IcooBook: When the Picture Book for Children Encounters Aesthetics of Interaction

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ABSTRACT

In this work, we propose a novel PCA(Perception & Cognition & Affection) model from the prospective of aesthetics of interaction. And based on this, we establish a new electronic interactive picture book for children, named IcooBook. First at the level of perception, it provides interfaces of multi-sensory interaction; second at the level of cognition, it builds some immersive interactive scenes; third at the level of affection, it creates some high-level interaction modes based on emotion recognition. In user study, it is proved that IcooBook can help children not only to put much more attention on reading, but also to get better understanding about the context, and furthermore can guide children to appreciate the beauty of deep affective interaction.

CCS CONCEPTS

•Human-centered computing → HCI design and evaluation methods; User centered design; E-book readers; •Hardware → *Design rules;*

KEYWORDS

Aesthetics of interaction; Electronic Picture books; Affection Computing

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1 INTRODUCTION

Picture books are considered beneficial for children in many ways, e.g., to help improve their concentration and memory while reading. However, traditional picture books are limited in paper media and adults' guidance is usually required in daily use, which can not avoid to limit the creativity and emotional expression of children to some extent. Recently, more and more electronic picture books are coming into people's view [2][3], such as mixed-media picture books, touch and feel picture books, game picture books and so on. While these electronic picture books have two major disadvantages: on one hand, their fancy interaction style is generally designed for entertainment instead of improving the attention and understanding on the content of picture books; on the other hand, only the beauty of product's appearance is taken into account in their design, but aesthetics of affective interaction in children's reading process is always ignored [1].

To solve these, we propose a novel PCA(Perception & Cognition & Affection) model from the prospective of aesthetics of interaction. And based on this, we establish a new electronic interactive picture book for children, named IcooBook. In details, our product is designed sequentially according to the following three levels (see Fig.1). First at the level of perception, it provides interfaces of multi-sensory interaction including clicking to animation (vision), clicking to sounds (hearing), finger painting (touch) and so on. Second at the level of cognition, it builds some immersive interactive scenes including "games of linking strokes" in which users can help characters in the picture book to go through obstacles by linking suitable strokes, and "magic brush" in which users can give characters in the picture book some useful things (or food) by graffiti, etc. Third at the level of affection, it creates some high-level interaction modes based on emotion recognition including "reading poetry" in which users read poetry with different emotions (e.g, happy) and then characters in the picture book will get corresponding style of poetry's matching photos (e.g, warm), etc.

Main contributions of this work can be organized as follows. Firstly, we propose a novel model, PCA, that can provide clear guidance not only in the stage of designing products from the prospective of interaction, but also in the stage of user study. Secondly, we establish a new electronic picture book, IcooBook, that can help children not only to put much more attention on reading, but also to get better understanding about the context, and furthermore can guide children to appreciate the beauty of deep affective interaction. Thirdly, we propose a novel supervised multi-path deep neural network framework to achieve a more effective and discriminative emotion inferring.

2 TECHNICAL IMPLEMENTATION

IcooBook builds an immersive interactive environment for reading picture books, in which with reading the main line of the story,

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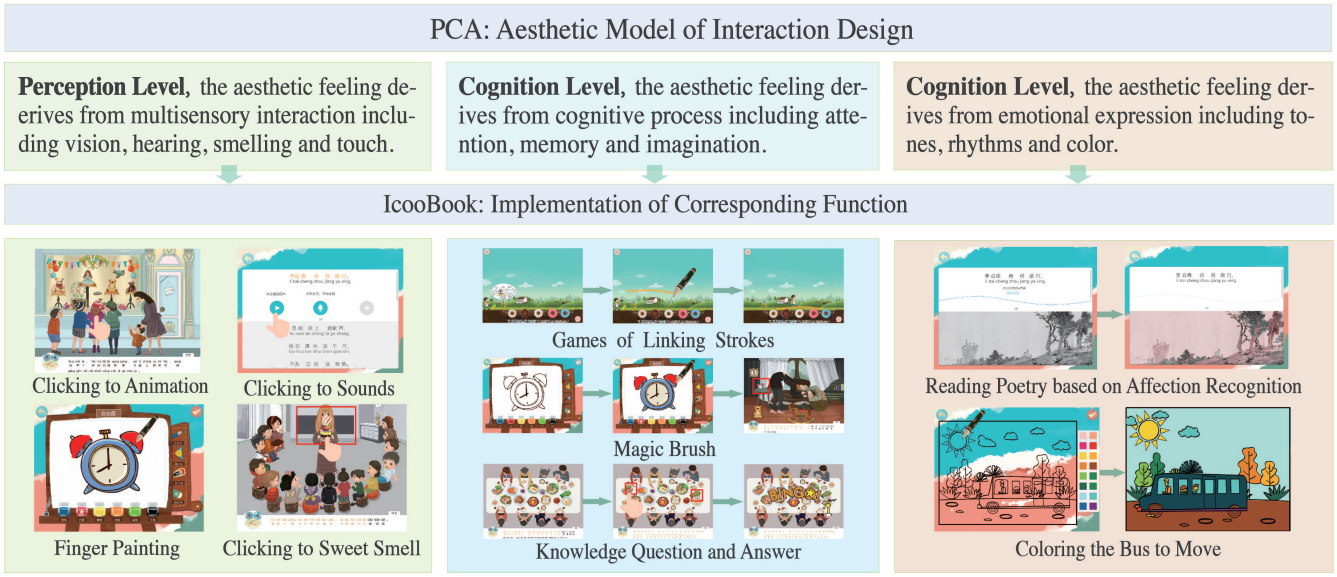

Figure 1: The architecture of PAC model and corresponding implementation of IcooBook

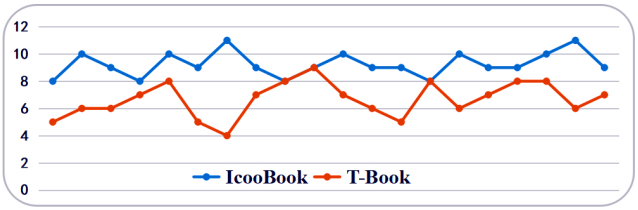

Figure 2: Number of pictures identified correctly.

users can independently create some vice lines to enrich the story. The main plot tells that children study knowledge and get along with each other happily in a kindergarten, which corresponds to story pictures, background music, clicking animation and narration in IcooBook. And on this basis, some other designs of interactive functions in IcooBook (as Fig.1) provides opportunities for users to explore branches of the storyline by themselves. In the following, we elaborate details of three typical functions among them.

Games of Linking Strokes means that users can link suitable strokes according to requirements of the plot, then characters in the story can go through obstacles by these connections. In implementation, we utilize the Unity3D as the engine of the game.

Magic Brush means that children draw relevant objects which heuristic questions point to, then the system transform the static picture to the dynamic real object that can be used by characters in the story. In implementation, the HTML 5 Canvas is used.

Reading Poetry means that children read poetry with the guidance of background voices, then the system conducts real-time affection recognition and matching photos of poetry get different color style according to recognition results. In implementation, we apply a multi-path deep neural network [4] to recognize four different emotions including happiness, sadness, impatience and peace and accuracy of recognition can respectively arrive at 56.8%, 70.4%, 84.7% and 52.1%.

3 USER STUDY

User study was designed from three different prospectives based on PCA model. In experiments, we invited 40 children aged 4-7 and divided them randomly into two groups, each with 20 people. And a traditional picture book in paper (denoted as T-Book) was selected as comparison with IcooBook.

Firstly, in order to verify the effect of our product on attention in reading, two group of children were asked to read T-Book and IcooBook respectively and we observed and recorded their reactions that involved in common expressions and nonverbal movements. And comparative results are show that IcooBook can help readers improve their concentration better.

Secondly, in order to verify the effect of our product on improving understanding and memory, we take the method of "picture re-identification" in which 11 correct pictures were required to be figured out from mixture of 33 wrong pictures after two picture books read respectively. And comparative results are as Fig.2, which proves that IcooBook achieves a very significant improvement on improving understanding and memory.

Lastly, at the level of affective interaction, we designed a questionnaire survey to investigate the degree of pleasure and satisfaction of emotional feedback in reading. It is analyzed that IcooBook is 60% and 80% higher than T-Book respectively.

4 ACKNOWLEDGEMENT

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