The Perceived and Expected User experiences of AR Book Reading: the Perspective of Parents

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Abstract: Studies regarding augmented reality (AR) books generally indicated its advantages on reading performance. Positive attitude toward the usage of AR books and acceptance of usability with AR books was also responded by users including samples of students and parents. AR books create a new experience of reading; and the further exploration of user experience beyond usability when using AR applications can be considered. The present study hence invited 29 pairs of parents and their children coming from different regions in Taiwan to join a shared AR book reading activity. Each parent was interviewed for understanding their perceived user experiences and expected user experiences of the selected AR book in this study; and the qualitative data was analyzed through phenomenographic method. The results showed that the parents perceived using the AR book in both emotional senses (e.g., joy and surprise) and cognitive senses (e.g., increasing attention). However, some of them perceived negative experiences such as interrupting traditional book reading by AR. Also, AR books are expected to provide parents with rich interaction and vivid animation for experiencing the augmented information. The diverse user experiences of the AR book reading perceived by the parents could be elaborated to further explore their relationships with intention to use and usage behaviors. The characteristics of perceived and expected user experiences responded by the parents found in this study can also be the basis for the practical design of AR books in the future.

Keywords: augmented reality, book reading, user experience, parents, phenomenographic method

1. Introduction

An augmented reality (AR) book, combining conventional paper book and real-time synthetic information for its simultaneous presentation through a screen device, has been considered its advantages on learning recently (Cheng & Tsai, 2014; Ibáñez et al., 2014). In addition to the experiences of paper book reading, AR books offer more virtual information such as 3D objects, video, or audio relevant to the book pages for users to read and thus originate a new reading experience. For the effects of AR books on reading performance, past studies have indicated their benefits (Abas & Zaman, 2011; Vate-U-Lan, 2012). AR book systems could enhance students' motivation to learn (Di Serio et al., 2013). Acceptance of usability (e.g., effectiveness, efficiency, satisfactory) with AR books was also responded by students (Chang et al., 2011). In terms of parents' attitude toward their children's use of AR technology in preschool education, they were inclined to agree with that AR could motivate their children to learn (Cascales et al., 2013). However, these findings only initially investigated the usability issues regarding users' attitude toward AR. Since AR books involve a new experience of reading, the further exploration of user experience beyond usability when using AR applications can be considered (Cheng & Tsai, 2013).

According to ISO, the definition of user experience is "a person's perceptions and responses that result from the use or anticipated use of a product, system or service." The definition may elicit the ideas that while a user's perceptions of "use" of a system stands for the concept of *perceived user experience*, a user's perceptions of "anticipated use" of a system indicates the concept of *expected user experience*. Moreover, researchers mostly agree with the notion that user experience moves beyond

usability toward more emotional concern about the interaction between users and products or systems (Desmet et al., 2007). Nevertheless, user experience involves a consequence of a user's internal state (e.g., motivation or mood), the characteristics of the designed system (e.g., usability or functionality), and the context within which the interaction occurs (Hassenzahl & Tractinsky, 2006). The findings imply that user experience is a broader scope including usability issues that designers are suggested to concern.

With regard to the research on the user experience of AR applications, recently, a study interviewed 28 participants in a shopping mall for exploring the expected user experience of mobile AR services for business purposes (Olsson et al., 2013). They found several characteristics of user experience (e.g., feelings of being connected with other people using the services) and requirements (e.g., requirements of privacy protection in interacting with the services) that affect and facilitate the mobile AR experiences. However, related research on user experience studies with AR applications is still limited, particularly on reading AR books along with parents' perspectives. Based on the two facets of *perceived user experience* and *expected user experience* discussed previously, this study therefore explored parents' experiences when reading an AR book with their children and qualitatively categorized the characteristics of user experience. Specifically, the research questions are as follows:

(1) What is the parents' *perceived user experiences* of the AR book reading?
(2) What is the parents' *expected user experiences* of the AR book reading?

2. Method

The participants in this study included 29 pairs of parents and their children coming from different regions in Taiwan (i.e., 10 pairs from northern region 9 pairs from central region, and 10 pairs from southern region). While the ages of the children are between 4 and 9 (mean=6.48, SD=1.21), the parents are between 24 and 60 years old (mean=37.72, SD=7.79). Most of the parents were familiar with using smartphones or tablet PCs; however, they generally did not experience the demonstration of AR.

An AR picture book with artistic introduction, namely "*The adventures of Yuyu: Yuyu Yang artistic journey (published by National Chiao Tung University Press in Taiwan),*" was utilized as the learning material in this study. In a pair setting, the parents and their children were required to freely share reading with an iPad. A trained research assistant introduced the reading process and the usage of the book before the activity began. When the participants finished the AR book reading, all the parents were interviewed for understanding their *perceived user experiences* and *expected user experiences* of AR book. The guiding interview questions include:

(1) Please describe the feelings when you read the AR book.
(2) What do you experience in the process of the AR book reading?
(3) What do you expect to experience when reading an AR book?
(4) What content of an AR book and the format it present do you expect to see?

The interviews were undertaken in Chinese and audio-recorded, as well as fully transcribed. To reveal the user experiences of the parents in the learning activity, this study conducted a phenomenographic method, which was used to analyze and further categorize students' conceptions of learning in previous studies (e.g., Tsai et al., 2011; Lee et al., 2013), to examine the verbatim transcripts of the parent interviews. Specifically, for each parent's interview transcripts, the researcher firstly marked the most important sentences that could represent their main idea of experiencing the AR book reading. The content-specific consistencies and differences across the interviewed parents' responses were then explored and summarized by comparing the selected sentences. Following previous steps, the qualitatively different categories of the user experiences of AR book reading perceived and expected by the parents can be constructed.

3. Results and discussion

3.1. Perceived user experiences

With an initial attempt to probe parents' user experiences of an AR book reading, the present study conducted phenomenographic analysis and preliminarily found that the parents perceived both positive and negative user experiences. In terms of the positive user experiences, some parents can feel the reality of objects or environments via the AR technology; and they emotionally expressed their joy, amusement and playfulness that arise from a brand-new experience of reading. Feelings about the traditional book reading being surpassed by the experiences of AR book reading, particularly for the 3D elements or virtual information overlapping from the paper book, also surprised them. In addition to these emotional senses, they perceived the advantages of AR technology on reading in a cognitive sense, for example enhancing awareness, memory, and knowledge about the content of the book.

However, some of them perceived negative experiences that reading book with AR technology likely interrupted traditional book reading, as well as operating the AR book alone with problems of usability. Some parents felt an antipathy toward technology use and tended to forbid their children to use electronic devices. In the consideration of this study, the diverse user experiences of the AR book reading perceived by the parents could be elaborated to further explore their relationships with intention to use and usage behaviors.

3.2. Expected user experiences

Regarding the parents' expectations of reading AR books, the present study found that they expected AR books to include more interactive design for users to interact with the virtual elements or information (e.g., tap the screen to control the augmented 3D objects). Also, they expected AR books to include more vivid animation regarding the book story to fulfill the content of the virtual information within the AR book. In other words, AR books are anticipated to provide parents with rich interaction and vivid animation for experiencing the augmented information with their children.

With regard to the help of learning, some parents expected more suitable content of AR books to draw on their children's interests or needs (e.g., interesting topics, life-relevant materials, or abstract knowledge).Also, AR books with value-added materials integrated into the paper books (e.g., a craft of cutting paper for increasing the children's impression of the artistic work) for their children were anticipated by the parents to be developed. Similar to the perceived user experiences found in this study, the parents also expected AR books to foster learning in a cognitive sense. Finally, some of them anticipated to read AR books with more ease of control, and even imagined to experience actual feelings of touching objects. An AR glass (e.g., Google glass) in the developing process may be up to the expectations of portability.

4. Conclusion

In sum, the characteristics of perceived and expected user experiences responded by the parents found in this study can be the basis for the practical design of AR books in the future. With more considerations in parents' user experience, the acceptance of adopting AR books for their children to learn may be increased.

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