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Analysis of Multi-Sensory Experience Design in AR Interactive Books

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Abstract

Starting from the concept and development of AR interactive books, this paper conducts theoretical analysis to summarize how AR interactive books break the traditional reading mode and provide users with a new reading experience combining the virtual and the real. Taking the analysis of multisensory experience design in AR interactive books as a starting point, it concludes the different experiences that users gain from this new reading mode through five senses. It is proposed that in the process of innovating AR interactive books, each stage from topic selection to graphic design, AR content design, and production should be combined with its content, and design methods should be considered from the perspective of users' usage to promote the continuous development of AR interactive books among young audiences. This paper also provides a reference for interactive book creators to consider routes and methods.

Keywords

AR interactive books, multisensory, experience design

1. AR Interactive Books

"AR interactive books" refer to interactive books that integrate Augmented Reality (AR) technology. Augmented Reality is a technology that creates an enhanced real-world experience by superimposing digital information onto the physical world. AR interactive books utilize this technology to combine the content of books with virtual imagery, providing readers with a more immersive and vivid reading experience. AR interactive books are typically physical books, but the images or graphics within them can be made dynamic and interactive through AR technology, integrating with virtual elements. Readers can use smartphones, tablets, or specialized AR devices to view these virtual elements. AR technology provides readers with opportunities to interact with the content of the books. Readers can interact with

virtual images through touch, gestures, or other control methods, such as rotation, zooming, or observing animation effects. This interactivity enhances readers' learning interest and comprehension.

Currently, Augmented Reality technology has essentially merged with the traditional publishing industry into the form of "printed books + mobile devices + App" applications. This means that users need to purchase physical books first, and then download a specific mobile application on their mobile devices to scan specific images in the book to access 3D images and other information.

Currently, AR interactive books on the market mainly target young children, focusing on children's books and educational content. The structure of these interactive books is relatively simple, with AR content mainly aimed at enabling children to fully understand certain objects. These interactive books primarily serve early childhood education. For example, in Bilin Hexi's "Magic Book," the textual and graphical content is rendered three-dimensionally, allowing children to wear special glasses while reading to see 3D scenes and animated content. This allows children to see the combined scenes of reality and virtuality and interact with the content of the book. This not only enables them to see vivid and interesting stories but also allows them to experience sensory experiences that traditional printed books cannot provide, making reading and learning more concrete and real.

Compared to traditional books, AR interactive books have unique advantages in terms of readers, creators, and the market. They provide richer reading information. Compared to traditional books, the narrative content of AR interactive books is richer and contains more information. Because books themselves carry textual information, using a three-dimensional structure makes the flat content more tangible, combined with the integration of AR augmented reality technology, various media such as sound, animation, and interaction are combined for storytelling, expanding the information content beyond the single expression of text, allowing readers to obtain richer information. They offer multi-dimensional sensory experiences. When reading traditional picture books, readers can only perceive the content expressed by static images and text, mainly relying on vision to comprehend the content. AR interactive books, on the other hand, can narrate through various media such as sound, images, and interactions in virtual scenes, providing users with multi-dimensional sensory experiences including auditory and tactile senses, not limited to visual perception.

2. AR Interactive Book's Multi-Sensory Experience Analysis

Users of AR interactive books undergo a transformation in experience from being mere readers to active participants. Their experience extends beyond traditional textual reading to encompass interactions and experiences with various media such as text, three-dimensional structures, 3D models, and interactivity. They are no longer merely readers in the traditional sense but rather more proactive and engaged users. AR interactive books themselves embody a variety of sensory experiences. Unlike traditional books, they do not rely on users' interpretation of excessive textual content but are presented directly to users, offering a completely new experience from different sensory perspectives.

2.1 Visual Experience of AR Interactive Books

Color is one of the most intuitive experiences in visual perception. Further analysis is conducted based on the physiological and psychological characteristics of the audience to make appropriate evaluations of visual effects. For example, compared to adults, children prefer vivid and rich colors. Additionally, preferences for colors vary between males and females, with most males leaning towards deeper hues while females tend to prefer pink and lower saturation colors.

AR interactive books primarily utilize printing technology, providing flexibility in material selection. Various materials possess different textures and qualities, which in turn offer users different visual experiences. This choice is not limited to paper-based materials. For instance, in "Journey to the West," the scene of the Water Curtain Cave utilizes transparent PVC material to depict water ripples. Transparent PVC sheets allow users to see the rocks inside the Water Curtain Cave, while the smooth texture of PVC enhances vividness. The application of such materials creates rich visual effects, more vivid than conventional copperplate paper. When readers turn to this page, they are drawn to these small details, feeling pleasantly surprised. Different materials yield different tactile sensations; smooth materials create delicate feelings, while rough materials add texture. Scientific and reasonable use and combination of materials such as paper can significantly enhance the visual impact of interactive books, improve the printing effects of traditional static children's books, and add highlights to the design.

As a means of enhancing visual effects, AR technology allows readers to view scenes that combine reality with virtual elements, an experience traditional books cannot provide. Given that about 80% of human information intake is visual, the appeal of interactive books primarily lies in visual perception. AR interactive books offer a visual experience that combines physical and virtual elements, which is their unique feature. However, to leverage this advantage, the key lies in content. Narrative content determines cultural connotations, and if the presented content exceeds the reader's comprehension, it will inevitably create barriers to acceptance.

2.2 Tactile Experience in AR Interactive Books

In the context of AR interactive books, tactile sensation extends beyond merely flipping through the pages; it encompasses a deeper level of "interactivity." This interactivity is manifested in two aspects: the interaction between users and the book itself, and the interaction with AR technology. Interactivity stands out as one of the most significant differences between interactive books and traditional ones, and it is also one of the key reasons why interactive books are increasingly popular. In the children's interactive book "Zoo," for example, the author has devised mechanisms to guide user operations. For instance, small fold-out pages on each page are designed as independent structures to encourage users to continually explore new content while flipping through the book. The more users engage with flipping and interacting, the more enjoyment they derive, as if they are personally exploring an uncharted wonderland. Furthermore, incorporating movable joints in some detailed designs can also allow readers to perceive the author's thoughtfulness and attention to detail.

Within the AR system, users need to perform some simple interactive operations. After scanning and identifying the patterns, users can freely move their smartphones to change perspectives and observe scene contents. Additionally, there are interactive elements that require user choices. For instance, when users are faced with choices, they are allowed to make decisions themselves. Different choices may lead to different outcomes and content. Through these interactive behaviors, users can immerse themselves in the story. This also implies that creators need to engage in bidirectional content creation based on readers' choices. Only in this way can the distinctive features of innovative design in AR interactive books be fully demonstrated. This bidirectional interaction greatly enhances immersive experiences. The satisfaction and entertainment users derive throughout the process are precisely what tactile experiences strive to achieve.

2.3 Auditory Experience in AR Interactive Books

Auditory perception, like visual perception, possesses unique characteristics and aesthetic effects that other senses lack. AR interactive books effectively address the inherent limitation of books not being able to produce sound. Through applications on mobile devices, users not only see scenes combining reality and virtual elements but also hear sounds emanating from these scenes. In cinematic narratives, the conveyance of information relies on both visuals and sounds. However, visuals confine narrative space within a certain scope, enhancing the conveyance of the author's narrative. This constitutes the most direct auditory experience.

Moreover, interactive books generate the natural sound of paper friction during page flipping due to the characteristics and structure of paper. This most "natural" sound is also sought after by many users who still prefer paper-based reading for its perceived authenticity. This feature also fosters a sense of familiarity among readers. Hence, some interactive book designers intentionally exploit this aspect. They deliberately design these paper structures to produce sound under specific circumstances. David Carter's "White Noise" provides an experimental demonstration of sound and music generated under constrained conditions, undoubtedly constituting one of the crucial features of interactive book reading. Whether it's background music, sound effects, or narration, users can only hear the sound information added by the creator after scanning and recognizing AR content through their devices. Sound can captivate readers' attention, enhance the value of books themselves, and enrich users' sensory experiences, bringing them surprises.

2.4 Olfactory Experience in AR Interactive Books

Research indicates that human memory of smells surpasses even that of visuals, lasting longer and eliciting more sensitive and profound reactions. Aromatic scents can uplift mood. The significance of olfaction in interactive book design warrants deeper exploration.

The ink aroma emitted by books themselves, stemming from various organic solvents commonly used in printing inks, offers readers a refreshing olfactory experience. In modern processes, many publishers incorporate scented inks into books, which can last for a considerable period, up to one to two years, as long as they are not exposed to sunlight or friction. Therefore, in interactive book design, we should

consider olfactory design, utilizing "scent" to create ambiance and enhance the expressive power of interactive books. However, when using paper with specific odors in interactive books, careful consideration is necessary. Fresh, natural scents induce relaxation and comfort, while pungent odors may evoke aversion and discomfort. Excessive intensity of odors may lead to odor amalgamation, resulting in unintended consequences. Furthermore, safety considerations regarding odors must also be taken into account. Here, we only discuss olfactory sensory experiences without delving too deeply into research. Creators can consider olfactory experiences as one of the elements in their design.

2.5 Gustatory Experience in AR Interactive Books

The natural freshness of plant fiber paper brings about a sense of nature. Therefore, the gustatory aspect in the design of interactive books does exist. However, it does not directly stimulate taste buds; rather, it evokes gustatory associations through artistic symbolic forms.

The aroma of books induces a subjective gustatory perception indirectly experienced by readers through sight and sound during the reading process. In traditional books, this gustatory experience often stems from textual descriptions. Vivid and imaginative textual depictions of flavors and textures enable readers to experience the taste and texture of food through reading, thus generating a gustatory sensation psychologically. Introducing gustatory experiences into the innovative design of interactive books is a novel and creative idea. Although taste cannot be directly triggered by books, it can be evoked through artistic means and symbolic forms to stimulate readers' gustatory associations, enhancing emotional resonance and immersion in reading. For instance, the use of special plant fiber paper, such as vanilla or tea-infused paper, can impart a natural freshness to the book, allowing readers to perceive a fresh aroma while flipping through the pages, thereby eliciting gustatory associations.

3. Conclusion

AR brings innovative possibilities and diversification to the design of interactive books. These possibilities also serve as important conditions for users to gain more experiences. The multisensory experiences of AR interactive books can interact and correlate with each other, enabling users to fully perceive the different sensory experiences brought about by this new reading form. These diverse sensory experiences have silently influenced every reader. By analyzing the formation of these experiences, creators can transform them into narrative innovations in their creations. Excellent narrative works that evoke multiple sensory experiences in users are bound to be favored by the market.

As Yasuhiro Sugihara once said, "The perfect form of a book should possess the function of inducing the reader's visual, tactile, olfactory, auditory, and gustatory senses." Therefore, when creating interactive books, creators not only need to continuously innovate and learn in terms of external forms but also need to consider internal narrative content from the perspective of comprehensive experience.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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