their approvals. For instance, the 2018 National Publishing Fund project “Red Journey—Party Member Education VR Experience Project” (with Chinese, Xishuangbanna Dai, Dehong Dai, Yi, Jingpo, and Wa languages) by Yunnan Education Audio-Video Electronic Publishing Co., Ltd.; the 2017 Beijing Popular Science Project “Living Science: Innovative Internet + AR, VR” series children's books by Beijing University of Technology Press Co., Ltd.; and the former State Administration of Press, Publication, Radio, Film and Television's first batch of key laboratories for technology and standards in the press and publishing industry—the Knowledge Service Technology Key Laboratory Based on AR/VR Presentation Methods, led by Jiangxi Publishing Group Red Star Electronic Audio-Video Publishing House and jointly built with Jiangxi New Media Publishing Co., Ltd. and the Computer Network Information Center of the Chinese Academy of Sciences—were successfully selected.

AR/VR are emerging technologies that the state encourages to integrate and innovate with traditional industries. Local governments in Shandong, Jiangxi, Fujian, Shanxi, and other regions have also vigorously invested funds to support the development of AR/VR industries.

## 8. VR Reading Experience Becomes Standard in Libraries and Bookstores

In recent years, public libraries across China have continuously increased investment in digital public cultural facilities, purchasing 3D stereoscopic books, VR reading devices, e-book borrowing machines, and other digital reading equipment, while also organizing VR reading-related science popularization activities. These initiatives provide readers of all ages with comprehensive knowledge service platforms, continuously meeting the people's reading needs.

In May 2017, the Tibet Library launched the “VR Reciting Classics” virtual reality service project, aiming to create a “digital library integrated into daily life.” The project constructed four traditional culture virtual scenes—“Studying Hard at Tieya,” “Huaisu Writing on Banana Leaves,” “Floating Wine Cups Along a Winding Stream,” and “A Thousand Miles of Beautiful Moonlight”—set against the backdrop of four seasons, guiding readers to read traditional poetry in virtual space while experiencing high technology and appreciating the charm of national traditional culture. In July 2017, the Hunan Provincial Children's Library underwent upgrading and renovation. After the renovation, paper reading would no longer be the only reading method; new methods such as audio-visual reading and VR reading would be added. In September 2017, the fifth National Publications Library Distribution and Construction Trade Fair was held in Changsha, where a VR reading experience pavilion was set up on-site. VR technology has also been substantively applied in digital library construction. Wearing VR glasses to read “Buddhist Statues of Yungang Grottoes” allows viewers to see life-sized Buddha statues, enhancing the reading experience. In March 2018, the Dengzhou Library in Henan Province launched the “Welcoming the New Year of the Dog” VR virtual reality experience activity. By building a “Spring Festival Family Courtyard” VR scene, participants could experience setting off fireworks, pasting Spring Festival couplets, writing the character “Fu,” and posting paper-cuttings, enhancing their love and understanding of excellent traditional culture. In April 2018, the Changchun Children's Library, in collaboration with Nanjing Shutong Technology, jointly carried out the “Shutong VR Experience” themed activity, allowing readers to read traditional classics in virtual space and experience new forms of digital reading.

## Future Development Trends in Publishing + VR/AR

### 1. VR Panorama Gradually Becomes Popular

According to Omnivirt research reports, VR panoramic content in 2017 had higher engagement than ordinary content. This data was based on analysis of over 1,000 campaign videos regarding completion, clicks, and overall engagement. Additionally, Omnivirt's research found that using VR panoramic content not only spreads across all vertical fields but also improves in content and quality year by year. With an increasing number of companies now using virtual reality and VR panoramas, we can foresee VR panoramic virtual reality content

becoming popular on a larger scale. In the publishing industry, VR panoramic applications are just beginning. Book fairs, bookstores, and publishing industry bases and groups can all use VR panoramas for display. Compared with previous display methods, VR panoramas offer a “what you see is what you get” visual experience with several notable advantages: authenticity, completeness, high precision, and efficiency. VR panoramas will become one of the key ways VR technology is applied in the publishing industry.

## **2. More AR Application Examples Will Emerge in Advertising**

Virtual reality VR advertising is an innovative advertising format, mainly divided into various loading screen ads and in-app implanted ads. Forms can include 360-degree panoramic video ads, theater-level large-screen video ads, 3D model ads, app recommendations, and hybrid ads combining the above forms. Compared with traditional advertising, VR advertising enables users to have immersive experiences. The non-intrusive ad format implanted within VR experiences greatly improves advertising effectiveness. It can be said that VR advertising is gradually changing our traditional advertising placement models. Although VR advertising has not yet become widespread, its prospects are vast.

Currently, some technology companies have developed backend systems for publishing enterprises that support VR publishing for books and periodicals and provide VR advertising formats, which to some extent can offer new development ideas and market space for publishing enterprises.

## **3. Virtual Reality Development Threshold Is Lowered**

With technological progress, the core modeling 环节 (modeling process) of VR technology can be completed through tools, achieving rapid modeling via infrared scanning. Additionally, VR development platforms have become more convenient and intelligent, allowing editors to develop VR books after short-term training. Technology enterprises such as Beijing Chujiao Technology Co., Ltd. and Jiangsu Dreamman Technology Co., Ltd. have launched customized VR content platforms that are already being used by some publishers.

In the future, VR will present more immersive experiences. Beyond vision, virtual reality devices will enable our sense of smell and touch to approach real experiences. Furthermore, favorable factors such as the arrival of the 5G era, continuously decreasing VR hardware prices, and alleviated technical bottlenecks in motion sickness have prepared the ground for the popularization of VR technology applications.

## **4. VR Reading Becomes a New Reading Format**

VR reading is becoming one of the new reading formats, with domestic and international publishing enterprises and technology companies dedicated to R&D and promotion in this field. At the Bologna International Children’s Book Fair held in March 2018, one of the world’s most important exhibitions for children’s

and young adult book publishing and multimedia products, virtual reality (VR) devices and augmented reality (AR) devices attracted significant attention. For example, the Google Daydream VR platform team brought devices that allow users to create 3D paintings in virtual space, enabling writers and illustrators to draw virtual stars and flames. The Snap-to-Learn VR helmet designed by Singapore's MXRi company is specifically designed for children aged 5-6, with four virtual worlds built-in, redefining children's reading experience. Children's literature author Sun Yuhu stated that once reading purposes are clarified, reading methods need not be limited, and using high technology to change children's reading methods is a new characteristic of the new era.

## 5. Publishing + VR Helps Chinese Culture Go Global

In recent years, VR+Traditional Culture has continuously appeared on the international stage. As early as 2003, the Palace Museum Cultural Assets Digital Research Institute, jointly established by the Palace Museum and Japan's Toppan Printing Co., Ltd., dedicated its first work to the public: the Palace Museum VR "Forbidden City·The Emperor's Palace." Through computer equipment and operation handles, audiences could freely "walk" through the Three Great Halls and the Hall of Mental Cultivation, with this video product traveling abroad with exhibitions, making the image of the Palace Museum deeply rooted in people's hearts. In recent years, the "Digital Dunhuang" project has accelerated. The Dunhuang Academy's Cultural Relics Digitalization Institute produces VR virtual roaming programs for grottoes, providing more and better channels for Dunhuang art to spread domestically and internationally beyond protection and inheritance. In June 2017, the "Touch China VR Interactive Experience Exhibition" held in Helsinki, Finland, received widespread welcome and praise from local citizens. Audiences could "explore" the Dunhuang Mogao Grottoes, "walk" through Tibet's Potala Palace, and even enter Xi'an's Terracotta Warriors to have "intimate contact" with China's army from a thousand years ago without leaving their country. The VR interactive experience exhibition received a continuous stream of Finnish citizens and international tourists daily, presenting an immersive cultural feast for 参展观众 (exhibition visitors).

VR technology has the advantage of breaking through spatial, temporal, and language communication barriers, making it easier for traditional Chinese culture to be displayed and disseminated to the world through VR. As an important carrier of cultural dissemination and inheritance, publishing can also introduce VR technology, allowing the world to understand the profound and long-standing Chinese culture through the window of books loaded with VR/AR.

## 6. VR Libraries Bring New Reading Experiences

The difference between VR libraries and traditional libraries lies in that VR libraries are libraries relying on network information resources, without the physical mass and volume concept of library buildings, and without traditional paper collections. The so-called virtual space refers to the network environ-

ment. VR libraries have no paper literature collections, do not use physical library buildings as service platforms, and do not use paper prints as carriers. In this virtual space, they mainly rely on network information and remote communication technology to obtain literature and information resources, creating a virtual library literature resource database using the Internet. Therefore, some call it a “wall-less library.”

In VR libraries, users can stroll, select books, and read, just as in a real environment, and can also communicate and interact with other readers in the library, while the two real individuals may be in different regions. The library community generally believes that future libraries will be a “union” of paper libraries, digital libraries, virtual libraries, and VR libraries. VR technology plays a bridging role in this and represents the research direction for future composite modern libraries.

Digital transformation has always been a task full of expectations and challenges facing the traditional publishing industry. Technologization, intelligence, and interactivity have become inevitable development trends in book digital publishing. The development of AR and VR technologies has added new momentum to book digitalization. Their immersive reading experiences have broken the pattern of traditional digital publishing, leading readers into a completely new reading mode and filling digital publishing practice with various possibilities.

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

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