Received September 30, 2014; Accepted January 4, 2015

International Journal of Asia Digital Art&Design

Study of Graphic TUI Correlation with Story in Emotive Themed Appbook for Children

Ratri, Dianing
Ewha Womans University
Seoul, South Korea
sanqyurian@yahoo.com

Choi, Yoomi
Ewha Womans University
Seoul, South Korea
yoomi@ewha.ac.kr

Abstract
Children appbook has become one of the education tools aside from literacy media. One of the themes that they offer is emotive theme which is a potential source for emotional coaching learning tool. In our study we analyzed how Touch User Interface (TUI) within graphic element have different function according to its connectivity with the story and how it can provide emotive literature expression during storytelling process. To find out three different functions of graphic TUI based on their connection with the story, this study conducted a review of recent appbook for children with emotive theme with a modification method from De Jong and Bus's theory of multimedia feature where interactive feature can dramatize a story. Six evaluators who are specializing in children literature and mobile application participated in our evaluation with four samples of emotive themed appbooks for children ages 4 to 12 years old. The evaluation sheet was divided into two parts with five coding in each section. The results include review of user's recognition of availability and readability of graphic TUI, it roles in dramatizing a story, and emotion expression carried by graphic TUI inside emotive themed Appbook for children. Based on the result we then summarize how recent appbook with emotive theme implement graphic interactive feature inside their stories and provide suggestion for further development of Appbook's graphic TUI.

Keywords: mobile application, graphic touch user interface, children literature

1 Introduction

Learning about emotion is one of important part in children's developing process. By learning how to deal with their emotion, children can learn to manage their social life including avoid peer rejection, negative contact with teachers, and school interaction failure [1]. While emotional literacy is not an instant quality children are born with, coping with negative emotion especially is a bigger challenge for children compared to handle positive emotion [2]. Therefore it is important for parent to assist them through emotion coaching.

Picturebook is one of alternative tools to learn emotion coaching since it can produce personal response which connects the text to one's own experience either from text to personal experience and vice versa [3]. By providing personal response picturebook can gives children opportunity to express their experience and feeling by discuss their concern and confusion in supportive situation [4]. As its predecessor, appbook is also one of potential tools for education as it can bring immersion by offering interactive experience that mirrors children's natural constructivist learning [5]. However its embedded interaction feature especially the non-related content can turn into distracting factor for young reader from the storytelling process [6].

As previous researches on graphic interaction feature are more focused in either in early learning area and literacy understanding, the objective of this study is to investigate the correlation between graphic TUI feature and story in appbook with emotive themed story. We also investigate on whether graphic TUI inside hotspot button can reveals emotive mood of the story as well as shows the emotion of story's character.

2 Related Studies

2.1 Tools for emotion coaching

Baker mentioned a technique called emotion coaching which help children dealing with destruction emotion. It teaches children how to identify, express and manage their emotions through parent-child interaction [7]. The technique includes focus on parents' awareness and acceptance of child's emotion, and how to provide instruction for children to manage their emotions [8]. As not all children are born with emotional literacy, so did all parents might not be born with the skill of emotion coaching. Parents who were raised in family that value emotional expression are more likely become naturally emotion-coach while those who were not might need tools to improve their emotion coaching skill.

Aside from parental self-help and guidance book for parent, children literature can be a mediation tool for parent-child

conversation as it has simpler language which more understandable for children. Emotive themed literature especially can be an emotional experience's simulation tool by stimulating personal response, which provides a solution for their emotional problem. We also found e-literature in the form of edutainment website with special themes such as divorce and separation. As seen in figure 1, these sites provide information about divorce and teach children how to deal with their emotion through a simulation game. Most of their narrator is a child character who represents children with their personal problem.

Figure 1 Edutainment website with simulation story

2.2 Literature expression inside graphic TUI

According to Reeves and Nass people tend to treat computer and other media as real person, causing unexpected user behavior and respond while interacting with computer and other media [9]. In her initial pilot report, Park reveals that gestures in recent appbooks are not intuitive for young children. However, inline with Reeves and Nass, Park found that the improvement of graphic graphic TUI for simulation of brushing teeth and observing germs (figure 2) inside her appbook's prototype brings more familiarity in interaction between user and story character which resulted in improvement of gesture manipulation and icon usability [10].

Figure. 2 Simulation activity inside graphic TUI activity (Park, 2013)

2.3 Usability Evaluation for Mobile Devices

In order to find the most suitable method for the study we reviewed five different evaluation methods for mobile device usability. The first evaluation methods is Heuristic evaluation [11] which adapted from evaluation sheet for website application and conducted mostly to investigate the function and usability of an application. With ten principles called Heuristic, each coding brings a comprehensive evaluation for interface usability with quicker, cheaper and easier method since it can be performed with minimum three expert evaluators. Similar as Heuristic, Web Content Accessibility Guidelinse (WCAG) 2.0 [12] also evaluates general access in content area. It also specialized for user with disabilities. Both of heuristic and WCAG 2.0 evaluations however have limitation as it only focuses in usability area.

In contrary, the evaluation method suggested by De Jong and Bus focuses in identifying design categories that serve as a macro-framework for evaluation of e-book's construction [13]. Whilst it can identify multimedia's core element for literacy learning and reveals design element that support learning in the e-book, it failed in revealing pedagogical assists tap function, types of knowledge inside appbook's environment, and failed on identifying cognitive demand of the e-book. Similar as them, Clark and Meyer created a tool to identify the knowledge inside graphic and multimedia feature inside e-book [14]. It advances in giving details of knowledge types in graphic and multimedia element also in describing personalization element that motivate attention and pedagogical assist (Table 1).

Table 1 Comparison of Usability Evaluation for Mobile Devices

	Nielsen (1995)	World Wide Web Consortium (2008)	De Jong & Bus (2008)	Clark & Meyer (2008)	Roskos, Brueck, & Widman (2008)
Coding	Checklist set of 10 principles called "Heuristic"	12 Guidelines in principle called POUR (Perceivability, Operability, Understandability, Robustness)	Book processing, Multimedia in picture, Multimedia connected to printed or spoken text, Interactivity of the story, Interactive legibility)	Multimedia, Contiguity, Redundancy, Coherence & Personalization; with addition of graphic types in multimedia design	Investigation of user behavior through action's flow map
Strength	Quick, affordable, easy method for user interface usability evaluation	Accessible for wider user especially user with disability	Identify core elements of multimedia that support literacy	Details on types of graphic knowledge & multimedia elements	Reveals user behavior & act in choosing features
Limitation	Focuses only in usability area	Focuses only in usability area	Unable to reveal pedagogical assist function, knowledge inside environment, & cognitive demand of the book	Limited in interactive design area & how it is being represented in appbook	Limited in locating evidence of knowledge types in design architecture

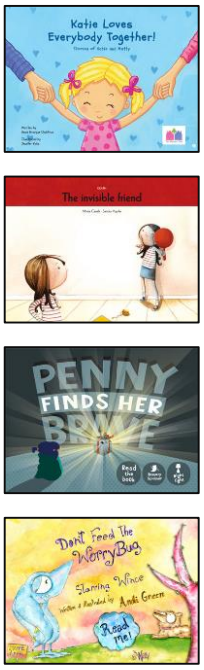
Our review on usability evaluation method shows that most of methods focus more in interactivity usability and its correlation with literacy ability. However "Multimedia in picture" coding from De Jong & Bus' methodology reveals that multimedia in picture can bring not only details but also convey some of text's fragment or even dramatize the whole story scene.

According to their coding which focusing on dynamic visual, De Jong and Bus suggest three ways in how multimedia in pictures can correlate with the story. The first degree is by becoming its details, where multimedia item apply as visual decoration, adding more fun aspect yet without relevancy necessity with the story. The second degree is what they named as fragment, when the multimedia repeats parts of the text in the story. The last degree is when it's not only imitates but also dramatizes and adds deeper meaning to the story. We believe that these codings can help our study in evaluating correlation between graphic TUI inside hotspot and emotive story in Appbook.

3 Method

This study collected existing appbooks as samples to analyze the connection between graphic interaction feature and story in children appbook. The initial samples include eight applications with negative emotion as their theme: fear, separation, and grief. The final number however was reduced to four samples that fulfill the limitation criteria. The stories are "The Invisible Friend" which bring a story of death and grief of family member, "Katie Loves Everybody Together", a story about how a young children dealing with her parents' divorce, "Penny Finds Her Brave" which teach children to overcome their fear with a help of magic tool, and "Wince: Don't Feed the Worry Bug", which follows a story of its hero try to defeat a worry bug by trying to dismiss his own worrisome (figure 3).

All samples are targeting young readers from 1 to eight years old. Most of them are meant to read with parents or teacher guide as some of the themes are sensitive and may lead to misperception. A tutorial and notes for parents are also included in some of the samples as guidelines.



"Katie Loves Everybody Together"
Developer: PicPocket Books/2013
User Target: 1-7 years old
Language: English
Theme: Parent's divorce

"The Invisible Friend"
Developer: Itbook/2012
User Target: 2.5-8 years old
Language: Multilingual
Theme: Grief & Loss

"Penny Found her Brave"
Developer: Mono/2012
User Target: 2 years old and older
Language: English
Theme: Fear

"Wince: Don't Feed the Worry Bug"
Developer: iMagine Machine/2012
User Target: 4 years old and older
Language: English
Theme: Worry

Figure 3 Appbook samples for hotspot's evaluation

All samples were reviewed using a modification of De Jong & Bus' evaluation with focus in hotspot button inside character and background image including its element. Background was chosen as one of the evaluation part as most of the literature expression is included inside appbook's background image [15]. Meanwhile we also focus on character because we believe it has many parts in being a narrative agent as it connects author narration, and readers as a whole [16].

We define hotspot as TUI or gesture button inside graphic elements that provide interactive output such as movement, sounds, and animation. Each part of evaluation sheet have five codings: availability, visibility, and usability of hotspot; hotspot connection with story, which divided into three codings: decorative, fragment, and dramatizing; and emotive expression inside hotspot (table 2).

Tabel 2 Codings for hotspot evaluation inside background and character in appbook for children

Coding		Qualification
Availability, visibility and usability		• Includes sound and visual effect • Visually pleasing with font choice, color, and sizes • Easily recognized by children • Easily executed by children
Correlation with story	Decorative	• Enjoyable and interesting • Gain user's attention • Not necessary related to story
	Fragment	• Represent one or some part of text • Engage children with story
	Dramatizing	• Enrich the story with deeper meaning • Allows children to enhance story comprehension
Emotive Expression		• Its visualization & output stimulate particular mood in the story • Its visualization & output represent character's emotion & characterization

Table 3 Demography of evaluators

Gender / Age	F / 45	M / 42	F / 34	F / 32	F / 27	M / 34
Occupation	Professor	Director	Lecturer	Researcher	Analyst	Illustrator
Field	Web content for education	Animation & education	Mobile app UX/UI	Interactive content for education	Mobile solution content	Children literature & Illustration
Experience	10 years	15 years	7 years	4 years	3 years	7 years

The evaluation was held during April to May 2014 with six experts in mobile application and children literature participated as reviewer. Each of evaluators reviews identical applications with the assumption each of them might find different flaws in each appbook. Each evaluation took roughly two hours and the result collected together along with additional comments and discussion from evaluators (table 3).

4 Results

The result of the evaluation shows that embedded graphic TUIs in recent emotive-themed appbooks are still lack in quality and connection with the story. Most of the samples do not have clear navigation for hotspot's availability, have more unrelated hotspot button compared to story-related one, rely more to "tap" command instead of using variety of other TUI commands as input mode, and pay more attention to graphic TUI inside background element more than inside character.

4.1 Availability, visibility, and usability of graphic TUI in emotive themed appbook

There were three questions asked in background evaluation part whilst five questions asked in character evaluation part to find out the general usability of hotspot button. The questions focus on graphic interaction usability, availability and visibility: whether reader can easily found and operate the hotspot button and whether the function disturbs the storytelling process. Figure 4 shows how in graphic TUI in background area "Wince: Don't Feed the Worry Bug" reaches highest score (66,67) while "Katie Loves Everybody" receives lowest evaluation score 58,33%). Similar result happens for graphic TUI in character where "Katie Loves Everybody Together" receives lowest score (43,33%) while Wince: Don't Feed the Worry Bug" has dominant score (58,33%) compares to the rest of applications.

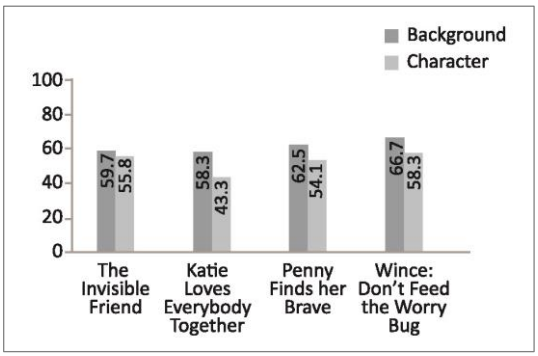


Figure 4 The availability, visibility, and usability of graphic TUI in emotive themed appbook

Based on discussion with evaluators, the problem with most applications lie in the absence of hint for hotspot's availability inside graphic elements including character. In most of the samples users need to tap in random spots to find the hotspot button. From four samples, only "Wince: Don't Feed the Worry Bug" gives direct hint of hotspot button presence in the form of blinking arrow button. However one of evaluator gave remarks on how the arrow icon is not clearly visible (figure 5, picture at the top). The absence of hint can also bring confusion and distraction as it triggers unexpected action while storytelling process is ongoing, for example in "The Invisible Friend" where a hotspot button triggers a zoom-in and zoom-out layout movement in the background (figure 5, picture in the bottom).

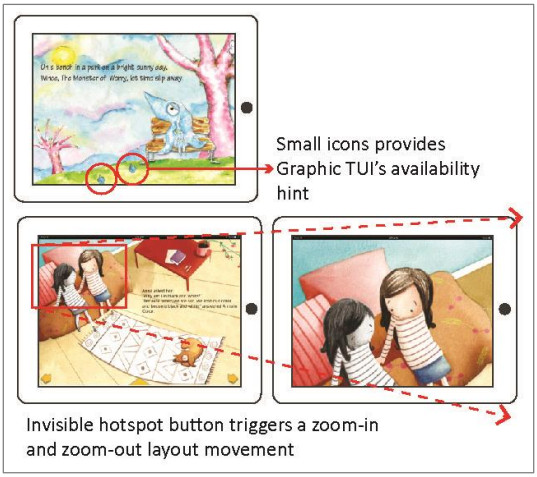


Figure 5 Graphic TUI weakness in samples

4.2 Connection between graphic TUI and story inside emotive themed appbook

Six questions in total were asked for both hotspots inside background and inside characters to determine the relevancy degree between graphic TUI with story inside appbook samples. Each of decorative, fragment, and dramatizing function is represented by two questions. In average hotspots in background are more dominating as decorative tool for story yet has least role in dramatizing or enriching the story (figure 6).

Evaluators gave notes that most of hotspot button in background element gives fun aspect without any correlation to the storytelling process. They also pointed out how in "Katie Loves Everybody Together" the background graphic is composed lots of sound interaction yet do not help reader in understanding the narration.

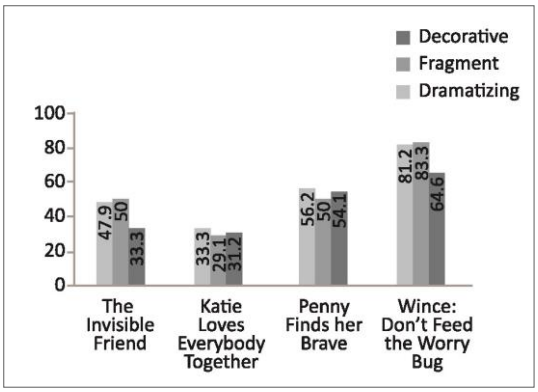


Figure 6 Connection between graphic TUI inside background element with story in emotive themed appbook

Similar as graphic TUI in background area, hotspots inside character are more dominant as decorative aspect and text fragment yet have least role as story dramatizing agent (figure 7).

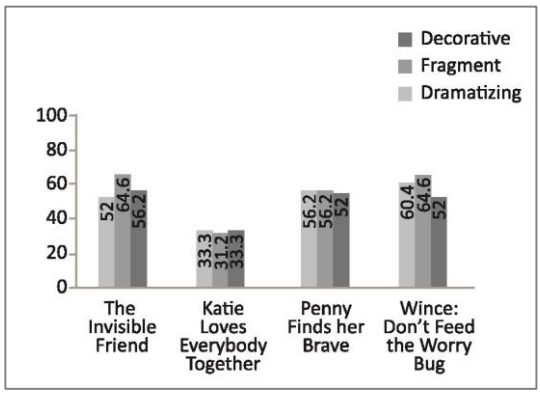


Figure7 Connection between graphic TUI inside character element with story in emotive themed appbook

Moreover, our finding shows how developer seems to give bigger portion to hotspot inside villain and supporting character compared to main character. In "Wince: Don't feed the Worry Bug", the antagonist "Worry Bug" have hotspot button in every pages with both decorative, fragment and dramatizing story function whilst the main character "Wince" has less hotspot with decorative function only. There is also evident in "Katie Loves Everybody Together" whereby main character rarely has hotspot button.

4.3 Emotive expression inside graphic TUI in emotive themed appbook

A total of seven questions were given in this evaluation part to find out if graphic TUI inside hotspot can trigger both story's mood and emotion in the form of sounds, movement, and visual. The questions for background area focused on how the execution of the hotspot stimulates particular moods in relation to the story while questions in character part focused more on how execution of hotspots inside characters brings more understanding in character's characterization and their emotion according to the story. The result shows that aside from "The Invisible Friend" other appbooks have quite visible gap between literature expression in background and character, indicating how developer prefer to embed graphic TUI inside background rather than inside character (figure 8).

Evaluators also revealed that most hotspots use sound as output to create certain moods in background while character build its emotional state using facial expression, gesture and movement. Hotspot's outputs such as short animation of hugging or parent stroking a child's hair are some examples of hotspot that borrow affective expression from emotion coaching.

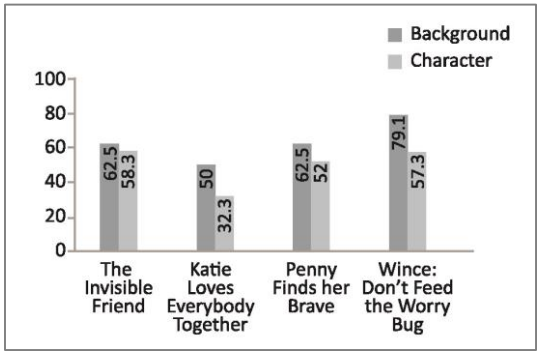


Figure 8 Emotive expressions inside hotspot in emotive themed appbook

Lastly our evaluators found that most of emotive expressions were created as dynamic visual, which does not have interactivity connection power with the user. The hotspots' input command is also limited to "tap-and-see" activity where user act as executor yet does not have direct interaction with the character nor the story, therefore failing to produce personal experience activity. For example in "Penny finds her brave" users can tap Penny's character to see how she reacts when she's afraid, yet there is no function to "help" Penny.

5 Conclusion & Suggestion

In appbook, the quality of graphic TUI has big impact in helping user achieve literacy understanding by dramatizing the story and reaching a user's personal response. From the result of our evaluation, we can conclude that in the availability and usability, appbook with emotive theme is still lack of qualified graphic TUI. Most of the problems lie in the absence of hints for hotspot's availability, which brings confusion and distraction during storytelling process. Our suggestion is to provide more navigation hints to show the existence of graphic TUI features, not only to avoid confusion from unexpected action, but also to help the storytelling process runs smoothly.

As for correlation between graphic TUI and story, we conclude that developers are still focusing on developing decorative and text-repetitive hotspot instead of bringing correlated graphic TUI which can trigger personal response. One of the evaluator gave remark on how there are many unnecessary hotspots appeared yet he could not find any hotspot in several points where he expected. Therefore we would like to suggest for developers to focus more in the quality of graphic interactivity instead of its quantity by creating more story-related hotspot

button inside characters and graphic environment. Exploration of various commands such as double tap, drag, flick, slide, etc might also become help for more direct stimulation of story's content.

Our last founding is that most samples have a bigger percentage of graphic TUI inside background compares to characters in all area. Though background carries more literature expression such as setting, visual items, and text compare to character, details in character's facial expression can fill in the aspect of the story and uncover multiple layers of its characterization development and plot by showing direct imitation of emotive expression. Therefore we would like to suggest paying more attention to graphic TUI inside character, which can dramatize the story and bring users to experience the story along with character.

Moreover, result shows that supporting and villain characters carry more graphic TUI than main character especially in giving affective expression. This shows that most stories like to give direct metaphors of negative emotions through icons or villain character. While young reader can feel the metaphor of their negative emotion through villain character, they might fail in getting personal response from the main character, as it carries almost non-existent experience. Thus future designer need to pay more attention in building intimate relationships between user and the main character. We also believe that by expanding these expressions through graphic TUI will not only increase the interaction between user and storytelling process, but it will also help user understanding the story more and leads user's deeper personal response.

References

[1] Baker, C. R., *Helping Children Tame Negative Emotion,* Deseret News, Retrieved from www.desertnews.com, 2013

[2] Ramsden, S. R., & Hubbard, J. A., *Family expressiveness and parental emotion coaching: Their role in children's emotion regulation and aggression,* Journal of abnormal child psychology, Vol. 30, no 6, spp 657-667, 2002.

[3] Sipe, L. R., *STORYTIME: Young Children's Literary Understanding in the Classroom,* New York: Teachers College Press, 2008.

[4] Robertson, J. P., *Teaching about Worlds of Hurt through Encounter with Literature: Reflections on Pedagogy,* Language Arts.Vol. 74, pp 457-466, 1997.

[5] Cohen, M., Hadley, M., & Frank, M., *Young Children, Apps & iPad,* New York: Michael Cohen Group LLC, pp 5-10, 2011.

[6] Vaala, S. & Takeuchi, L., *Co-reading with Children on iPads: Parents' Perceptions and practice.* The Joan Ganz Cooney Center, pp 1-5, 2012.

[7] Ibid.

[8] Gottman, J. M., Katz, L. F., & Hooven, C., *Parental meta-emotion structure and the emotional life of families: Theoritical models and preliminary analyses.* Journal of Family Psychology, Vol. 19, pp 243-268, 1996.

[9] Reeves, B & Nass, C., *The Media Equation,* California: CSLI Publications, pp 3-15, 1998.

[10] Park, N. Y., *Research for Infant's App-book Behavioral Pattern applied to Multimedia Contents,* pp 64-65, Ewha Womans University, 2013.

[11] Nielsen, J., *10 Usability Heuristics for user Interface Design,* www.nngroup.com/articles/ten-usability-heuristics/

[12] World Wide Web Consortium. *Web content acessibility guidelines (WCAG) 2.0.*, 2008.

[13] De Jong, M. T. & Bus, A. G., *How Well Suited are Electronic Book to Supporting Literacy?,* Journal of Early Childhood Literacy, Vol. 3 no.2, pp 167-164. 2003.

[14] Clark, R. & Mayer, R., *E-Learning and the science of instruction,* San Francisco, CA:Pfieffer, 2008.

[15] Nikolajeva, M & Scott C. *How Picturebooks Work.* London: Garland Publishing, 2001.

[16] Nikolajeva M. *The Rhetoric of Character in Children's Literature.* Oxford: Scarecrow Press, Inc, 2002.