



## Augmented Reality-Based Interactive Picture Book Design

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**Abstract:** A picture book is a book as its main content and text as an auxiliary, even without text. The interactive picture book is a new type of picture produced under the action of digital technology. With the rapid development of digital technology, traditional pictures have changed in form. Interactive picture books are becoming a major e-book, using digital technology to improve the form of picture books to meet the needs of the digital age. The interactive picture books in the new century have also had a great impact on the current picture book situation. In this paper, through the shortcomings of traditional picture books, enhanced display technology has been introduced to display the picture books to verify their feasibility. In this article, through the related concepts of interactive picture books, mainly taking children's picture books as an example, through the multi-sensory experience of listening, speaking, seeing, touching, and thinking in picture books, the situation of picture books under AR technology could be understood. This paper mainly compared traditional picture books and new picture books in terms of learning efficiency, interest, satisfaction, and interesting value. It was found that the efficiency of the new AR picture book increased by 13%, and the interest rate increased by 14%. Satisfaction has improved well, and the fun value has also increased by 0.12. It showed that the new AR interactive picture book is conducive to learning and cultivating children's abilities in all aspects.

**Keywords:** Interactive Picture Book, Augmented Reality Technology, User Experience, Traditional Picture Book

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### 1. INTRODUCTION

At present, Chinese picture book research mainly discusses the positive significance of picture books, the history of picture books, the theory of picture book creation, and the artistry of picture books, but few studies have been done on the changes in picture books in the digital age. The traditional static books are transitioning to a multi-dimensional dynamic, and interactive e-books are thus produced. Interactive picture books are gradually becoming the main application field of e-books, which helps to improve the drawing form through digital technology to adapt to the development of the digital age. The development and application of digital technology make this kind of reading and interactive pictures more and more close to people's daily lives. In the era of reading pictures in the electronic version, the way of reading books has gradually lost its leading role, and TV and computer networks have gradually replaced books and become the most basic and important cultural media. It has changed people's perceptions, thinking, behavior, and cognition. With its extensive promotion and application, it has transformed the cultural form with text as the basic medium to the visual culture with images as the basic form. The design and reading experience of traditional picture books are facing unprecedented changes. Interactive picture books, as a new form of reading that integrates images, text, and interactive elements, have gradually become an important tool for children's education and cultural dissemination. However, there are still many challenges in the current interactive picture book design in practice. How to achieve deep interaction of content in design to promote reader engagement and immersion is an urgent problem that needs to be solved.

AR technology, as an innovative means of seamlessly integrating virtual information with the real world, provides new possibilities for the design of interactive picture books. Through AR technology, the content of

picture books can surpass the limitations of flat pages and achieve a three-dimensional dynamic display, allowing readers to explore the story plot through multiple sensory experiences such as visual and auditory senses. Meanwhile, AR technology can also endow picture book content with real-time interactivity, allowing readers to interact with characters and scenes in the story through simple operations, thereby enhancing the fun and educational effect of reading. Explore interactive picture book design based on augmented reality, analyze how to use AR technology to solve the main problems faced in current interactive picture book design, explore its potential in enhancing reader experience and educational value, provide new ideas and methods for future picture book design, and promote further development in the field of interactive picture books.

This article mainly compares traditional picture books and AR picture books in the new era. By explaining the shortcomings of traditional picture books, new picture books are introduced. The comparison results showed that the learning efficiency has been significantly improved. The degree of interest has also improved. The satisfaction has increased by 16%, and the interest value of picture books has also reached 0.6, with an increase of 0.12. The new picture books in the new era can better exercise children's learning ability in many aspects.

The main contributions of this article include:

(1) An innovative application framework of augmented reality technology in interactive picture book design has been proposed: This article analyzes the shortcomings and challenges of current interactive picture book design in depth and constructs a design framework with augmented reality technology as the core. This framework not only provides a multidimensional solution for content display but also systematically integrates interactive elements, enhancing users' immersive experience and sense of participation.

(2) Designed and validated a multi-scenario interactive picture book prototype: This article designed a series of prototypes to explore the impact of different AR interaction methods on the picture book reading experience. These prototypes have validated the effectiveness of AR technology in enhancing reader immersion and story understanding through interaction in different scenarios.

(3) Innovation in Interactive Design: This article explores in detail the diverse applications of augmented reality technology in picture books and demonstrates how interactive design can enhance the sense of participation and immersion in stories. The combination of images and sounds through augmented reality, as well as real-time interaction between readers and storylines, greatly enhances the expressive power of traditional picture books.

## 2. RELATED WORK

Picture books are familiar to people. Traditional picture books are hand-painted, which is more complicated than interactive picture books. Many scholars have also discussed interactive picture books. Given the products that incorporate indigo dyeing on the market, new and old products are constantly being introduced, but there are only a few picture books related to traditional crafts and manufacturing. Hafiz M used data collection technology to modify and design children's picture books. By organizing and calculating the pictures in the picture books, he designed teaching materials that effectively stimulated children's cognitive development and made children more interested in learning [1]. Darmawan L A used the Borg&Hall model for research and development, designed and produced suitable picture storybooks. The significance value of the independent sample t-test of students' learning outcomes was 0.001, indicating that picture storybook media has a significant impact on creative thinking ability and learning outcomes [2]. The creation and publication of original picture books have made great progress, but judging from the best-selling books in the picture book market, there is still a big gap between original picture books and picture books.

At present, the design research of interactive picture books focuses on how to enhance children's reading interest and learning effects through multiple sensory experiences such as vision, hearing, and touch. Dinç B G et al. [3] explored the application of interactive elements in picture book design and emphasized the importance of combining storytelling with interactivity. Polyzou S et al. [4] analyzed the acceptance and usage preferences of children of different ages for interactive picture books through user research. Scholars have studied various aspects of picture books, but no practical progress has been seen in combining modern technology.

As an innovative means of superimposing virtual information on the real world, AR technology is increasingly used in the field of education. Scholars have discussed various aspects of augmented reality technology (also known as AR). Augmented reality is considered to be one of the most complex technologies in virtual reality research and is very effective as a learning medium. Hidayat H et al. [5] studied the application of AR technology in children's education and found that it can significantly improve learning motivation and participation. In addition, Yilmaz R M [6] verified the effectiveness of AR technology in promoting children's language learning through experimental research. Although AR technology has broad application prospects in the field of education, its integration into picture book design is still in the exploratory stage. Alyousify A L [7] proposed an AR-based picture book design framework that provides children with a new reading experience by integrating visual recognition and real-time feedback mechanisms.

Yan W reviewed relevant academic literature and award-winning commercial works to analyze the characteristics of AR picture books and gain insights into future trends [8]. The conclusion shows that the future trend of AR picture books will blur reality more seamlessly, effectively enhancing engagement without distracting

the audience. Augmented reality (AR) technology for maintenance aims to improve human performance by providing relevant information about corrective and preventive maintenance. These choices are challenging due to the fragmentation caused by the wide range of services and options. Palmarini proposed an innovative process. It helps the selection by asking some questions to guide readers in understanding the requirements and limitations of any specific application. This leads to the selection of hardware, development software, and visualization methods[9]. In order to help individuals learn and train in volleyball, Duan designed an online volleyball distance teaching system based on augmented reality (AR) technology. The system software includes four modules: motion acquisition and recognition. The test results show that the functional modules and performance of the system meet the expected requirements, verifying the effectiveness and practicality of the system[10]. AR technology is used in various fields, but it is rarely used in picture books. In this regard, this article discusses the application of augmented reality in picture books.

### 3. INTERACTIVE PICTURE BOOK DESIGN

#### 3.1 Development Status of Traditional Picture Books and Interactive Picture Books

The United Kingdom is the birthplace of contemporary picture books. People in the UK are also working hard to turn these classic illustrations into dynamic ones. They spare no expense in creating picture books. On the one hand, this can make picture books a best-selling children's TV. On the other hand, computer terminals have also launched many interactive books for children, which are much more mature than Chinese interactive picture books [11]. With the development of computer picture books and the popularization of digital media, the form of picture books has changed.

The United States and Japan are both mature countries in the picture book industry. The form of comics began in the 1950s by turning the best-selling classic children's comics into cartoons, which was an approach that was a huge emotional and commercial success for audiences. Chinese comics used to be on par with European and American comic books, but comics were on the verge of extinction in the heyday of the 1980s. Now children rarely read comics, and it isn't easy to have any traditional comics [12]. In contrast, Chinese comic books have become the first choice of many young children and adults, which is precisely because of this that Chinese picture books have received more attention and development [13].

Although the Chinese picture book market is thriving, with the development of society, the world is getting smaller and smaller, and communication is becoming more and more frequent. Viewing the picture book market in China, the development under such a situation is not good enough [14]. As a whole, picture books and text reading have some shortcomings while developing in China.

(1) Market surveys, reader surveys, and research on psychology and educational concepts at different ages are in a state of "extensive." (2) For picture books and text readings of various age groups, the age division of readers is not meticulous. Especially for Chinese youth books, the age division is too broad. (3) There are very few books that have been originally written in other countries and lack local brands. In the children's book market, many publishers' key books are imported editions. (4) Books and text reading are faced with more and more market competition, as well as the problem of book selection and repetition. In addition, the research and development of Chinese picture books, interactive picture books, and picture book peripheral products are independent. Most of them are based on picture books, and few people pay attention to the innovation of digital technology. At the same time, the design and production of interactive picture books is also an interactive process, which must have layers. China's interactive technology is not mature enough. The choice of media is not reasonable enough, and the interactive activities are not perfect. However, in the new media era, the change in reading mode can attract more attention and development.

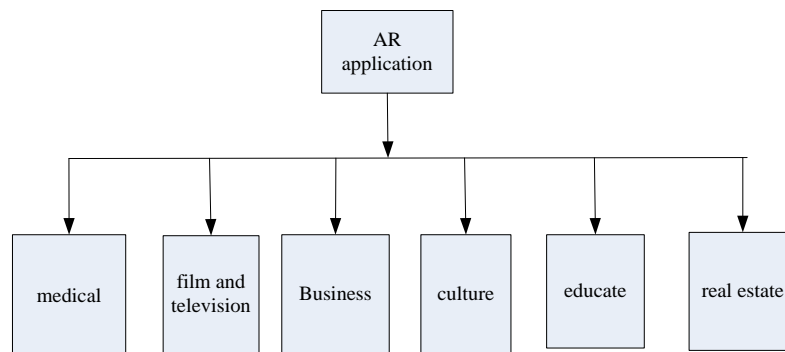
#### 3.2 Related Concepts of AR Interactive Picture Books

Augmented reality (AR) technology is a technology that perfectly combines the real and virtual worlds through high technology [15-16]. It can not only show the real world but also generate three-dimensional data within a certain period. Using 3D technology to enhance reality can also integrate real scenes and virtual objects into a two-dimensional or three-dimensional space so that players can better feel the real world [17-18]. Through various mobile devices, users can experience a range of sensory inputs that immerse them in a virtual reality world, allowing them to engage in multiple senses such as "seeing, hearing, speaking, touching, and thinking." As shown in Figure 1, users can access virtual objects within the text.

The development and improvement of AR technology have made the forms of human-computer interaction richer and more interesting. Its uses are expanding day by day. Later, with the development of technology, AR technology also constantly innovates and develops. In addition to people's daily leisure activities, it can also be applied to real estate, business, education, culture, and other fields [19], as shown in Figure 2. AR technology can let children feel the sense of achievement brought by knowledge in a "real" environment, thereby stimulating their enthusiasm for learning, stimulating their enthusiasm for learning and enhancing their enthusiasm for learning, which not only opens a new door for the application of AR technology in children's education, but also injects a new teaching method into children's education [20].



**Figure 1:** The application of AR in text.



**Figure 2:** Application of AR technology.

The key to the learning of Chinese characters is to solve the basis of memory clues and connections [21]. Etymological literacy is a great way to address people's memory cues and relational bases. When children learn Chinese characters, they can learn Chinese characters from the etymology of Chinese characters and use the pictographic structure features of Chinese characters to understand the meaning of Chinese characters better. Human memory has its characteristics. Short-lived memories are often quickly forgotten, and it is very difficult to remember immediately when first felt. On the contrary, people need to recall constantly. In this process, people go from unfamiliar at the beginning to familiarity now. As long as there is memory, they can "naturally" remember the things. AR technology solves the problem of short-term memory loss very well. It can superimpose real scenes and real things in real time so that people's senses can feel them so as to reproduce forgotten things, which fully proves the application of AR technology in the teaching of Chinese characters to young children. AR interactive picture books not only maintain the traditional picture form but also break the limitations of the plane. It turns a still picture into a three-dimensional figure, allowing the three-dimensional model to jump on the plane, providing children with the opportunity to learn and observe, which can achieve a vivid graphic form that meets the needs of children. AR technology is to insert virtual objects into picture books, overlapping the virtual scene with the real world. It not only enriches the expression of picture books but also enhances the interactive ability of conventional picture books, which can improve children's perception ability, thus enhancing the fun of picture books. The reason why AR technology can be rapidly promoted in the field of children's education is that AR technology can create a completely enclosed space instead of being restricted to a real environment. A virtual world can be created with few restrictions on the environment, making it easier to acquire and learn.

### 3.3 Augmented Reality Algorithm

Tracking registration is a technology in augmented reality technology, which is used to complete the cooperation between virtual information and real scenes, and also to achieve automatic and seamless integration between the two [22-24]. Then, based on the collected characteristic signals, the system decides when, where, and how to provide the virtual signal in the real scene.

The state value and observation value of the system at time  $t$  are defined to be  $X_t, Z_t$  respectively. Then the state transition model and observation model are [25]:

$$X_t = f_t(X_{t-1}, v_{t-1}) \quad (1)$$

$$Z_t = h_t(X_t, n_t) \quad (2)$$

Among them,  $f_t$  represents the system dynamics mode.  $v_{t-1}$  represents a single identically distributed noise sequence.  $h_t$  represents the observed model, and  $n_t$  represents one of the IID noise sequences. The subgroup

composed of N discrete samples and the corresponding weights are used to approximate, and each weight of one sample is relatively a particle. The post-test probability distribution is generated using the Bayesian iteration of each particle set.

$$P(X_t|Z_t) \approx \sum_{i=1}^N w_t^i \varphi(X_t - X_t^i) \quad (3)$$

Among them,  $\varphi(\cdot)$  is the Dirichlet function. The new particles are obtained by the method of importance sampling.

$$X_t^i \sim q(X_t|X_{t-1}^i, Z_t) \quad (4)$$

Through the mathematical calculation method, the new weights of the particles can be obtained.

$$w_t^i \propto w_{t-1}^i p(Z_t|X_t^i) \quad (5)$$

The weights are normalized to:

$$w_t^i = w_t^i / \sum_{i=1}^N w_t^i \quad (6)$$

The weighted particles are predicted to obtain the system situation at time t.

$$\bar{X}_t = \sum_{i=1}^N w_t^i X_t^i \quad (7)$$

The dynamic model of the system is selected. This system uses a 4x4 transformation matrix to convert the world coordinate system to the camera coordinate system [26].

$$P^C = X P^W \quad (8)$$

$$X = \begin{bmatrix} R & t \\ 0 & 1 \end{bmatrix} \quad (9)$$

In the camera coordinate system, the homogeneous coordinate of  $P^C$  for any point p in space is  $P^C(x_c, y_c, z_c)$ . The homogeneous coordinate of p is  $P^W(x_w, y_w, z_w)$  in a global coordinate system of  $P^W$ . X is the position transformation matrix from the world coordinate system to the camera coordinate system. The 3x3 rotation matrix R represents the relative position of the two coordinate systems, and the 3x1 movement vector t represents the relative displacement. On this basis, the prior probability distribution of a frame t is constructed by using the posterior probability distribution of the previous frame and the interference function.

$$X_i^- = P_t(X_n^+) \quad (10)$$

In Formula 10, n is sampled by weight based on the importance of particle weight  $\{w_1 \dots w_n\}$ . The  $P_t(\cdot)$  function is used to adjust the camera pose, which is generated by the Gaussian noise model. On this basis, the known 3D model of the target object is placed in the particle pose, and the resulting boundary is compared with the boundary detected in the image. This results in an estimate of the similarity of the particles and, in turn, a posterior probability distribution resulting from the similarity [27].

$$X_i^+ = X_i^- \quad (11)$$

$$w_i = L_h(X_i^-) \quad (12)$$

Among them,  $L_h(\cdot)$  is the similarity evaluation function. Traditional boundary-based particle filtering methods are mostly used for self-occlusion of general plane contours or simple three-dimensional objects. By counting the two pixels, the similarity of the particles can be obtained.

$$L_h(X_i^-) = j e^{\frac{1}{1-kd/v}} \quad (13)$$

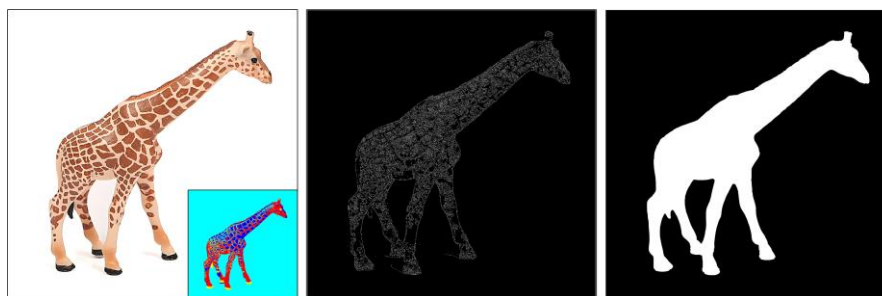
Interactions are simulated based on their similarity. Figure 3 shows the synthesis of scenes and models under AR algorithms. Figure 4 shows the process of edge detection for 3D models.



Figure 3: Synthesis of scenes and models in AR algorithms.

### 3.4 Implementation of AR Technology

In interactive picture book design, the implementation of AR technology mainly includes content display design, interactive design, and multi-sensory experience design:



**Figure 4:** 3D model edge detection.

### *(1) Content Display Design*

In terms of content display design, the combination of the Unity3D engine and Vuforia AR SDK is used to achieve precise matching and overlay between 3D models and real scenes. Specifically, using image recognition technology, key images in picture books are used as AR landmarks, and high-precision feature point extraction and matching algorithms are employed to ensure that the generated virtual content is completely consistent with real web pages. By using feature extraction algorithms, we can solve the problem of difficulty in accurately identifying landmark points due to changes in lighting, and improve the stability and realism of AR images.

### *(2) Interaction Design*

In terms of interaction design, a dual-mode interaction mode based on gesture recognition and touch screen is adopted. Through the built-in Leap Motion gesture recognition device, users can interact with virtual characters through gestures such as rotation and scaling. This non-contact interactive mode not only increases the user's degree of freedom in control but also reduces physical contact between the user and the device, thereby reducing user fatigue. In interactive response, a combination of multi-threaded processing and GPU acceleration is used to optimize gesture recognition, in order to improve the response speed and fluency of interaction.

### *(3) Multi-sensory experience design*

To enhance the multisensory experience of picture books, I integrated sound processing technology into their design, achieving synchronization with the real-world environment. Using HRTF (Head Related Transfer Function) technology, a realistic 3D sound environment is established in Unity, allowing users to perceive the spatial connection between sound and objects. Real-time tracking of the user's head position and posture, and dynamic adjustment based on this to improve the three-dimensional and realistic sound effects. In the implementation process, low-latency audio processing algorithms are used to ensure synchronization between the image and sound without causing auditory fragmentation. In addition, by utilizing the API of the sound engine, the sound effects and the behavior of virtual characters are closely integrated, so that each interaction can trigger corresponding sound feedback. For example, when a character is clicked, it will trigger sound or sound effects. This fusion of multiple feelings not only enriches the expression of picture books but also increases the sense of immersion when reading.

## **3.5 Design Process Report**

This article is designed from the perspective of young children, so as to avoid tasks that are too complicated and affect learning and strive to be concise and easy to understand. It is convenient for children to master the operation process and reduce the probability of operation errors, thus guiding children to learn to use AR Chinese character interactive picture books. Simple interface design helps children master skills and enhance their practical ability. APP icons and buttons are flat, while the main scene and other scenes of AR interaction have both a sense of hierarchy and a close relationship. The sub-scene is a branch of the main scene of AR interactive recognition. A "return" button is set on each scene interface, and children can confirm and participate in other activities through AR. Animated characters can be designed, and the learning content of Chinese characters can be combined with the situation, making them vivid, so as to arouse children's interest in Chinese characters. In addition, this article also designed a "word-finding game", so that children can deepen their understanding of Chinese characters during the game. In this way, children can feel the learning effect of children when they play with others, and can also better understand their literacy skills. By using text and drawings, corresponding 3D models can be quickly generated, as shown in Figure 5.

Due to the physical characteristics of young children, their browsing on the APP is not a special rule. In order to allow children to operate and learn better, the layout design of the APP mobile interface adopts a horizontal screen instead of a text description. The content of AR interactive picture books is divided into two parts: AR interactive and picture books. The AR interaction part includes the startup interface, the main scene and the sub-scene recognized by the AR interaction. The picture book is composed of three main parts, namely the operation process description diagram, the AR recognition diagram, and the content analysis of Chinese

characters. This article presents the overall content of the AR interactive picture book in a frame for easy understanding, as shown in Figure 6.

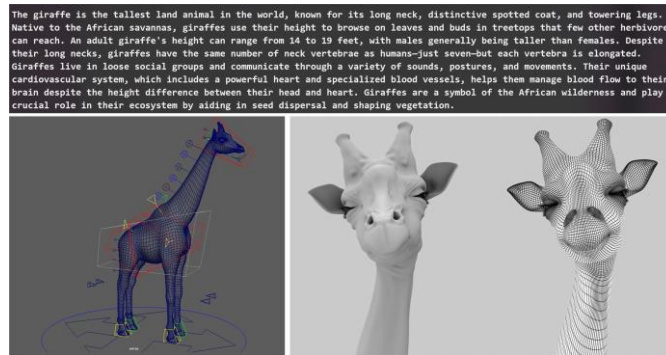


Figure 5: Rapid generation of 3D models.

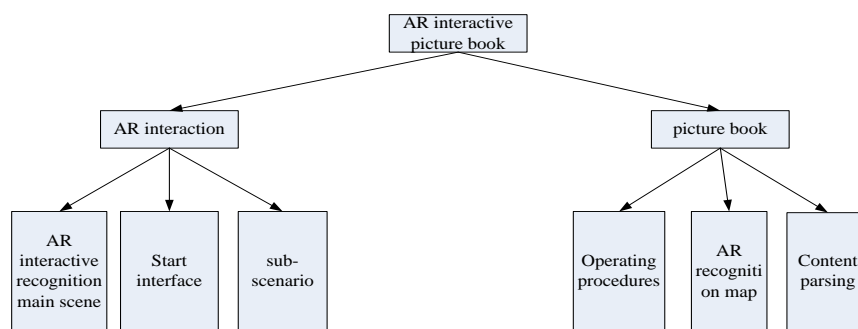


Figure 6: AR interactive picture book framework.

AR interactive scene transition logic: Every game has an inherent loop mechanism, and at the application level of the AR interactive atlas, children can also switch in this loop. The AR interactive picture book is divided into three parts, as shown in Figure 7. When children use it, the transition process between different interfaces of the AR interactive scene of the AR interactive picture book can jump between different scenes according to the process.

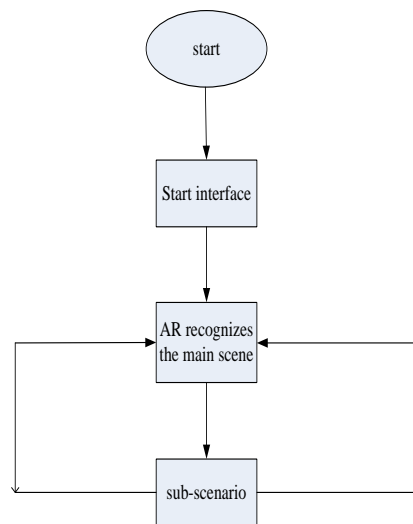
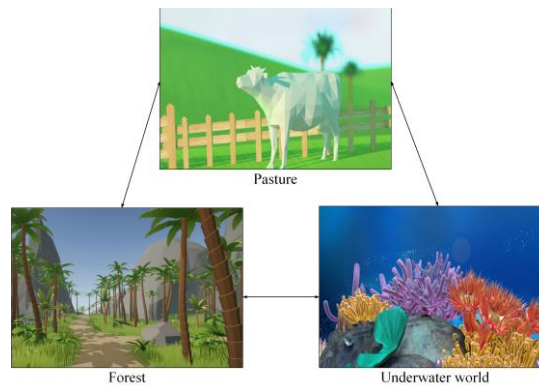


Figure 7: AR interactive scene-switching process.

When the AR interactive scene is started, a startup interface appears in the AR interactive animation. Children click the "start" button to enter the AR recognition interface, scan the recognition map, and then enter the corresponding AR recognition scene. The main scenes recognized by AR include pastures, forests, and underwater

worlds, as shown in Figure 8. The characters in the three scenes are animated, and each character has its own unique text. The startup interface is connected to the AR recognition main scene. The AR recognition main scene is connected to the main scene, and children can switch between different scenes. The AR technology is used to identify the main scene and other scenes respectively.



**Figure 8:** Main scenes recognized by AR.

Interactive picture book function design: Because the research object of this design is 3-6-year-old children, a lot of investigation and analysis has been carried out when designing creative ideas. The interface of the whole game is unified, and children can perform simple operations and learn easily in an easy-to-understand way under the guidance of their parents. This startup interface is the first scene in the AR animation animation. Its function is very simple, which is to display the theme of the AR animation, allowing the children to interact, so there is a start button in the game. Children only need to press the "start" button to enter the "scanner" of "AR recognition", and they can enter the "interaction" and "home screen" with "AR" by "recognizing" the image, as shown in Figure 9. In order to meet the overall design of the AR interactive picture book, the background picture adopts an awareness map and takes the AR interactive picture book as the theme. A dynamic effect is added to the start button so that the shape of the start button can become larger or smaller, longer or shorter, which can arouse the curiosity of children. This allows kids to hit the start button and go straight to the AR recognition scene.



**Figure 9:** Interactive picture book function design

AR interactive recognition main scene settings: The main scene of AR interactive recognition is an important link in the AR interactive scene. After entering the AR image recognition interface, the software recognizes it. When AR technology recognizes images, it can automatically generate a stereoscopic image. The main scenes of AR interactive recognition include pastures, forests, and underwater worlds, as shown in Figure 10.



**Figure 10:** Interactive scene selection.



In the interface layout design of the main scene of AR interactive recognition, the user's psychological needs are first considered. The main scene of AR interactive recognition adopts a flat design, and multiple function buttons are set in the upper right corner of the interface, which is convenient for users to be familiar with the interaction. In the main scene of AR interactive recognition, the voice and photography buttons are set in sequence, as shown in Figure 11. In terms of functions, there are functions such as playing music, taking pictures, rotating, zooming in, zooming out, and changing scenes. In this process, the background music, photography, and scene switching are all done by tapping the screen, and the functions of rotating, zooming in, and zooming out are done by touching the screen with fingers.



**Figure 11:** Scene function button.

AR interaction recognition sub-scene settings: The sub-scene is the main scene corresponding to AR interaction. Children can interact in the sub-scene or press the return button of the next scene to return to the main scene of the AR interaction on the previous layer and then perform other activities and interactions with other scenes. In the sub-scene, basic functions such as sound playback, photographing, rotation, zooming in, zooming out, and scene transition are also set. The difference between it and the main scene of AR interactive recognition is that the partition scene is more interactive. On this basis, functions such as tapping the screen to play character sounds and animations and tapping the sound buttons to play Chinese characters and pinyin boards have also been designed. The content of the pinyin board includes Chinese characters and pinyin. Children can understand Chinese characters by listening to their pronunciation. In this way, the pronunciation of Chinese characters can be compared and corrected, and the pronunciation of Chinese characters can be combined with listening, reading, and writing to improve children's reading ability. The AR interactive picture book also includes the design of visualization, characterization, sound effects, icons, scenes, and so on.

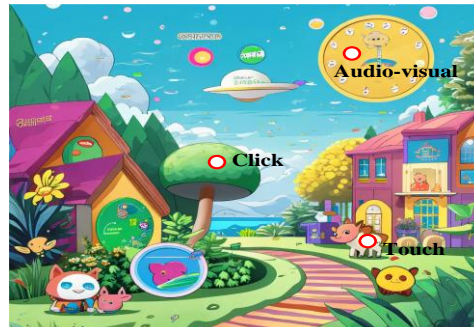
### 3.6 Advantages of Augmented Reality Technology in the Field of Picture Books

AR children's picture book, usually referred to as a mobile phone application with an AR interactive function, is a kind of software based on paper picture books and matched with it. If parents want to help their children read books, they all need to download software that matches the picture books on their mobile phones or tablets. Then, they have to scan a logo or special picture on a piece of paper, and once confirmed, a 3D model or animation can be displayed on the phone or tablet. Compared with traditional paper books, AR picture books convert the original still images into multi-dimensional representations such as sound and video in a three-dimensional and intuitive nonlinear form so that children can feel it in various senses, such as sight and hearing, as shown in Figure 12. AR picture books can not only satisfy the curiosity of young readers but also relieve the troubles of parents who cannot spare time to accompany their children to read.



**Figure 12:** AR picture book display.

Interactive design enriches the reading experience. Traditional paper is a single linear reading, which is a passive interactive behavior, and children cannot actively participate in reading during the reading process. AR children's books not only maintain the image characteristics of traditional paper books but also add virtual elements that can be interacted with in real-time. Children interact with AR books by clicking, touching, audio-visual, etc., turning themselves into the protagonists of the books and interacting with the characters in the books, as shown in Figure 13. In this way, children can not only be immersed in the situation but also satisfy their curiosity and desire to participate and enrich their reading experience.



**Figure 13:** Interaction between children and picture books.

Learning efficiency can be improved by entertaining and entertaining. Traditional paper books use static graphic illustrations as the main content, and their expressions are single. The readers' reading is also relatively boring. With the help of AR technology, children can follow the protagonist in the story, and with the help of 3D models and audio animations, they can obtain a new experience so that readers can understand the book more clearly, thereby improving the efficiency of reading. Young readers can understand the content of books more clearly in the reading context. This reading mode, which is experienced by multiple senses such as sight, hearing, touch, etc., is a kind of "playing" reading. It not only makes the still pictures vivid but also expands the multi-dimensional visual experience, which stimulates children's interest in reading, thereby improving the efficiency of reading.

#### 4. COMPARISON OF AR INTERACTIVE PICTURE BOOKS AND TRADITIONAL PICTURE BOOKS

This paper mainly compared the learning efficiency of children aged 3-6 in different picture book situations, from the number of interests, the satisfaction of parents, and the value of interest, mainly through questionnaires. The number of respondents was 200. In order to ensure the accuracy of the data, three surveys were conducted to calculate the mean.

The learning efficiency of children can be compared to the time and effect of their learning picture books. Learning efficiency can also explain the contrast between the two picture books to a certain extent. A comparison of the two pictures is shown in Figure 14.

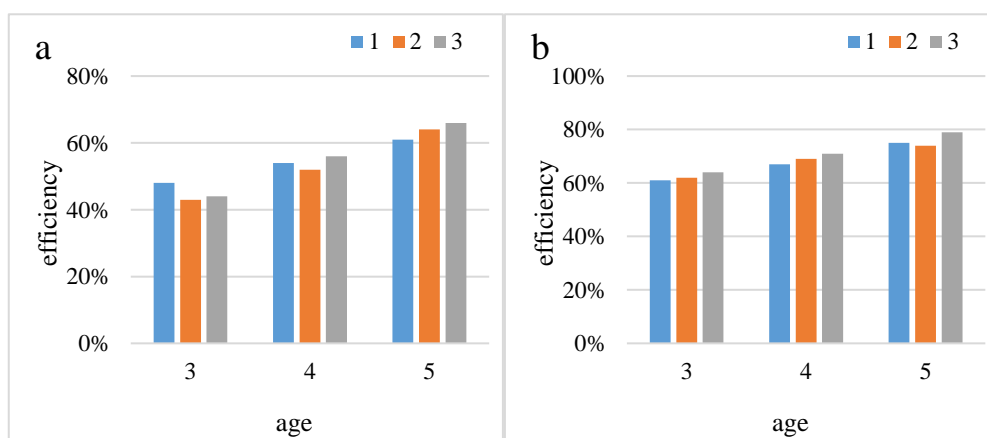


Figure 14a: Traditional picture books

Figure 14b: AR interactive picture books

**Figure 14:** Comparison of learning efficiency.

It can be found from the two sets of data that efficiency varied across age groups. With age, there was some improvement in efficiency. The learning efficiency of traditional picture books was 48%, 54%, and 62% when children were three to five years old. However, the learning efficiency of AR interactive picture books was 62%, 66%, and 76%. It showed that AR interactive picture books can effectively improve children's learning efficiency, and the improvement rate was about 13%.

The degree of interest of children could mainly be judged by the time and performance of children's learning. The article mainly divided the degree of interest into three types: no interest, interest, and strong interest. The interest situation was judged by counting the number of people, as shown in Figure 15.

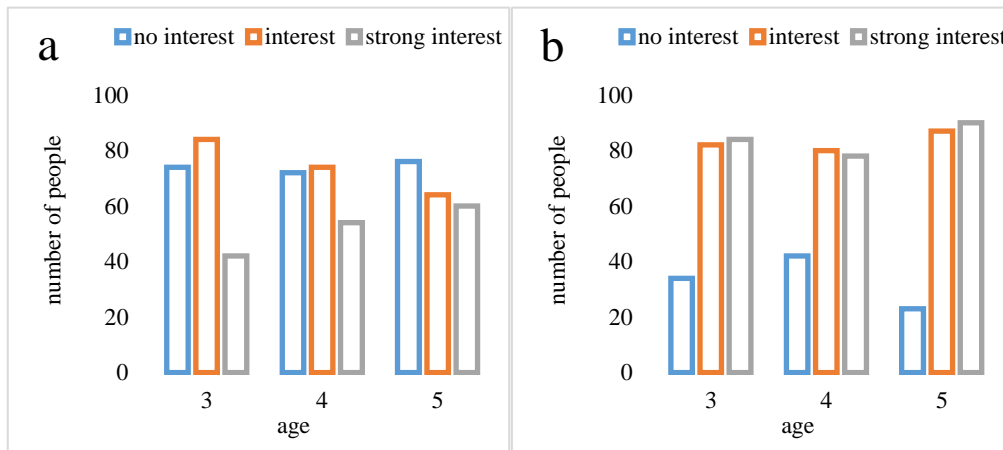


Figure 15a: Traditional picture books      Figure 15b: AR interactive picture books

**Figure 15:** Comparison of interest.

Through two sets of data, it can be found that compared with traditional picture books, the number of people who were not interested reached 37%, and the number of people who were strongly interested was only 26%. However, in AR interactive picture books, only 16% of people had no interest. The number of people with strong interest reached 40%. A 21% decrease in no interest and a 14% increase in strong interest were found. It showed that AR picture books could be more popular than traditional picture books.

In the case of using the two picture books, parents had different satisfaction situations through their own feelings. In this paper, the satisfaction situation was mainly divided into three situations: dissatisfied, satisfied, and very satisfied, and the situation of the number of satisfied people was analyzed. The satisfaction between the two is shown in Figure 16.

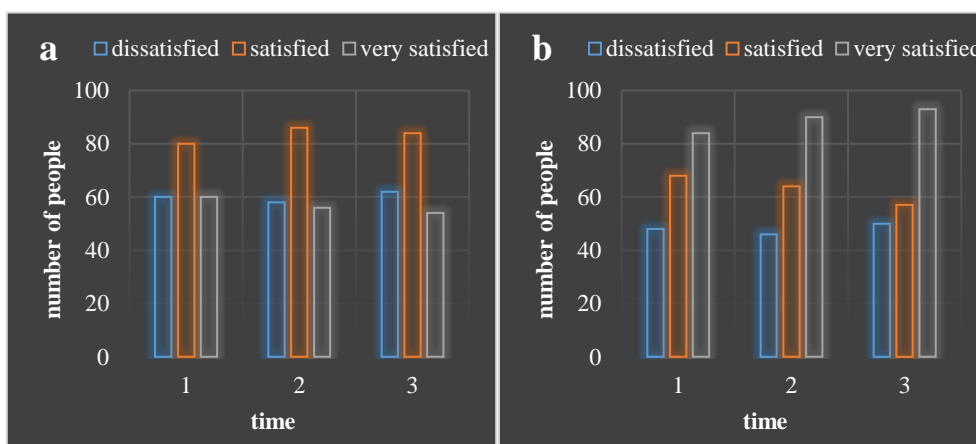


Figure 16a: Traditional picture books      Figure 16b: AR interactive picture books

**Figure 16:** Comparison of satisfaction conditions.

Through the comparison of the two data, it was found that the number of people who were dissatisfied with traditional picture books has reached 30%, and the number of people who were quite satisfied was only 29%.

However, in the AR interactive picture book, the number of dissatisfied people decreased by 5%, and the number of people who were quite satisfied reached 45%, with an increase of 16%. It showed that this new type of picture book could be more suitable for the current technological society.

The two methods bring different interests to children, because AR can make them feel the content and knowledge in the picture book more vividly. The comparison chart of their interesting values is shown in Figure 17. Interest values ranged between 0 and 1.

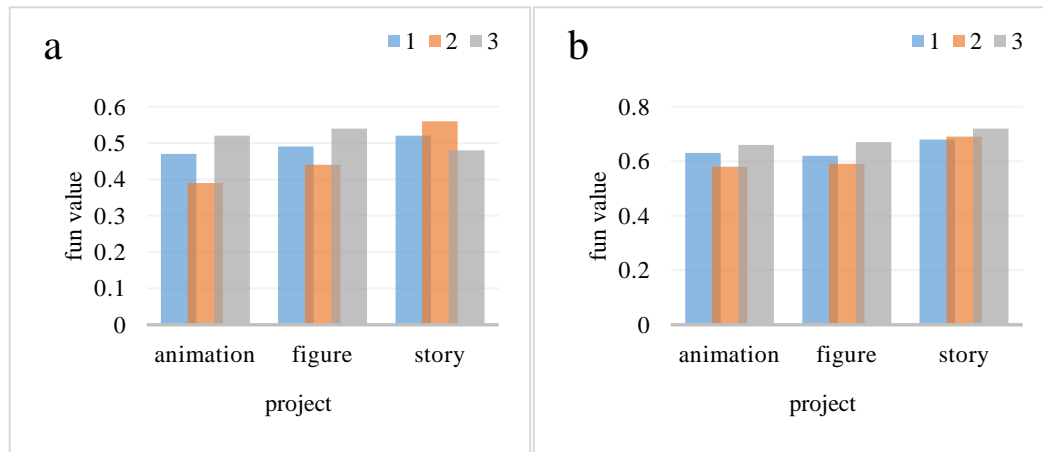


Figure 17a: Traditional picture books

Figure 17b: AR interactive picture books

**Figure 17:** Comparison of interest value.

Through the two sets of data, it can be found that the interesting values of traditional picture books and interactive picture books were different. Traditional picture books were less interesting, with a fun value of only about 0.48, while AR interactive picture books reached 0.6. It showed that AR picture books were more interesting and beneficial to promote children's learning.

## 5. CONCLUSIONS

In this paper, by explaining the current situation of traditional picture books in China, it put forward its shortcomings, so as to create a new AR interactive picture book in the age of technology. By combining the content of the picture book with augmented reality technology, a new type of interactive picture book was formed. In this paper, the impact of the new picture book was also explained, and the AR was deeply understood through the algorithm under the AR technology. It mainly took children's picture books as the research object and designed the language, characters, animation, sound, story, plot, etc. in the design. Finally, the comparison with traditional picture books was carried out mainly through questionnaires. The two kinds of books were compared mainly from the four aspects of learning efficiency, the number of interested people, parents' satisfaction, and the interest value of picture books. The results found that the new interactive picture book was easier for children to understand and learn, which effectively made them understand the use of interactive picture books, thus verifying the effectiveness of the design method. The shortcoming of this article is that it does not fully explain the design level, or does not explain the advantages and disadvantages of traditional picture books and AR picture books. However, with the gradual development of technology, in the era of the Internet, AR can also be used in life and work, and parents can also understand and pay more attention to their learning methods. The state is also paying more and more attention to education so that the education of children can be guaranteed.

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