Designing Children’s Interactive Pop-up Books: Creating enhanced experiences through the incorporation of animation principles and interactive design.

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Designing Children’s Interactive Pop-up Books: Creating enhanced experiences through the incorporation of animation principles and interactive design.

by

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ABSTRACT

This thesis, *Designing Children’s Interactive Pop-up Books: Creating enhanced experiences through the incorporation of animation principles and interactive design*, created by Michael Begay, explores how interactive design and computer graphics can be used to create enhanced user experiences in children’s book design. Key factors taken into consideration during the creation of this thesis include children’s book design, typography, storytelling, animation principles, and interactive design principles.

In order to explore the effect computer graphic design has on creating an enhanced user experience in pop-up book design, this project starts with research on writing a compelling, age appropriate story for children between the ages of three and six. After the story is complete, the next step of this project is the creation of a traditional printed pop-up book. This printed pop-up book is then used to inform design decisions around the creation of the interactive pop-up book, such as the types of interactions to use (e.g., pull tabs, drag and drops, and simple clicks) as well as how the pages animate. The interactive pop-up book uses full-screen display and sound to help further create an immersive environment and enhanced reading experience.

After finishing the creation of the traditional printed pop-up book and the interactive pop-up book, both books are tested with a group of participants (consisting of parents, caretakers, older siblings, and teachers) who interact with children between the ages of three and six. The tests contain questions related to the story’s comprehensiveness, the overall aesthetic of the illustration style, ease of use, and format preference—printed versus digital. While the findings from these tests suggest that there is a still a wonderment for watching folder paper come to life in three-dimensional forms, the interactive pop-up book has more potential in creating an enhanced reading experience.

*Keywords: children’s book design, pop-up book design, designing for children, interaction design, flash application design, Actionscript 3, computer graphic design*
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1.1 Problem Statement

This thesis focuses on the creation of an interactive pop-up book for children between the ages of three and six, illustrating how computer graphics can create an enhanced user experience compared to a traditional printed pop-up book.

1.2 Background

Originally, pop-up books were not designed for children. Instead, these movable books contained revolving discs, which were used for teaching anatomy, making predictions, and telling the future. As time passed, movable books grew in popularity, and in the 19th century the first large quantity of truly movable books was published. These books continued to be published until around 1914. With the beginning of World War I, diminishing resources resulted in a significant drop in the production of pop-up books [Montanaro, n.d.].

Pop-up book production remained stagnant until the Great Depression, when many publishers were looking for ways to increase sales. In 1930, Blue Ribbon Publishing in New York discovered a way to bolster sales by using pop-up books to animate Walt Disney characters and other traditional fairy tales. In the following years, the number of publishers producing pop-up books increased [Montanaro, n.d.]. Contemporary pop-up books have become increasingly complex, as found in the work of such artists as Robert Sabuda and David A. Carter.

In particular, Sabuda’s style stood out and inspired me. The precision, creativity, and complexity of his work invoke the feeling of motion out of still images, and I began thinking about alternative ways of animating these pop-ups visually while still staying true to the pop-up book form. This curiosity and my interest in computer graphics and animation lead to the concept of creating an interactive pop-up book that would utilize common printed pop-up book attributes, such as the pull tab, folded elements, and three-dimensionality.
1.3 Case Studies

**The Eco Zoo | ecodazoo.com**

Eco Zoo is a fully interactive flash site that teaches users the importance of energy conservation and sustainability. Featuring five lessons, each with a different main character, the stories are presented in a way that mimics a traditional pop-up book. This is accomplished through the use of Papervision 3D, an open source 3D graphics engine.

**The Bailey’s Lounge (UK)**

Similar to Eco Zoo, The Bailey’s Lounge used Papervision 3D and Flash to create a magazine style pop-up book featuring brand-related lifestyle content, including drink recipes, fashion, and music. This example demonstrated a more realistic design aesthetic through the use of photography. The graphical user interface and navigation of this site is simple, clean, and intuitive, which resulted in a positive user experience.

2. SURVEY OF LITERATURE

*Illustrating Children’s Books: Creating Pictures for Publication*
Author: Martin Salisbury
Publisher: Barron’s Educational Series (2004)

In *Illustrating Children’s Books: Creating Pictures for Publication*, Salisbury provides a short and concise introduction to the field of children’s illustration. Geared toward students, it includes topics such as media, materials, and techniques, along with short chapters on design and typography. This book contains 10 case studies, with one focusing on pop-ups. This book provided a complete introductory survey of children’s books illustration and was helpful for gaining a better understanding of how to design for the target audience.

*Writing with Pictures: How to Write and Illustrate Children’s Books*
Author: Uri Shulevitz
Publisher: Watson-Guptill (1997)

Written by a Caldecott medalist, Shulevitz provides an in-depth look at the theory and practicalities of picture book illustration. This book is divided into four main parts: Telling the Story, Planning the Book, Creating the Pictures, and Preparing for Reproduction. Geared toward professional illustrators and writers, this resource acted as a guide during the story writing and storyboarding processes.
Geared toward novices in the world of pop-up book designs, Barton’s book provides an introduction on the mechanics of creating pop-up books. Complete with step-by-step instructions on how to build basic forms and shapes, it also provides examples for building more complex pop-up interactions from basic shapes. Barton’s book provided insight on the types of pop-up interactions used in the printed book of this project.

The Elements of Pop-Up provides readers with detailed descriptions of the basic elements of pop-up book design. In addition to providing working samples for each description, it also illustrates the necessary math behind making complex pop-up interactions. The Elements of Pop-Up was used as a guide when brainstorming the page design for the printed pop-up book in this thesis.

In this paper, Fisher defines typographic factors that influence reading comprehension in children and explores how typographic variables apply to page layout and the overall book design. Additionally, he provides information on how meaningful decision making can aid in the development of reading skills in children. The data in this thesis helped shape the typographic treatments throughout this project.

In this thesis, Ponce-Rivera creates a children’s book and develops it into an educational Flash application. Since the subject of Ponce-Rivera’s thesis shares a similar foundation to this project, her thesis provided valuable information for what has been done before and provided historical context for this project.
*ActionScript 3.0 Bible*
Authors: Roger Braunstein, Mims H.Wright, Joshua J. Noble  
Publisher: Wiley (2007)

*ActionScript 3.0 Bible* is written as a desk reference for covering ActionScript code. This book is geared toward intermediate to advanced level Flash users and is useful for checking syntax and logic. This book contains many examples and code snippets covering most of the ActionScript classes that are used in this thesis.

*Learning ActionScript 3.0: A Beginner’s Guide*
Author: Rich Shupe, Rosser Zevan  
Publisher: O’Reilly / Adobe Developer Library (2008)

In *Learning ActionScript 3.0: A Beginner’s Guide*, Shupe and Zevan provide an introduction to ActionScript coding. This book is geared toward those who are just learning ActionScript 3.0 and provides some of the basic concepts used in ActionScript, such as conditional statements, functions, variables, and syntax. This book also includes detailed examples for both coding on the timeline as well as breaking things out into separate files. This book was an additional resource during the coding stage of this project.

*Don’t Make Me Think: A Common Sense Approach to Web Usability*
Author: Steve Krug  

In *Don’t Make Me Think*, Krug covers various topics, including User Patterns, Use of Copy, Navigation Design, Page Layout and Usability Testing. This book is geared toward beginner/intermediate web designers. Although this book focuses on web design, the section on setting up and conducting usability testing provided guidance throughout this project.

*The Encyclopedia of Writing and Illustrating Children’s Books*
Author: Desdemona McCannon, Sue Thornton, Yadzia Williams  
Publisher: Running Press (2008)

In *The Encyclopedia of Writing and Illustrating Children’s Books*, the authors provide a practical guide for becoming a successful visual storyteller. This book also provides insight to creating exciting plots and characters that will engage an audience. Geared toward those who are new to writing for children, this book helped determine whether or not the story was appropriate in length and complexity for the target audience.
This case study, presented at the 8th International Conference on Interaction Design and Children, investigates the use of an authoring tool for multimedia storytelling in a class of preschool children. Intended for those interested in using interactive environments as a teaching tool for young children, it provides insight into key concepts behind developing low-tech environments, which helped to determine a strategy for building the interactions in this thesis.
3. PROCESS

3.1 Initial Research

In order to develop age-appropriate content to be used for both the printed pop-up book and the interactive pop-up book, I started by looking at the work of children’s authors and artists, including Eric Carle, Theodor Seuss Geisel (Dr. Seuss), Sandra Boynton, Emma Quay, Anna Walker, and Eric Hill.

While looking at these authors' and artists' works, I paid particular attention to their use of language, illustration style, color, and typography. For example, in terms of language, there is a range in the number of words used to tell the story. In some books, such as *Spot Loves His Friends* (Hill, 2010), the word count per page is minimal, with each page only having a sentence or two comprised with only a few simple words.

In contrast to the short, concise simple sentences in Hill’s work, many of Dr. Seuss’s books feature longer stories made up of poetic verses that are comprised of tongue-twisting phrases. Although Seuss’s style is very distinct and fun to read, I felt that taking a similar approach would be problematic for younger, less experienced readers.

In addition to studying the written aspect of the children’s books, I also paid attention to the illustration style of each authors’ books. Hill’s artwork features simple line drawings with flat, solid color. In contrast, Carle’s artwork has a more painterly effect, with each color being comprised of textures, resulting in a collage aesthetic. Similar to Carle’s artwork, Quay and Walker’s illustrations are painterly, with visible brush strokes and water colors. This painterly / collage style interested me and became a reference point as I started to think about the overall illustration style for both the printed and interactive pop-up book.

3.2 Story Writing

After studying the books of the aforementioned authors, I brainstormed ideas for my story. With my target audience between the ages of three and six, I limited the number of characters to a duck and a bear as a way to keep the story from being too complex. Once the characters were established, I developed a first draft of the story. The animals themselves became a jumping off point for the rest of the story. Namely, the setting taking place in the forest and mountains was based upon the fact that these are realistic habitats of each animal. I also liked the idea of one of the characters embarking on an epic journey and felt that it would be better to have the duck be the one to travel on that journey, since even just walking through a forest could be seen as an epic journey for a small duck. Aside from having one of the characters taking part in an
epic journey, I also wanted the story to have an underlying moral theme, which, over time, developed into the theme of sharing.

In the first draft of *Duck! Here Comes the Bear!*, the duck is introduced as the main character, and he smells something delicious coming from a far-off land. He decides that he must find out where the smell is coming from and sets off on a journey, traveling through the forest, over the hills and up a mountain to where he finds a house. Inside the house, the duck sees a kitchen full of baked goods and decides to knock on the door. The door opens, and the duck is met by a ferocious bear who asks the duck what he is doing at the bear’s doorstep. The duck simply explains that he would like some of the bear’s delicious treats. Instead of inviting the duck inside, the bear opens his mouth and gobbles up the duck. (A complete version of the first draft of *Duck! Here Comes the Bear! is included in the Appendix 6.2)

After meeting with my thesis committee members and conducting a simple focus group test with the first draft, I received feedback, which led to a revised story that maintains the same general premise of the duck embarking on a journey through the forest. However, instead of ending with the bear eating the duck, the frightened duck offers to share his own sandwich, and the bear softens toward the duck and shares a piece of the delicious smelling apple pie. With this change, I felt that the end of the story was not only less gruesome and age-appropriate, but it also developed the moral theme of sharing.

In addition to the revised ending, another important piece of feedback I received was that the story was too long and may have contained grammatical elements that were too complex for the target audience. Specifically, the story relied on the use of contractions and compound sentences. Taking this feedback into account, I reduced the word count and shortened sentences in order to tell the story in the most efficient way possible. I also removed the use of contractions throughout the story, which eliminated the problem of compound sentences. These changes, along with the revised ending, resulted in a story that was not only more succinct and easier to read, but also more emotionally age-appropriate. (The full text of the final version of *Duck! Here Comes The Bear! is available in the Appendix 6.3)

### 3.3 Character Design

Once the content of the story was established, I moved onto the design of the two main characters: the duck and the bear. I started with rough pencil sketches of each character in different poses (Fig. 1). During this initial exercise, I kept the drawings very simple and loose. I was more concerned with trying to capture an expressive, fun feeling with
the sketches, rather than focusing on details or trying to draw anatomically photo-realistic renderings of each animal. Although I knew in the end that all of the drawings would be created in Adobe Illustrator, sketching with pen and paper proved to be an important step towards maintaining a hand-drawn aesthetic that I was interested in after looking at the works of Carle, Quay and Walker.

3.4 Storyboarding

With the rough character designs completed and amid the story writing process, I used storyboards to brainstorm how the visuals and written story would work together. After inserting the first draft of the story, my initial storyboard (Fig. 2) revealed that the length of the story, when compared to the inspirational works I had examined, was not only too long, but it also contained grammatical concepts that were too complex, such as contractions and too many descriptive words.
3.5 Printed Pop-up Book Research and Development

When developing the initial mocks for the printed pop-up book, I started by looking at the work of David A. Carter and Robert Sabuda, two well known pop-up book artists. Both artists’ work helped to shape my decisions when it came to building pop-up book functionality that enhanced the story. Throughout the process, I also referred to The Elements of Pop-Up (Carter and Diaz, 1999) for guidance.

After conducting the initial research, I started with creating simple pop-up interactions illustrated in The Elements of Pop-Up (Carter and Diaz, 1999). By doing this, I learned how to create simple shapes, tabs, and interactions. At this point it was purely experimental, with the focus being more on learning the techniques used in pop-up book design and less about trying to illustrate the story.

This stage of the process also helped determine some of the technical aspects I would later use in the finished copy, including what type of adhesive to use, thickness of paper, and best way to cut out complex shapes. An important discovery during this stage was that 80 lb. card stock paper was optimal for the pop-up book, since it was strong enough to support user interaction, but still pliable enough to fold. I also found it was important to score any intended folds with a bone folder tool before
actually folding the paper. This resulted in clean, crisp lines. In terms of what adhesive was best, I used rubber cement at first, but it took too long to setup when rapid prototyping. Instead, I switched to 3M double-sided tape, which adhered instantly, allowing me to quickly create three-dimensional mocks of the pop-up book pages.

INITIAL POP-UP BOOK PROTOTYPE

After learning the basics of how to create pop-ups and discovering the best materials to use, I started to create a rough draft of the printed pop-up book (Figs. 3–11). At this stage of the process, I built the pages with rough sketches produced with pencil and marker instead of the finished artwork since I was more concerned with working out the mechanics rather than the aesthetic of the art.

FIGURE 3
Initial prototype cover

FIGURE 4
Initial prototype page 2
FIGURE 8
*Initial prototype page 7*

FIGURE 9
*Initial prototype pages 8 & 9*

FIGURE 10
*Initial prototype page 10*
Using the initial hand-drawn pop-up book as a guide, I started to work on a second prototype of the printed pop-up book (Fig. 12–18). I began refining the artwork and story. During this stage I paid close attention to the amount of words per page, the type point size, as well as the cohesiveness of the illustration style used throughout the book.

**FIGURE 11**
Initial prototype page 11

**FIGURE 12**
Second prototype front & back cover
3.6 Printed Pop-up Book Usability Testing

The usability testing for the printed pop-up book focused primarily on the written story and the user interactions with the physical printed book. After creating the story, I felt that it was important to share it with a small group of participants in a focus group setting in order to gain insight into the effectiveness of the story. The main points covered in this initial round of testing included the comprehensibility of the story, word difficulty, story length, and the likelihood of rereading. (A sample of the initial usability test form is available in the Appendix 6.5)

3.7 Printed Pop-up Book Final Prototype and Design

Using the feedback from the usability tests, I revised the printed pop-up book to include the edited story, which allowed for fewer words per page. I also increased the point size of the font from 11.5pt to 16pt making it easier for younger readers to identify the letter-forms in each word.

In addition to increasing the point size of the type, I also added a white border around to all of the artwork used in the pop-up elements of the book. This technique, found in the work of David A. Carter, not only created a more finished look by hiding imperfections in the cutting, but it also reduced the amount of time it took to cut out all of the small pieces, producing a more efficient way to build the book.

The final printed pop-up book (Fig. 19-30) also included revised pages for the duck climbing the mountain, the bear and duck confrontation and resolution, and the story’s ending. The final printed pop-up book specifications are listed below:

**Dimensions:** 7(W) x 8.5 (H) Inches  
**Paper used:** Mohawk VIA Pure White Smooth 80lb Cover  
**Printer used:** Canon 8 Color Inkjet  
**Fonts used:** Whitney Semibold, Whitney Black, 16pt  
**Materials used:** Elmer’s Rubber Cement, X-Acto Knife with #11 Blade, Bone folder, 18 and 24 inch Metal Straight Edge, 3M Double-Sided Tape, Self-healing Cutting Mat
FIGURE 19  
Final prototype cover

FIGURE 20  
Final prototype pages 2 & 3

FIGURE 21  
Final prototype page 4
FIGURE 22
Final prototype page 5

FIGURE 23
Final prototype pages 6 & 7

FIGURE 24
Final prototype page 8
FIGURE 25
Final prototype page 9

FIGURE 26
Final prototype pages 10 & 11

FIGURE 27
Final prototype page 12
FIGURE 28
Final prototype page 13

FIGURE 29
Final prototype pages 14 & 15

FIGURE 30
Final prototype back cover
3.8 Interactive Pop-Up Book Design

The interactive pop-up book was created once the printed pop-up book was completed. In order to create a cohesive design between the two pop-up books, I used much of the same artwork. The illustrations created for each of the pages were designed to match as closely as possible to the interactive version, and both books utilized the same story.

Using the printed pop-up book as a guide, I started building layouts for each of the pages in Adobe Photoshop (Fig. 31). Initially, I intended to build all of the assets in Photoshop, save each asset as transparent Portable Network Graphics (PNG), and import into Adobe Flash. Once everything was imported into Flash, I would then move forward with animating. However, early testing revealed that the Flash Player’s playback limitations resulted in noticeably choppy animations and delays with interactivity. Not wanting to downgrade the quality of the artwork, I brainstormed alternative ways to create the animations.

To remedy the choppy playback issue, I created some of the more complex page animations in Adobe After Effects. This allowed for the animation of high fidelity artwork with effects, such as motion blur and drop shadows, without the choppy playback issues I had experienced in Flash. It also made it easier to create animations that simulated the book opening, pages folding and other pop-up style interactions through the use of the After Effect’s 3D layer tools.

While working in After Effects I created intro animations (Fig. 32) for each of the pages. During these animations, the different elements that made up the layout (e.g. trees, shrubs, mountains, the duck and the bear) would unfold, slide in from the top and bottom, simulating a page building itself.
Furthermore, although the animations were not a direct replica of how the printed pop-up book functioned, they did provide a sense of movement, the sliding and unfolding of elements, that evoked the feeling of the printed pop-up book. After all of the page intro animations were complete, I exported each composition as a separate Small Web Format (SWF) movie.

During the animation process, I also started to work on the Graphical User Interface (GUI) design. First, I started by building a basic project requirement document containing simple wireframes and a list of user features (Fig. 33 & 34). This initial list of features included a simple navigation, pagination, a help section, sound controls, and the ability to exit the application. These wireframes were create in Adobe Photoshop, using simple vector lines and shapes.
Once the initial wireframes were established, I created high fidelity mocks of four different layouts featuring different options for the branding, pagination, text placement, and navigation. Option one (Fig. 35) featured the title in the top left corner, navigation in the top center, and the utility controls (sound, help, close) in the top right. The story’s text was located under the main image. In option two (Fig. 36), the layout was the same as option one, with the addition of previous and next arrows to the left and right of the main image. Option three (Fig. 37) switched the title of the story and the navigation from the top of the screen to the bottom. The story text was moved to the top right and it also featured an alternative design treatment for the previous and next buttons. The fourth option (Fig. 38) kept the navigation at the bottom of the screen, but pushed it further down, making room for the story text directly above it. It also featured a different design treatment of the story title, which was placed inside of a banner that overlapped the main image. These four mocks, were then used in the first round of usability testing, which is described in greater detail in section 3.8.
FIGURE 36
High fidelity mock, option 2

FIGURE 37
High fidelity mock, option 3

FIGURE 38
High fidelity mock, option 4
After receiving feedback from the first round of user testing on the proposed mocks, I began building the interactive pop-up book’s page layout in Flash. Since I had decided to build some of the more complex animations in After Effects, I felt the best way to build and maintain this interactive pop-up book was to create all of the pages as separate SWFs and then import each page (SWF) into a shell file (Fig. 39) that contained all of the constant page elements, which included the help button and modal window, the sound controls, exit application button, story text and the navigation. By separating the content from the code, I was able to create a modular system that resulted in an efficient way to update and edit individual pages.

In addition to using the timeline for animating the text movements, character movements, and tab interactions, I also used the open source animation class Tweener to create some of the GUI animations. For example, the smooth fade in and out transitions on the numerical navigation buttons, the next and previous arrows, and the help window were all controlled using Tweener, a custom class under the MIT License and part of the Open Source Initiative (https://code.google.com/p/tweener/). Using Tweener resulted in an easier and quicker way to fine-tune and update the animations. It also helped maintain a cleaner and more efficient timeline.

To help enhance the user experience of the interactive pop-up book, I included sound, in addition to the written text, to tell the story. The narration was recorded using an USB microphone and Apple Soundtrack Pro. Initially, I recorded test tracks in a fairly large room. When I played the tracks in the Soundtrack Pro, there was too much white noise and the quality of the sound was lacking. To help remedy this, I conducted my next recording in a much smaller room and used moving blankets to dampen the sound. This resulted in an overall improvement in the sound quality.
Once the sound was recorded, I edited it so that each track contained the narration for each individual page. For the pages that had more than one interactive animation tied to copy for that page, I broke the narration down even further into one track per phrase. The audio files were exported as MPEG-3 audio files with a bit rate of 320kbps. Afterwards, I streamed the audio files into the interactive pop-up book using the Sound Class in ActionScript 3.

With the interactive pop-up book in the final stages of completion, I started to think about how I would publish the final project. Initially, I considered deploying the final interactive pop-up book as a web-based streaming experience, but had concerns over the file size and loading times as it related to the users’ available bandwidth. I decided that the best way to avoid the file size issue was to publish the final interactive pop-up book as projector file, so that it would act as a stand alone application. From the export as projector options, I selected .app and .exe file formats to ensure compatibility with both Mac and PC operating systems.

3.9 Interactive Pop-Up Book Usability Testing

Usability testing for the interactive pop-up book was conducted in two phases. For both phases, participants completed a survey that rated each usability factor by assigning a value based on five Likert items. In addition to choosing the desired item, participants were encouraged to provided written feedback to justify their decisions. The first phase focused on testing the following aspects of the application: ease of navigation, overall readability and legibility of the story, smoothness of playback, and ease of use of the interactive elements. The second phase of testing focused on the open and closing the application, the incorporation of the sound and the using an updated navigation. Test stations were setup with the interactive pop-up book already opened to the first page, and the participants filled out their forms while interacting with the flash application. There was no time limit during either the phase of testing.

3.10 Final Interactive Pop-Up Book

The final interactive pop-up book (Fig. 40-51) was created as a download-able Flash application featuring animations and interactions influenced by the printed pop-up book, with additional features, such as the incorporation of sound, with the purpose of creating an enhanced user experience. The final interactive pop-up book specifications are listed below:

**Dimensions:** 1280x854 pixels  
**FPS:** 30  
**Fonts used:** MetaPlus Bold – 30pt, MetaPlus Black – 40pt
**Code language:** ActionScript 3

**External Actionscript Classes:** Tweener

**Audio used:** MPEG-3, 320kbps, Stereo

**Project Download Link:**

**Software used:** Adobe Photoshop, Adobe Flash, Adobe After Effects, Adobe Illustrator, Apple Soundtrack Pro, Logitech USB Microphone, Canon LiDe 30 Scanner

(Final Pop-up Book Prototype)

(The complete source code of this application is included in the Appendix 6.4)
FIGURE 42  
Screenshot of final interactive pop-up book page 2

FIGURE 43  
Screenshot of final interactive pop-up book page 3

FIGURE 44  
Screenshot of final interactive pop-up book page 4
FIGURE 45
Screenshot of final interactive pop-up book page 5

FIGURE 46
Screenshot of final interactive pop-up book page 6

FIGURE 47
Screenshot of final interactive pop-up book page 7
FIGURE 48
Screenshot of final interactive pop-up book page 8

FIGURE 49
Screenshot of final interactive pop-up book page 9

FIGURE 50
Screenshot of final interactive pop-up book page 50
FIGURE 51
Screenshot of final interactive pop-up book help screen
4. SUMMARY

Collected throughout the project, user feedback was an integral part of the creative process for both the printed and interactive pop-up books. The first instance of user feedback was gathered at the completion of the story. Findings related to this feedback revealed that the story was too long and contained complex descriptions and contractions. With this new data, I revisited the story and began cutting words and reducing the need for commas to create a shorter story with simple sentences. It was also during this test that the story’s content was discussed. I found that having the bear eat the duck in the first story was too gruesome for an ending and didn’t resolve the story in a way that was appropriate for the intended audience. Results from this first test led to rewriting the ending of the story to be about sharing and compromising.

The second usability testing of the printed pop-up book focused on the design and pop-up interactions of the second prototype. For this test, six participants were given the printed prototype and asked to read the story from cover to cover and provide feedback in the following areas: ease of use as it related to the pop-up interactions, legibility of the font, overall impression of the illustration style, cohesiveness of the story, and to rank their favorite page. The feedback gathered from this round of testing resulted in another important design revision—an increase in the point size of the type.

In addition to gathering feedback on the story and design of the printed pop-up book, I also conducted usability testing for the interactive pop-up book. In the first round of testing, four participants were asked to launch the book application and go through each page of the story. While reading the interactive pop-up book, participants were asked to provide feedback on the animation playback smoothness, the intuitiveness of the navigation, the ease of use of the help screen, and story comprehension. One major issue discovered from this round of testing was that participants found it unclear when to click to the next page, as well as what page number they were on in the story. As a result of this feedback, I added distinct yellow arrows and next buttons to the end of each sentence. I also added a current page indicator by changing the opacity of the number boxes in the bottom navigation based on the user’s current page.

With the updated navigation and additional yellow next buttons added to the interactive pop-up book, I conducted a second round of usability testing that focused on opening and closing the application, ease of use as it related to the interactive elements and navigation, and the implementation of sound.
By conducting usability testing throughout the creative process of the printed pop-up book and interactive pop-up book, I found that it helped produce constructive feedback, which helped to inform the content of the written story, the overall design of the book as it pertained to type size, color, illustration style, and the overall use of pop-up book interactions in both the printed and digital formats.
5. CONCLUSION

With the completion of this thesis, I learned that elements of computer graphics design, more specifically interactive design, graphical user interface design, principles of animation, and sound, can help to enhance the overall experience of the pop-up book.

Additionally, I discovered differences and similarities between children’s book design for print and digital. For example, when designing in print there are different considerations including the artwork resolution, the tactile feel of the paper, the printed text size, and the overall size of the book. Some similarities in the design of both the printed and digital books included the need for bright, compelling artwork in order to best appeal to children, large type with simple letter forms for optimal readability and legibility, and the use of intuitive interactions—the use of page folds and tabs in the printed books and tabbed buttons and arrows in the digital book.

By using animation principles such as easing, staging, and secondary action, it was possible to recreate the sense of motion and interaction of a traditional printed pop-up book without creating an exact digital replica. The interactive pop-up book also provided additional opportunities for character expression through animation. Characters could walk across the page, shake with anger, or tremble with fear. All of these small actions help to add excitement and make the written story come to life.

For me, this thesis helped to reinforce the importance of using non-digital influences to develop a sense of historical context for digital design. Researching and creating a more traditional printed pop-up book, proved to be a very important step in the process of building the interactive pop-up book. It influenced the design of the pages, as well as how to build the interactions and animations on each page.
6. APPENDIX

6.1 Original Thesis Proposal
Thesis Proposal for the Master of Fine Arts Degree
Rochester Institute of Technology
College of Imaging Arts and Sciences
School of Design
Computer Graphics Design

Title: Designing Children’s Interactive Pop-up Books: Creating enhanced experiences through the incorporation of animation principles and gestural navigation.

Submitted by: Michael Begay
Date: November 11, 2009

Thesis Committee Approval:

Chief Adviser: Assistant Professor Dan DeLuna, Computer Graphics Design

__________________________________________  ________________________
Signature of Chief Adviser                  Date

Associate Adviser: Associate Professor Chris Jackson, Computer Graphics Design

__________________________________________  ________________________
Signature of Associate Adviser               Date

Associate Adviser: Professor Marla Schweppe, Computer Graphics Design

__________________________________________  ________________________
Signature of Associate Adviser               Date

School of Design Chairperson Approval:

Chairperson, School of Design: Patti Lachance

__________________________________________  ________________________
Signature of Chairperson                    Date
Problem Statement

This thesis will focus on creating an interactive pop-up book to illustrate how the incorporation of animation principles and graphical user interfaces can be used to create an enhanced user experience compared to that of a traditional printed pop-up book. This thesis will utilize the principles of animation and graphical user interfaces to demonstrate how these design components allow for alternative ways of storytelling that are not possible with traditional printed pop-up books.

Background

Originally, pop-up books were not designed for children. Instead these moveable books contained revolving discs and were used for teaching anatomy, making predictions, and telling the future. As time past moveable books became more and more popular and in the 19th century the first large quantity of true moveable books were published. These books continued to be published up until around 1914. Once World War I started, there were strains on resources and the amount of published pop-up books dropped significantly. This remained constant up until the Great Depression.

During the Great Depression, many book publisher were looking for ways to increase sales. In 1930, Blue Ribbon Publishing in New York found a way to do this by using pop-up books to animate Walt Disney characters and other traditional fairy tales. In the following years the amount of publishers producing pop-up books increased. Currently, pop-up books have become more and more complex, including Robert Sabuda’s Alice’s Adventures in Wonderland: A Pop-Up Adaptation.

After looking at Robert Sabuda’s Alice’s Adventures in Wonderland: A Pop-up Adaptation, I was inspired by the precision, creativity and complexity of the pop-ups and immediately began thinking about how Sabuda’s pages suggest motion even when looking at still images. I also began thinking about alternative ways of animating these pop-ups visually, while still staying true to the pop-up book form. This general curiosity and my interest in computer graphics, more specifically animation, lead to the concept of creating a interactive pop-up book that would incorporate animation principles and graphical user interfaces to provide readers with an enhanced user experience.

Scope

The components of this thesis include a 6-8 page written story about the importance of sharing geared towards children between the ages of 7 and 10, a interactive pop-up book desktop application consisting of 6-8 pages, and a physical printed pop-up book to be used for comparison studies.
The story revolves around two main characters – a bear and a goose. The bear is baking a pie and places the pie to cool on his window sill. As the pie is cooling, a goose walks by the bear’s house. The goose smells the delicious pie, and decides to stop to ask the bear if he would share the pie with her. The bear answers the door angrily and tells the goose that the pie is only for him and that he will eat the whole thing. The goose leaves disappointed. The bear, worried that others might ask for a piece of his pie or worse steal the pie, decides to quickly eat the whole pie. The bear then develops a very unpleasant stomach up and learns that it would have been better to share the pie, then to get sick.

Key concepts that will be taken into consideration during this study include: designing for children, usability and graphic user interface design, and the principles of animation

Survey of Literature

DESIGN

Paper Engineering for Pop-Up Books and Cards
Author: Mark Hiner
Publisher: Tarquin (1986)

In this book, the author provides a solid introduction to creating pop-up books. Geared towards beginners, this book provides examples, detailed instructions, and explains some of the mechanics used to enable objects to pop out. This book will be a valuable resource for me when I am creating the physical pop-up book component for this project.

Up-Pops: Paper Engineering with Elastic Bands
Author: Mark Hiner
Publisher: Tarquin (1993)

In Up-Pops: Paper Engineering with Elastic Bands, the author introduces the use of elastic bands to create to different interactions. This book contains examples showcasing 10 basic paper engineering mechanisms that fold flat, but when eased out of their slots, the folds suddenly pop-up creating three-dimensional shapes. This book acts as a guide for a possible way to recreate easing in the physical book.

Illustrating Children’s Books: Creating Pictures for Publication
Author: Martin Salisbury
Publisher: Barron’s Educational Series (2004)

In this book, the author provides a short and concise introduction to the field of children’s illustration. This book is geared towards students and includes topics such as media, materials, and techniques, along with short chapters on design and typography. This book contains 10
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case studies, with one focusing on pop-ups. This book provides a complete introductory survey of children’s books illustration and will be helpful for gaining a better understanding on how to design for the target audience.

Writing with Pictures: How to Write and Illustrate Children’s Books
Author: Uri Shulevitz
Publisher: Watson-Guptill (1997)

Written by a Caldecott medalist, author Shulevitz provides the reader with an in-depth look at the theory and practicalities of picture book illustration. This book is broken down into 4 main parts: Telling the Story, Planning the Book, Creating the Pictures, and Preparing for Reproduction. Writing with Pictures: How to Write and Illustrate Children’s Books is geared towards professional illustrations and writers, and will be a helpful reference for when I am finalizing the story and starting to plan out the visual storyboard.

Design for Children: Marketing Design that Speaks to Kids
Author: Catharine Fishel
Publisher: Rockport Publishers (2001)

In this book, author Fishel provides readers with an overview of strategies used when designing for children. Geared towards people with an interest in marketing for children, this book contains samples of existing products and breaks down many key components that make these products successful. Although it fails to discuss theory, this book will be useful for developing an appropriate style for the interactive pop-up book.

Typographic Decision-making: Children’s Book Design
Author: Christina Fisher
Publisher: RIT (2007)

In this paper, Fisher defines typographic factors that influence reading comprehension in children. Fisher also explores how these typographic variables apply to page layout and the overall book design. Additional information is presented on how meaningful decision-making can aid in the development of reading skills in children. The data in this thesis will help shape the typographic treatments throughout this project.

Writing, Illustrating and Designing a Printed and an Interactive Book for Children
Author: Sara Ponce-Rivera
Publisher: RIT (2006)

In this thesis, Ponce-Rivera creates a children’s book and develops it into an educational Flash application. Since the subject of Ponce-Rivera’s thesis shares a similar foundation to what I am proposing, her thesis provides valuable information for what has been done before and will help me to make sure that I do not repeat previous efforts and try to keeping pushing my design.
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Ponce-Rivera’s interactive book is targeted to children between the ages of 7 and 10.

TECHNOLOGY

**Actionscript 3.0 Bible**  
Authors: Roger Braunstein, Mims H.Wright, Joshua J. Noble  
Publisher: Wiley (2007)

*Actionscript 3.0 Bible* is written as a desk reference for covering actionscript code. This book is geared more towards the intermediate to advanced level Flash user and is useful for checking syntax and logic. This book contains many examples, and code snippets covering most of the anticipated classes that I will be using for this project. *Actionscript 3.0 Bible* will be a useful reference for creating the interactive application in Flash.

**Learning Actionscript 3.0: A Beginner’s Guide**  
Author: Rich Shupe, Rosser Zevan  
Publisher: O’Reilly / Adobe Developer Library (2008)

In *Learning Actionscript 3.0: A Beginner’s Guide*, authors Shupe and Zevan provide readers with an introduction to actionscript coding. This book is geared to those who are just starting out in actionscript 3.0 and provides some of the basic concepts used in actionscript, such as conditional statements, functions, variables, and syntax. This book also includes detailed examples for both coding on the timeline as well as breaking things out into separate files. This book will be a helpful resource during the coding stage of this project.

**Don’t Make Me Think: A Common Sense Approach to Web Usability**  
Author: Steve Krug  

In *Don’t Make Me Think*, Krug covers topics including: User Patterns, Use of Copy, Navigation Design, Page Layout and Usability Testing. This book is geared towards beginner/intermediate web designers. Although this book focuses on web design, I will reference the section covering setting up and conducting usability testing throughout this project.

**Create 3D elements in Flash**  
Author: Tom Baker  
URL: [http://www.computerarts.co.uk/tutorials/new_media/create_3d_elements_in_flash](http://www.computerarts.co.uk/tutorials/new_media/create_3d_elements_in_flash)  
Date Accessed: November 10, 2009

In this tutorial, award-winning UK based animator Tom Baker provides an introduction to the new 3D engine that is packaged with Flash CS4. Baker describes tips and techniques that allow for integration of 3D objects with 2D objects. This tutorial is geared towards intermediate Flash designers and developers who are already familiar with working in the Flash environment. This
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tutorial is helpful for gaining additional ideas of how to create engaging interactions.

CONTENT

The Encyclopedia of Writing and Illustrating Children’s Books
Author: Desdemona McCannon, Sue Thornton, Yadzia Williams
Publisher: Running Press (2008)

In The Encyclopedia of Writing and Illustrating Children’s Books, the authors provide a practical guide for becoming a successful visual storyteller. This book also provides insight to creating exciting plots and characters that will engage an audience. Geared towards those who are new to writing for children, this book will help to determine whether or not the story is appropriate in length and complexity for the intended target audience.

Interactive Storytelling in Pre-School
Authors: Nicoletta Di Blas, Bianca Borett
Publisher: ACM (June 2009)

“Interactive Storytelling in Pre-School”, is a case study presented at the 8th International Conference on Interaction Design and Children that investigates the use of an authoring tool for multimedia storytelling in class of pre-school children. This case study is intended for those interested using interactive environments as a teaching tool for young children. This case study provides insight into key concepts behind developing low-tech environments, which will help to determine a strategy for building the interactions in this thesis.

Hand on what? Comparing Children’s Mouse-based and Tangible-Based Interaction
Authors: Alissa N. Antle, Milena Droumeva, Daniel Ha
Publisher: ACM (2009)

This case study investigates the similarities and differences in performance and behaviors between how children manipulate objects using mouse-based input versus tangible based input. For this case study, a test group of 132 children are given a task to complete a jigsaw puzzle using both mouse-based input and tangible-based input. This case study also examines some of the pros and cons of using these inputs and interactive styles. This case study provides valuable information that can be used to help determine which interactive methods and inputs are appropriate.

Designing Mobile Interfaces and Interactions for Children using Cooperative Inquiry
Authors: Jerry Alan Fails, Allison Druin, Mona Leigh Guha
Publisher: ACM (2009)

In this paper, the authors explore the advantages to creating and designing interactions and
mobile interfaces using cooperative inquiry. The authors argue that the most efficient and best way to design interactions for a specific target audience is to allow the target audience to participate in the design process. Although this paper is primarily geared towards those interested in design mobile interfaces, it also brings up some interesting concepts for receiving feedback from a younger audience. These concepts will help to determine if the characters in the pop-up book will appeal to the target audience.

Methodology

DESIGN
The design components of this thesis include the use of color and typography in relation to designing for children.

SUBJECTS/PARTICIPANTS
Children between the ages of 7 and 10 will be the primary participants. I will work with local schools, libraries and the community members to set up small testing groups for usability and feedback testing throughout the project. Each testing group will consist of 3-5 children and will be conducted in an open forum format. I will ask questions verbally, which will be age group appropriate, and create a written record of all answers and/or feedback offered by the participants.

COMPUTER GRAPHICS
The specific aspect of computer graphics included in this thesis are graphical user interface design and the principles of animation.

PROCEDURE
As a starting point for this thesis, I will begin researching book design – more specifically designing books for children. After gathering information on book design, I will then research information about creating pop-up books in order to understand how pop-up books work. The pop-up book research will focus not only the physical construction of a pop-up book, but it will also focus on key concepts behind making a successful pop-up book.

While researching how to make a physical pop-up book, I will begin to create characters and write the story. I anticipate creating 3 sets of character designs and testing each one with the target audience for feedback, before committing to a final set of characters. This stage of the project will also help determine the final visual style for the entire book and website.

After completing the story, I will start to create a physical mock up of the pop-up book. By creating a physical pop-up book, I will then be able to use this book as a reference when I am creating the interactive pop-up book, as well as using the physical pop-up book in comparison studies with participants to gather data on topics such as preferences, ease of use, workmanship, etc.
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Once the physical pop-up book is completed, I will begin to create the interactive pop-up book. The interactive pop-up book will be an application in flash, so this stage will also focus heavily on researching and writing code, as well creating a beta prototype. The prototype will include supporting animations, page interactions, graphical user interface and the story. Once the prototype is completed, I will setup a user test session that focus on the graphical user interface. At this point, I will be checking to see if the interactive pop-up book navigates like a physical pop-up book, if there are any issues with identifying what is clickable or not, and if the interactions match expected results.

Once the prototype has been tested, I will begin working towards creating the final interactive pop-up book. I will start by taking all of the final content for the book and making sure that all of the files have been optimized and are in the correct file formats. I will also begin to create a second, final version of the physical pop-up book to used in conjunction with testing the final interactive pop-up book.

After testing the final pop-up books, I will then focus on debugging. Although debugging will be ongoing from creating the prototype to this point, this stage will focus on resolving any issues brought up during the testing sessions. During this stage, I will also conduct additional tests when necessary that will be determined by how drastic the change impacts the story, interactions, or interface.

With the final interactive pop-up book complete, I will create a simple, standards compliant 3-page website. This website will include a home page that showcases and describes what the interactive pop-up book application is, a download page where users can download the application at no charge, and a credits/contact page. This website will be created as an additional way for marketing this project. At the end of this stage, this project will be ready to show.

TECHNOLOGY REQUIREMENTS

Software:
- Adobe Photoshop
- Adobe Illustrator
- Adobe Flash
- Adobe Dreamweaver
- Adobe After Effects
- Apple Soundtrack Pro

Hardware:
- Apple Intel Based Mac w/ OS 10.4 or higher
- Windows PC w/ XP or Vista
- Wacom Intuos 3
- Broadband Internet Connection

Sketches/Examples
Research Implications
This thesis’s potential ability to provide children with alternative ways of interacting with narratives and storytelling concepts in an electronic format has the potential to not only provide entertainment, but also has the potential to promote reading literacy. By producing this product in an electronic format, I will be able to take advantage of distributing the final product online, which allows for a cost effective way for reaching a large audience.

However, producing the final product in an electronic format can also be viewed as a limitation. Especially when taking into consideration that the physical interactions in traditional printed pop-up books have the ability to play a significant role in creating a unique, positive user experience. Another possible limitation to this project is the online distribution. Since this is designed to be a desktop application, file sizes are going to be larger than if the end target was for web deployment, making a user’s internet connection an important factor to whether or not the final product is accessible.

Budget

<table>
<thead>
<tr>
<th>BUDGET</th>
<th>TOTAL</th>
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<tbody>
<tr>
<td>Physical Pop-Up Book</td>
<td>Materials*, Books, Printing</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Interactive Pop-up Book</td>
<td>Books, Images, Audio</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Marketing &amp; Promotion</td>
<td>Web Url, Competition Entry Fees**</td>
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* Paper, rulers, xacto blades, glue, (materials for the physical construction, etc.)
** Based on 2010 entry fees for the Communication Arts Interactive Competition & HOW Interactive Competition.
pc, as well as some additional information about how to use the application, and a credits/contact page. In addition to self-promoting this interactive pop-up book on a website, I plan to submit this project to the HOW Magazine Interactive Design Competition, and the Communication Arts Interactive Annual.

TARGET AUDIENCE
• Males and Females
• Ages 7-10
• Educational Level: Elementary
• Experience with Thesis Subject Matter: New to Moderate

PERSONAS

Katie
Katie is a 7 year old only child who likes animals. She is used to getting a lot of attention and always gets her way. She likes to color and her favorite food is peanut butter cookies. Katie does not like to read, and would rather spend time playing games.

Tom
Tom is a 8 year old middle child who enjoys playing outside. He has one older brother and a younger sister. He receives the least amount of attention from his parents, and is considered to show signs of self reliance. Tom dislikes pastel colors, and vegetables.
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Timeline

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<tr>
<th>MILESTONES</th>
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<tr>
<td>___ Proposal Accepted</td>
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<tr>
<td>___ Web Site Started</td>
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<tr>
<td>___ Story Finished</td>
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<tr>
<td>___ 1st Committee Meeting</td>
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<tr>
<td>___ Storyboards Done</td>
</tr>
<tr>
<td>___ User Feedback/Testing</td>
</tr>
<tr>
<td>___ 2nd Committee Meeting</td>
</tr>
<tr>
<td>___ Physical Pop-up Book Done</td>
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<tr>
<td>___ 3rd Committee Meeting</td>
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<tr>
<td>___ Interactive Prototype Done</td>
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<tr>
<td>___ User Testing</td>
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<tr>
<td>___ Begin Final Application</td>
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<tr>
<td>___ 4th Committee Meeting</td>
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<tr>
<td>___ Pass Thesis Defense</td>
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<tr>
<td>___ Complete Final Application</td>
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<tr>
<td>___ Complete Website</td>
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<tr>
<td>___ Thesis Report Online</td>
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<tr>
<td>___ Final Committee Meeting</td>
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<tr>
<td>___ Thesis Show</td>
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<td>___ Graduation</td>
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<tr>
<td>11 - Thesis Proposal Defense</td>
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<td>18 - Thesis Accepted</td>
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<td>30 - Website Started</td>
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<th>DECEMBER - 2009</th>
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<tbody>
<tr>
<td>4 - Story Finished / Start Storyboards</td>
</tr>
<tr>
<td>9 - 1st Committee Meeting</td>
</tr>
<tr>
<td>11 - Storyboards Done</td>
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<tr>
<td>14 - 20 User Feedback / Testing</td>
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<tbody>
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<td>12 - 2nd Committee Meeting / Start Interactive Prototype</td>
</tr>
<tr>
<td>18- Physical Pop-up Book Done</td>
</tr>
<tr>
<td>20 - 3rd Committee Meeting</td>
</tr>
<tr>
<td>14 - 20 User Feedback / Testing</td>
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<tbody>
<tr>
<td>8 - Interactive Prototype Done</td>
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<tr>
<td>15 - 20 - User Testing</td>
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<tr>
<td>28 - Makes Changes Based on Feedback</td>
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<th>MARCH - 2010</th>
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<tbody>
<tr>
<td>3 - 4th Committee Meeting</td>
</tr>
<tr>
<td>8 - 19 - User Testing / Debugging</td>
</tr>
<tr>
<td>31 - Start Final Application</td>
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<th>APRIL - 2010</th>
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<tbody>
<tr>
<td>1 - 30 - Continue Working on Final Application</td>
</tr>
<tr>
<td>31 - Prepare for Thesis Defense</td>
</tr>
<tr>
<td>31 - Committee Meeting</td>
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</tbody>
</table>
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MAY - 2010
1 - 30 - Continue Working on Final Application
21 - Thesis Defense
31 - Start Finalizing Report

JUNE - NOVEMBER 2010
- Complete Final Application
- Complete Documentation
- Final Committee Meeting
- Show Thesis
- Graduation
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The Eco Zoo

Eco Zoo is an interactive Flash site that teaches users about living green. Users can flip through interactive pop-up books, explore a forest environment, and meet interesting characters.

http://ecodazzoo.com/

The Baileys Lounge

Baileys Lounge is an interactive site built with Papervision3D. Users learn about new Baileys promotions and current events in a fun and engaging way, by clicking on hotspots to reveal pop-up animations.

http://www.thebaileyslounge.co.uk/

Early Main Character Design
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Visual Style Examples
6.2 Story - First Draft
PAGE 2:
There once was a duck that lived deep in the forest.

PAGE 3:
One day he smelled something delicious coming from the other side of the forest, over the green grassy hills, and off towards the mountains. "I must find out where that smell is coming from", said the duck.

Page 4:
After traveling through the forest and over the hills, the duck came to a house sitting at the foot of the mountains.

Page 5:
The house was large and beige, with a red brick chimney and old wooden door. The duck walked up to the window and looked inside.

Page 6:
He saw a kitchen where someone had been cooking. Sitting on the counter were freshly baked cookies, pies, and a cake. "That delicious smell must have been coming from this house. Boy, I would really like some of those treats." said the duck as he started to knock on the door.

Page 7:
Just as he knocked the door opened wide.

Page 8 and 9:
"WHAT ARE YOU DOING HERE?" growled a very large bear with very large teeth. The duck trembled in fear.

Page 10:
"I just wanted to taste some of your delicious treats." said the duck.

"But those treats are for after dinner," said the bear. "I have to eat dinner first, and I think you will taste just fine!"

Page 11:
Just as the bear finished his sentence he opened his mouth wide. The duck, not wanting to be eaten, quickly ran away. The End.

(alternate ending)
Just as the bear finished his sentence he opened his mouth wide and gobbled up the duck in one swift bite. The End.

Back Cover:
Alone and hungry, a duck smells something sweet and goes on a journey he’ll never forget...
6.3 Story - Final Draft
There once was a duck that lived deep in the forest. One day he smelled something delicious from far far away...

"Where is that delicious smell coming from?" asked the duck. "I must find out!"

The duck followed the delicious smell though the forest...

And over the hills...

And over the mountains...

Until he reached a house. On the window sill sat a delicious cherry pie.

Just then, the door opened wide.

"WHO ARE YOU?"

"WHAT ARE YOU DOING HERE?"

"Well, I would really like some pie." said the duck. "But that pie is for later. I have to eat dinner first, and I think you will taste just fine!" said the bear.

"Wait!" shouted the duck. "I have a peanut butter and jelly sandwich [original sandwich was ham] we can share".

"PB and J, that is my favorite!" said the bear. "Ok, I will share with you."

The duck shared his sandwich and the bear shared his pie.

The End.

Alone and hungry, a duck smells something sweet and goes on a journey he’ll never forget...
6.4 Complete Source Code for the Interactive Pop-up Book
import caurina.transitions.*;
import flash.events.MouseEvent;
import flash.display.Loader;
import flash.net.URLRequest;
import flash.events.Event;
import flash.display.MovieClip;
import flash.media.SoundMixer;
import flash.media.SoundTransform;

stop();

//------------------------------- projector fullscreen and exit options
fscommand("allowscale","false");
fscommand("fullscreen","true");
quit_btn.addEventListener(MouseEvent.CLICK, exitProgram);
quit_btn.addEventListener(MouseEvent.MOUSE_OUT, pageBtnUp);
quit_btn.addEventListener(MouseEvent.MOUSE_OVER, pageBtnDown);

function exitProgram (e:MouseEvent) {
    fscommand("quit");
}

//------------------------------- universal sound control  ------------
var sound_transform:SoundTransform = new SoundTransform();
sound_transform.volume = 1;
flash.media.SoundMixer.soundTransform = sound_transform;
stage.addEventListener(Event.ENTER_FRAME, checkAudio);

function checkAudio (e:Event) {
    if (sound_transform.volume == 1)
    {
        volume_on_btn.visible = true;
    }
    else
    {
        volume_on_btn.visible = false;
    }

    if (sound_transform.volume == 0)
    {
        volume_off_btn.visible = true;
        volume_off_btn.alpha = .5;
    }
    else {
        volume_off_btn.visible = false;
    }
}

volume_on_btn.addEventListener(MouseEvent.CLICK, turnOffVolume);
volume_on_btn.addEventListener(MouseEvent.MOUSE_OUT, pageBtnUp);
volume_on_btn.addEventListener(MouseEvent.MOUSE_OVER, pageBtnDown);
volume_off_btn.addEventListener(MouseEvent.CLICK, turnOnVolume);
volume_off_btn.addEventListener(MouseEvent.MOUSE_OUT, pageBtnUp);
volume_off_btn.addEventListener(MouseEvent.MOUSE_OVER, pageBtnDown);

function turnOnVolume (e:MouseEvent) {
    sound_transform.volume = 1;
    flash.media.SoundMixer.soundTransform = sound_transform;
}

function turnOffVolume (e:MouseEvent) {
    sound_transform.volume = 0;
    flash.media.SoundMixer.soundTransform = sound_transform;
}

//------------------------------- intro screen loading code  ----------
var pageLoader:Loader = new Loader();
pageLoader.load(new URLRequest("pages/cover.swf"));
container_mc.addChild(pageLoader);

//------------------------------- enter story control / buttons  -------
enter_btn.buttonMode = true;
enter_btn.addEventListener(MouseEvent.CLICK, startStory);
enter_btn.addEventListener(MouseEvent.ROLL_OVER, showDownState);
enter_btn.addEventListener(MouseEvent.ROLL_OUT, showUpState);

function startStory (e:MouseEvent) {
    nextFrame();
    swfLoader.load(new URLRequest("pages/page01.swf"));
    addChildAt(swfLoader, 0);
    swfLoader.contentLoaderInfo.addEventListener(Event.COMPLETE, onComplete);
}

function showDownState (e:MouseEvent) {
    Tweener.addTween(enter_btn, {alpha: 1, time: .5, transition:"easeOutSine"});
}

function showUpState (e:MouseEvent) {
    Tweener.addTween(enter_btn, {alpha: .8, time: .5, transition:"easeOutSine"});
}

//------------------------------button page buttons and loading swf code
var swfLoader:Loader = new Loader();
var holder:MovieClip = new MovieClip();

page1.addEventListener(MouseEvent.CLICK, loadPage);
page2.addEventListener(MouseEvent.CLICK, loadPage);
page3.addEventListener(MouseEvent.CLICK, loadPage);
page4.addEventListener(MouseEvent.CLICK, loadPage);
page5.addEventListener(MouseEvent.CLICK, loadPage);
page6.addEventListener(MouseEvent.CLICK, loadPage);
page7.addEventListener(MouseEvent.CLICK, loadPage);
page8.addEventListener(MouseEvent.CLICK, loadPage);
page9.addEventListener(MouseEvent.CLICK, loadPage);
page10.addEventListener(MouseEvent.CLICK, loadPage);

for (var i:uint = 1; i<11; i++) {
    this["page" + i].addEventListener(MouseEvent.MOUSE_OVER, pageBtnDown);
}

for (var l:uint = 1; l<11; l++) {
    this["page" + l].addEventListener(MouseEvent.MOUSE_OUT, pageBtnUp);
}

function pageBtnDown (e:MouseEvent) {
    Tweener.addTween(e.target, {alpha: 1, time:.2, transition:"easeOutSine"});
}

function pageBtnUp (e:MouseEvent) {
    Tweener.addTween(e.target, {alpha:.5, time:.2, transition:"easeOutSine"});
}

function loadPage (e:MouseEvent) {
    nextPageScreen_mc.alpha = 0;
    nextPageScreen_mc.visible = false;
    swfLoader.unload();
    if (e.target.name == "page1") {
        gotoAndStop(2);
        swfLoader.load(new URLRequest("pages/page01.swf"));
    }
    if (e.target.name == "page2") {
        gotoAndStop(3);
        swfLoader.load(new URLRequest("pages/page02.swf"));
    }
    if (e.target.name == "page3") {
        gotoAndStop(4);
        swfLoader.load(new URLRequest("pages/page03.swf"));
    }
    if (e.target.name == "page4") {
        gotoAndStop(5);
        swfLoader.load(new URLRequest("pages/page04.swf"));
    }
    if (e.target.name == "page5")
{ gotoAndStop(6); swfLoader.load(new URLRequest("pages/page05.swf")); }

if (e.target.name == "page6")
{
    gotoAndStop(7);
    swfLoader.load(new URLRequest("pages/page06.swf"));
}

if (e.target.name == "page7")
{
    gotoAndStop(8);
    swfLoader.load(new URLRequest("pages/page07.swf"));
}

if (e.target.name == "page8")
{
    gotoAndStop(9);
    swfLoader.load(new URLRequest("pages/page08.swf"));
}

if (e.target.name == "page9")
{
    gotoAndStop(10);
    swfLoader.load(new URLRequest("pages/page09.swf"));
}

if (e.target.name == "page10")
{
    gotoAndStop(11);
    swfLoader.load(new URLRequest("pages/page10.swf"));
}

addChildAt(swfLoader,0);
swfLoader.contentLoaderInfo.addEventListener(Event.COMPLETE, onComplete);

} function onComplete (e:Event)
{
    holder = MovieClip(swfLoader.content);
    holder.x = 0;
    holder.y = 100;
    checkPlayProgress();
}

function checkPlayProgress()
{
    stage.addEventListener(Event.ENTER_FRAME, checkFrame);
}

function checkFrame (e:Event)
{
    if(holder.currentFrame == 65 && currentFrame == 7)
    {

stage.removeEventListener(Event.ENTER_FRAME, checkFrame);
loadNextPage(null);
}
}

//------------------------------- help and info buttons and menu  ----------------------------------

help_mc.visible = false;
help_btn.addEventListener(MouseEvent.CLICK, showHelp);
help_btn.addEventListener(MouseEvent.MOUSE_OUT, pageBtnUp);
help_btn.addEventListener(MouseEvent.MOUSE_OVER, pageBtnDown);
help_mc.helpClose_btn.buttonMode = true;

function showHelp (e:MouseEvent) {
    help_mc.visible = true;
    Tweener.addTween(help_mc, {alpha: 1, time: .5, transition:"easeOutSine");
}

help_mc.helpClose_btn.addEventListener(MouseEvent.CLICK, closeHelp);
help_mc.helpClose_btn.addEventListener(MouseEvent.MOUSE_OUT, closeHelpBtnUp);
help_mc.helpClose_btn.addEventListener(MouseEvent.MOUSE_OVER, closeHelpBtnDown);

function closeHelp (e:MouseEvent) {
    Tweener.addTween(help_mc, {alpha: 0, time: .5, transition:"easeOutSine",
onComplete:function() { help_mc.visible = false; }});
}

function closeHelpBtnDown (e:MouseEvent) {
    Tweener.addTween(e.target, {alpha: 1, time: .5, transition:"easeOutSine");
}

function closeHelpBtnUp (e:MouseEvent) {
    Tweener.addTween(e.target, {alpha: 0.75, time: .5, transition:"easeOutSine");
}

//-------------------------------fading in and out back and next arrow buttons

stage.addEventListener(Event.ENTER_FRAME, checkArrowStatus);

function checkArrowStatus (e:Event) {
    if (currentFrame == 2) {
        backArrow_mc.visible = false;
    } else {backArrow_mc.visible = true;}
    if (currentFrame == totalFrames) {
        nextArrow_mc.visible = false;
    } else {nextArrow_mc.visible = true;}
}
backArrow_mc.addEventListener(MouseEvent.MOUSE_OVER, showBackArrow);
backArrow_mc.addEventListener(MouseEvent.MOUSE_OUT, hideBackArrow);
backArrow_mc.addEventListener(MouseEvent.CLICK, loadPreviousPage);
backArrow_mc.buttonMode = true;

function showBackArrow (e:MouseEvent) {
    Tween.addTween(backArrow_mc, {alpha: .75, time: 1, transition:"easeOutSine"});
}

function hideBackArrow (e:MouseEvent) {
    Tween.addTween(backArrow_mc, {alpha: 0, time: 1, transition:"easeOutSine"});
}

function loadPreviousPage (e:MouseEvent) {
    nextPageScreen_mc.alpha = 0;
    nextPageScreen_mc.visible = false;
    prevFrame();
    swfLoader.unload();
    if (currentFrame == 2) {
        gotoAndStop(2);
        swfLoader.load(new URLRequest("pages/page01.swf"));
    }
    else if (currentFrame == 3) {
        gotoAndStop(3);
        swfLoader.load(new URLRequest("pages/page02.swf"));
    }
    else if (currentFrame == 4) {
        gotoAndStop(4);
        swfLoader.load(new URLRequest("pages/page03.swf"));
    }
    else if (currentFrame == 5) {
        gotoAndStop(5);
        swfLoader.load(new URLRequest("pages/page04.swf"));
    }
    else if (currentFrame == 6) {
        gotoAndStop(6);
        swfLoader.load(new URLRequest("pages/page05.swf"));
    }
    else if (currentFrame == 7)
{ 
gotoAndStop(7); 
swfLoader.load(new URLRequest("pages/page06.swf")); 
}

else if (currentFrame == 8)
{

gotoAndStop(8); 
swfLoader.load(new URLRequest("pages/page07.swf")); 
}

else if (currentFrame == 9)
{

gotoAndStop(9); 
swfLoader.load(new URLRequest("pages/page08.swf")); 
}

else if (currentFrame == 10)
{

gotoAndStop(10); 
swfLoader.load(new URLRequest("pages/page09.swf")); 
}

else if (currentFrame == 11)
{

gotoAndStop(11); 
swfLoader.load(new URLRequest("pages/page10.swf")); 
}

addChildAt(swfLoader,0); 
swfLoader.contentLoaderInfo.addEventListener(Event.COMPLETE, onComplete);
}

nextArrow_mc.addEventListener(MouseEvent.MOUSE_OVER, showNextArrow); 
nextArrow_mc.addEventListener(MouseEvent.MOUSE_OUT, hideNextArrow); 
nextArrow_mc.addEventListener(MouseEvent.CLICK, loadNextPage); 
nextArrow_mc.buttonMode = true;

function showNextArrow (e:MouseEvent) {
    Tweener.addTween(nextArrow_mc, {alpha: .75, time: 1, transition:"easeOutSine"});
}

function hideNextArrow (e:MouseEvent) {
    Tweener.addTween(nextArrow_mc, {alpha: 0, time: 1, transition:"easeOutSine"});
}

function loadNextPage (e:MouseEvent) {
    nextPageScreen_mc.alpha = 0; 
    nextPageScreen_mc.visible = false; 
    nextFrame();
}
swfLoader.unload();

if (currentFrame == 2) {
    gotoAndStop(2);
    swfLoader.load(new URLRequest("pages/page01.swf"));
}

else if (currentFrame == 3) {
    gotoAndStop(3);
    swfLoader.load(new URLRequest("pages/page02.swf"));
}

else if (currentFrame == 4) {
    gotoAndStop(4);
    swfLoader.load(new URLRequest("pages/page03.swf"));
}

else if (currentFrame == 5) {
    gotoAndStop(5);
    swfLoader.load(new URLRequest("pages/page04.swf"));
}

else if (currentFrame == 6) {
    gotoAndStop(6);
    swfLoader.load(new URLRequest("pages/page05.swf"));
}

else if (currentFrame == 7) {
    gotoAndStop(7);
    swfLoader.load(new URLRequest("pages/page06.swf"));
}

else if (currentFrame == 8) {
    gotoAndStop(8);
    swfLoader.load(new URLRequest("pages/page07.swf"));
}

else if (currentFrame == 9) {
    gotoAndStop(9);
    swfLoader.load(new URLRequest("pages/page08.swf"));
}

else if (currentFrame == 10) {
    gotoAndStop(10);
    swfLoader.load(new URLRequest("pages/page09.swf"));
}
else if (currentFrame == 11)
{
    gotoAndStop(11);
    swfLoader.load(new URLRequest("pages/page10.swf"));
}
addChildAt(swfLoader,0);
swfLoader.contentLoaderInfo.addEventListener(Event.COMPLETE, onComplete);

//------------------------------- yellow next page graphic ------------
nextPageScreen_mc.alpha = 0;
nextPageScreen_mc.visible = false;
nextPageScreen_mc.buttonMode = true;
nextPageScreen_mc.addEventListener(MouseEvent.CLICK, loadNextPage);
6.5 Sample Usability Forms
Duck! Here Comes The Bear!  

**GENERAL INFORMATION**  
Please fill out the form below.

<table>
<thead>
<tr>
<th>FULL NAME:</th>
<th>DATE:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>ADDRESS (street, city, state, zip):</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>EMAIL ADDRESS:</th>
<th>PHONE (optional):</th>
</tr>
</thead>
</table>

Is it ok to contact you with follow up questions regarding your answers and/or feedback provided on this form?  

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
</table>

**QUESTIONNAIRE**  
Please read each statement below and circle the phrase that best corresponds to your opinion.

1. This story is easy to read, and contains a clear point.
   - STRONGLY DISAGREE  
   - DISAGREE  
   - NEUTRAL  
   - AGREE  
   - STRONGLY AGREE  
   - NA

2. The content of this story is appropriate for my child.
   - STRONGLY DISAGREE  
   - DISAGREE  
   - NEUTRAL  
   - AGREE  
   - STRONGLY AGREE  
   - NA

3. The moral theme of the story is clear.
   - STRONGLY DISAGREE  
   - DISAGREE  
   - NEUTRAL  
   - AGREE  
   - STRONGLY AGREE  
   - NA

4. I would re-read this story to my child.
   - STRONGLY DISAGREE  
   - DISAGREE  
   - NEUTRAL  
   - AGREE  
   - STRONGLY AGREE  
   - NA

5. The length of the story is appropriate.
   - STRONGLY DISAGREE  
   - DISAGREE  
   - NEUTRAL  
   - AGREE  
   - STRONGLY AGREE  
   - NA

6. I would recommend this story to friends with a child.
   - STRONGLY DISAGREE  
   - DISAGREE  
   - NEUTRAL  
   - AGREE  
   - STRONGLY AGREE  
   - NA

**COMMENTS / FEEDBACK**

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Duck! Here Comes The Bear!

Printed Pop-up Book Test 2

**GENERAL INFORMATION**

*Please fill out the form below.*

**FULL NAME:** _______________________________  **DATE:** __________________

**ADDRESS** *(street, city, state, zip):* _______________________________

**EMAIL ADDRESS:** _______________________________  **PHONE** *(optional):* __________________

Is it ok to contact you with follow up questions regarding your answers and/or feedback provided on this form?  **YES [ ]**  **NO [ ]**

**QUESTIONNAIRE**

*Please read each statement below and circle the phrase that best corresponds to your opinion.*

1. The story is easy to comprehend and appropriate for my child.
   
   STRONGLY DISAGREE  DISAGREE  NEUTRAL  AGREE  STRONGLY AGREE  NA

2. The artwork and illustration is appropriate for a children’s book.
   
   STRONGLY DISAGREE  DISAGREE  NEUTRAL  AGREE  STRONGLY AGREE  NA

3. There is an appropriate amount of the text on each page.
   
   STRONGLY DISAGREE  DISAGREE  NEUTRAL  AGREE  STRONGLY AGREE  NA

4. The book’s construction feels sturdy enough for a child to use.
   
   STRONGLY DISAGREE  DISAGREE  NEUTRAL  AGREE  STRONGLY AGREE  NA

5. The pop-up elements are easy to operate.
   
   STRONGLY DISAGREE  DISAGREE  NEUTRAL  AGREE  STRONGLY AGREE  NA

6. I re-read this book to my child.
   
   STRONGLY DISAGREE  DISAGREE  NEUTRAL  AGREE  STRONGLY AGREE  NA

**COMMENTS / FEEDBACK**

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Duck! Here Comes The Bear!  

Interactive Pop-up Book Test 1

GENERAL INFORMATION  Please fill out the form below.

FULL NAME: ___________________________________  

ADDRESS  (street, city, state, zip) : ___________________________________  

EMAIL ADDRESS: ___________________________________  

PHONE (optional) : ___________________________________

Is it ok to contact you with follow up questions regarding your answers and/or feedback provided on this form?  

YES ☐  NO ☐

QUESTIONNAIRE  Please read each statement below and circle the phrase that best corresponds to your opinion.

1. The interactive pop-up book navigation is clearly labeled.  

   STRONGLY DISAGREE   DISAGREE   NEUTRAL   AGREE   STRONGLY AGREE   NA

2. Navigating between pages is intuitive.  

   STRONGLY DISAGREE   DISAGREE   NEUTRAL   AGREE   STRONGLY AGREE   NA

3. Animation playback is smooth and consistent.  

   STRONGLY DISAGREE   DISAGREE   NEUTRAL   AGREE   STRONGLY AGREE   NA

4. The help section is clearly defined and easy to access.  

   STRONGLY DISAGREE   DISAGREE   NEUTRAL   AGREE   STRONGLY AGREE   NA

5. The story is presented in way that facilitates reading and comprehension.  

   STRONGLY DISAGREE   DISAGREE   NEUTRAL   AGREE   STRONGLY AGREE   NA

6. The text on screen is an appropriate size.  

   STRONGLY DISAGREE   DISAGREE   NEUTRAL   AGREE   STRONGLY AGREE   NA

COMMENTS / FEEDBACK

________________________________________________________________________

________________________________________________________________________

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________________________________________________________________________
Duck! Here Comes The Bear! Interactive Pop-up Book Test 2

**GENERAL INFORMATION**  Please fill out the form below.

**FULL NAME:** ________________________________  **DATE:** __________________

**ADDRESS** (street, city, state, zip) : ________________________________

**EMAIL ADDRESS:** ________________________________  **PHONE (optional) :** __________________

Is it ok to contact you with follow up questions regarding your answers and/or feedback provided on this form?  YES  NO

**QUESTIONNAIRE**  Please read each statement below and circle the phrase that best corresponds to your opinion.

1. The navigation is clearly labeled and easy to use.
   - STRONGLY DISAGREE
   - DISAGREE
   - NEUTRAL
   - AGREE
   - STRONGLY AGREE
   - NA

2. The back and previous arrows are useful.
   - STRONGLY DISAGREE
   - DISAGREE
   - NEUTRAL
   - AGREE
   - STRONGLY AGREE
   - NA

3. Launching and closing the application is intuitive.
   - STRONGLY DISAGREE
   - DISAGREE
   - NEUTRAL
   - AGREE
   - STRONGLY AGREE
   - NA

4. The interactive elements on the individual pages are clearly labeled and easy to use.
   - STRONGLY DISAGREE
   - DISAGREE
   - NEUTRAL
   - AGREE
   - STRONGLY AGREE
   - NA

5. The sound quality of the narration is acceptable.
   - STRONGLY DISAGREE
   - DISAGREE
   - NEUTRAL
   - AGREE
   - STRONGLY AGREE
   - NA

6. The incorporation of sound helps to enhance the reading experience.
   - STRONGLY DISAGREE
   - DISAGREE
   - NEUTRAL
   - AGREE
   - STRONGLY AGREE
   - NA

**COMMENTS / FEEDBACK**

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
7. REFERENCES


